Performance of the Ottawa 3DY Scale as a Screening Tool for Altered Mental Status in Elderly Emergency Department Patients

A Thesis Submitted in Partial Fulfillment of the Requirements for the
Masters of Science Degree in Clinical Epidemiology
University of Ottawa

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BRIEF ABSTRACT

Altered mental status (AMS), a common and serious entity in elderly Emergency Department patients, is not well recognized by physicians. Our prospective cohort study evaluated the implementation, by nurses and physicians, of the Ottawa 3DY Scale, a cognitive screening tool. We enrolled 260 patients (60.0% female, mean age 83.7). Screening rates were: overall - 78.3%; physician - 51.8%; and nurse - 64.2%. Interrater reliability was 0.65. Physician and nurse sensitivity was 78.9, 84.6% and specificity was 39.4, 54.2%, respectively, compared with the Mini-Mental State Exam. Patient living situation, educational level, triage location, hospitalization, admission location and 30 day mortality were associated with AMS. Implementation of the Ottawa 3DY Scale increased screening for AMS in elderly Emergency Department patients. It was feasible, sensitive, specific and had good interrater reliability. Use will lead to increased identification of cognitive impairment and ultimately result in improved care and outcomes in this vulnerable patient population.

EXECUTIVE SUMMARY

Introduction: Physicians are not adept at recognizing altered mental status in elderly Emergency Department (ED) patients, a common and serious entity associated with increased morbidity and mortality. The Ottawa 3DY Scale (O3DY) is a four question cognitive screening tool that has been previously validated in this population.

Objectives: The overall objective was to improve screening for altered mental status in elderly ED patients. More specifically, our goal was to assess: 1) level of implementation of the O3DY Scale; 2) barriers and facilitators of use of the O3DY Scale; 3) interrater reliability of nurse and physician scores; 3) classification performance compared with the Mini-Mental State Exam (MMSE); 4) prevalence of altered mental status; and 5) patient characteristics, ED disposition and 30 day outcomes associated with altered mental status.

Methods: We conducted a prospective cohort study enrolling patients ≥ 75 years of age who presented to a tertiary care ED. Patients underwent mental status screening with the O3DY Scale by the bedside nurse and physician. Abnormalities resulted in a comprehensive cognitive evaluation. Descriptive statistics were used to assess level of implementation, prevalence of altered mental status and sensitivity and specificity compared with the MMSE, using a cut-off of <25. Kappa coefficients were calculated.

Results: 260 patients, 60.0% female with a mean age of 83.7 years, presented during study hours. Screening rates were: overall – 78.3%; physician – 51.8%; and nurse – 64.2%. Clinicians (physician, nurse) reported the O3DY was easy to learn (98%, 97%), remember (88%, 95%) and use (95%, 97%). However, patient benefit (30%, 55%) and usefulness to practice (50%, 72%) were not strongly endorsed. There was strong interrater reliability

(kappa: 0.65 (95% CI 0.51-0.80). O3DY by nurses had a sensitivity of 84.6% (95% CI 64.3 – 95.0) and specificity of 54.2% (95% CI 39.3 – 68.3). O3DY by physicians had a sensitivity of 78.9% (95% CI 53.9 – 93.0) and specificity of 39.4% (95% CI 23.4 – 57.8). Prevalence of altered mental status was 38.4% (95% CI 34.4 – 0.42.6). Patient living situation, level of education, triage location, hospitalization, admission location and death in 30 days were associated with altered mental status.

Conclusions: Use of the Ottawa 3DY Scale increased screening for altered mental status in elderly patients when implemented in the ED. It was found to be feasible, sensitive, specific and to have good interrater reliability. Its use will lead to increased identification of altered mental status in elderly ED patients and ultimately result in improved care and outcomes in this vulnerable patient population.

ACKNOWLEDGEMENTS

I could not have completed this thesis without the support from my husband, Shawn, who has encouraged me to follow my passion in spite of the burden it has placed upon our family. I am indebted to my daughters, Caroline and Grace, for their patience with my seemingly never ending studies.

I am grateful to Dr. Ian Stiell, for his ongoing encouragement and guidance over the past nine years, without which, I would not have pursued this path. Thank you for your continued confidence in me. I am thankful for the excellent feedback and words of wisdom Dr. George Wells has imparted to me, not only with respect to this thesis, but research in general. A special thank you to Dr. Samir Sinha, for his expertise in geriatrics and sharing his passion for improving care in the elderly.

This project would not have been possible without the help from many people, including, Angela Marcantonio, Carolyne Kennedy, Jennie Cote, My-Linh Tran, Laura Wilding and the GEM nurses and of course, the ED nurses and physicians at the Civic Campus of the Ottawa Hospital, who completed the forms and surveys. Special mention must be given to Damanjot Otal, who worked tirelessly in the ED on this study.

Finally, thank you to the Department of Emergency Medicine, University of Ottawa who provided necessary funding for this project.

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CHAPTER 1: BACKGROUND

1.1 Introduction to Altered Mental Status in Elderly Emergency Department Patients

For the first time in history, the geriatric age group (65 years and older) is the largest growing segment of the population. There are multiple implications for the healthcare system, and the Emergency Department (ED) in particular. Elderly patients are high users of the ED. They are more complex for many reasons, including multiple co-morbidities, polypharmacy, atypical presentations and altered mental status. Altered mental status, dementia and delirium, are common in elderly patients; their incidence increasing with age. Patients with altered mental status are unable to provide reliable histories and are at risk for unsafe discharges from hospital. Both delirium and dementia are associated with increased risk of hospitalization, length of hospital stay, institutionalization and death. Evaluation of mental status is a key component of an assessment, particularly in elderly ED patients as the prevalence of altered mental status is high in this patient population. ED physicians are poor at recognizing altered mental status, in part because no clinically feasible screening tool has been widely accepted. Identification of altered mental status in geriatric ED patients would facilitate improved workup and management of this vulnerable patient population, leading to improved outcomes.

1.2 Definition of Altered Mental Status, Dementia and Delirium

The term altered mental status implies a change in level of consciousness and/or cognitive ability. This change may be chronic, acute or acute on chronic. In clinical terms, these neurocognitive disorders are more commonly known as dementia and delirium. The

Diagnostic and Statistical Manual of Mental Disorders, 5th edition describes neurocognitive disorders as a medical disorder with a primary cognitive deficit that is acquired over time, resulting in a decline from previous cognitive level.[1] These disorders are further classified into delirium and major and minor neurocognitive disorder and their associated subtypes.

Delirium refers to an acute, fluctuating disturbance in attention, awareness and cognition secondary to a medical condition, substance withdrawal or intoxication. Major neurocognitive disorder refers to dementia. It is defined as a chronic, decline in cognitive level in one or more of the following cognitive domains: complex attention, executive function, learning and memory, language, perceptual-motor or social cognition and a resultant loss of function in activities of daily life. The most common subtypes include: Alzheimer's disease (41%), vascular disease (32%), Lewy body disease (8%) and frontaltemporal lobar degeneration (3%).[2] Mild neurocognitive disorder refers to mild cognitive impairment. It is distinct from major neurocognitive disorder in that the level of cognitive impairment is not as great and there is no functional impairment.

1.3 Scope of the Problem

1.3.1 Aging Population

The Canadian population is experiencing disproportionate growth within the geriatric age cohort. There are several reasons for this, the most important being: 1) the baby boomer effect; 2) below replacement birth rates; and 3) increased life expectancy. Following the end of World War II, there was an increase in the Canadian birth rate for nearly 20 years, with an average of 3.7 children born per woman. The overall result was a growth of 8.2 million

people during that time frame. In 2011, the leading wave of the baby boomers turned 65, heralding the beginning of a large cohort of elderly Canadians.[3] To maintain an equitable age distribution across the life span, the birth replacement rate must be 2.1 children per woman. Canada has not seen this rate since 1971; in 2009 the rate was 1.67 children per woman.[4] Therefore, over the past three decades there has been a perpetuation of imbalance between older and younger Canadians. To further compound this, the average life expectancy of Canadians is increasing at a rapid rate. In the 1950's, live expectancy was 69 years of age. By 2011, it had increased by 15%, to 79 years of age. These three factors are the main contributors to the aging of the Canadian population.

The absolute growth in numbers of elderly Canadians, bear witness to these irrefutable facts. In 1981, 2.4 million Canadians were 65 years or older. In 2001, seniors comprised 12.6% of the Canadian population, numbering 3.9 million people. Just over a decade later, in 2012, as the first of the baby boomers were turning 65 years of age, senior citizens comprised 14.9% of all Canadians, with a population of 5.2 million.[5] It is projected that by 2036 this number will double and by 2051, seniors will comprise one quarter of our population.[6]

Within the geriatric cohort, the proportion of individuals over the age of 80 is increasing exponentially. Those over 80 years of age represented 14% of the elderly population; by 2000, this increased to 24%, with absolute numbers of 1.33 million and by 2050 it is estimated that the oldest-old will represent 37% of the geriatric population.

1.3.2 Epidemiology of Altered Mental Status in the Elderly

A multitude of health issues arise with aging. One of the most significant disorders to affect the elderly is dementia. The prevalence of dementia rises with age, doubling every 5.5 years. At 65 years of age, the prevalence of dementia is approximately 3-5%; this rises to 25% by 85 years of age. It is estimated that, in 2010, 35.6 million people worldwide lived with dementia. This is projected to approximately double every 20 years to 65.7 million people in 2030 and 115.4 million in 2050.[7, 8] In Canada, in 2008, an estimated 1.5% of the population (480,618 Canadians) were living with dementia. By 2038, that is expected to double to roughly 2.8% of the population (1.1 million Canadians).[9]

1.3.3 Use of the Emergency Department by Elderly Patients

Elderly patients account for approximately 12-24% of all ED visits.[10] Proportionately, individuals 75 years and older are the highest adult users of the ED. Adults 75 years or older, are more likely to have at least one ED visit in 12 months compared with their younger counterparts (26.5% vs 19.6%).[11] The number of visits per 100 person per year is 63.5 compared with 40 in those 25-64 years of age. They are more likely to be triaged as having a greater severity of illness, have longer ED length of stays and are more likely to be admitted.[12, 13] Time spent in the ED increases with increasing age. In Ontario, the median ED length of stay was 2.9 hours for patients 60-64 years of age compared with 5.4 hours in those 85 years and older.[14] This has huge implications for the ED as their disproportionate use of the ED will be magnified by the increase in absolute numbers of seniors.

1.3.4 Altered Mental Status in Elderly Emergency Department Patients

Naughton et al were one of the first to evaluate the prevalence of cognitive impairment in elderly ED patients. The Glasgow Coma Scale, the MMSE and the Confusion Assessment Method were used to assess for altered mental status. They found an overall prevalence of 39.9% (altered consciousness 8.5%, delirium 9.6%, cognitive impairment without delirium 21.8%).[15] Subsequent studies have shown a similar high rate, ranging from 16 - 46.7 %. [16-21] The variation in rates is likely secondary to different patient populations, as well as study exclusion criteria and evaluation methodology.

Studies have shown that the incidence of delirium in elderly ED patients ranges from 7-25.8%. [18, 19, 22-28] This incidence may be underrepresented, as most of these studies excluded critically ill patients in which the level of delirium would be expected to be high.

Two studies examining the prevalence of altered mental status in the ED, reported the number of patients that had a pre-existing diagnosis of dementia recorded in their medical record. They found documentation rates of less than 20%.[18, 29] It is unclear whether this reflects under recognition or poor documentation. Similarly low levels of prevalence in primary care studies would suggest the former.[30]

Altered mental status, both dementia and delirium, is a common and important comorbidity in elderly ED patients which is not well documented in their medical record. Thus, a cognitive assessment must be incorporated into the evaluation of this vulnerable patient population.

1.3.5 Impact of Altered Mental Status

The burden of dementia to the individual, their family and community is profound. Patients with Alzheimer's disease are ten times more likely to be institutionalized during the course of their disease than patients without cognitive impairment. In 2008, 45% of individuals in long term care facilities suffered from dementia. The number of individuals suffering from dementia will outstrip the availability of institutional care, leaving the burden of care to fall to community care and family. It is estimated that by 2038, this vulnerable population will require an estimated 756 million hours of informal care. It is estimated that the total annual economic burden (total direct costs, total unpaid caregivers opportunity cost, total indirect costs and monetary economic burden) to Canadians in 2008 was 14.9 billion dollars. By 2038, this is extrapolated to exceed 150 billion dollars.[9] Patients with altered mental status are more likely to have an ED visit, have higher rates of admission and increased mortality.[31-33]

Patients with delirium are less likely to provide a reliable history, and are at risk of adverse outcome at discharge through decreased understanding of discharge diagnosis, reasons to return to the ED and follow-up instructions.[18] It is not surprising therefore that delirium is associated with increased return visits to the ED. If admitted to hospital, delirium is associated with increased hospital length of stay, increased risk of admission to an Intensive Care Unit (ICU) and to being discharged to an increased level of care.[25] Delirium is also associated with functional decline[34] and increased risk of institutionalization.[35] Moreover, delirium has also been shown to be associated with an increased mortality, as high as 37% at six months.[22, 26, 35-37]

1.3.6 Benefits of Early Diagnosis of Altered Mental Status

Studies show that dementia is most often diagnosed once it has become moderate or severe.[30, 38-41] Intuitively, it makes sense that an early diagnosis of dementia would facilitate management of underlying risk factors for certain types of dementia (for example the treatment of hypertension in vascular dementia), initiation of symptomatic treatment and provision of caregiver support leading to improved quality of life and outcomes. A recent systematic review showed that acetylcholinesterase inhibitors did slow the rate of decline in cognitive and global functioning in the short term.[30, 42] It also found that cognitive stimulation improved global cognitive function. These purported benefits are controversial; while there is a statistically significant benefit noted, it is unclear whether it is clinically significant as little improvement in function is found. Interventions to decrease caregiver burden and depression in those caring for patients with moderate dementia showed benefit.[43] There is growing evidence that earlier diagnosis of Alzheimer disease can lead to health care savings. Two recent economic health model from the United Kingdom suggest that early diagnosis and intervention for dementia, leading to even slight improvements in quality of life and delay of admission to residential care is economically feasible.[44, 45] Geldmacher et al used Medicaid information from New Jersey to model risk of institutionalization based on timing of Alzheimer disease treatment. They found that initiation of treatment predicted a delay in institutionalization of 91 days, with potential savings to Medicaid of over one billion per year.[46] Aside from these benefits which have been studied, are the less tangible benefits such as safety within the home and advanced health care planning.

Improved identification of delirium can facilitate expedient management of the underlying pathology, appropriate management of the symptoms and improved outcomes, including mortality. Kakuma et al. wished to determine whether delirium was an independent predictor of mortality in elderly ED patients. They used a subset of delirious and non-delirious patients from a larger case control study in their analysis. In their multivariable analysis, controlling for age, sex, number of medications and functional level, delirium was found to be significantly associated with mortality. Furthermore, when they evaluated the effect of physician detection of delirium on mortality they found that undetected delirium had the highest risk of death at six months. There was no statistical difference in six month mortality in those elderly patients without delirium and with detected delirium.[36] This provides strong impetus for the screening of delirium in elderly ED patients.

1.4 Screening for Altered Mental Status in the Emergency Department

1.4.1 Definition and Evaluation of Screening Programs

Screening in medicine involves testing individuals for diseases that have yet to manifest significant symptoms, in the belief that early diagnosis and thus treatment will lead to improved outcomes. This concept has been around for over a century. It was initially used for the identification of communicable, infectious diseases such as tuberculosis and syphilis. After World War II, broader application of screening tests was endorsed for detection of cancers and chronic diseases, such as diabetes.[47, 48] Recognizing the potential harms that can arise as a result of indiscriminate screening and the need to use

health care resources appropriately, Wilson and Jungner, in a landmark report commissioned by the World Health Organization in 1968, outlined criteria for evaluating screening programs.[49] They proposed the following criteria: '1) The condition sought should be an important health problem; 2) There should be an accepted treatment for patients with recognized disease; 3) Facilities for diagnosis and treatment should be available; 4) There should be a recognizable latent or early symptomatic stage; 5) There should be a suitable test or examination; 6) The test should be acceptable to the population; 7) The natural history of the condition, including development from latent to declared disease, should be adequately understood; 8) There should be an agreed policy on whom to treat as patients; 9) The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole; and 10) Case-finding should be a continuing process and not a "once and for all" project. The concept of screening is more relevant now than ever in an era of genomic sequencing and proliferation of chronic diseases in an aging population. Thus, numerous variations of the original criteria have been proposed.[50, 51]

The concept of screening patients in the ED is not new. It is generally accepted that the ED is often an entry point of care for patients, especially those at higher risk of specific conditions. As such, screening programs exist for alcohol addictions, domestic violence, and HIV.[52-58] The geriatric population is a similarly high risk population with issues related to frailty, polypharmacy, and dementia.

1.4.2 Recommendations for Mental Status Screening in the Emergency Department

The U.S. Preventative Services Task Force recently concluded that "the evidence is insufficient to recommend for or against routine screening for dementia" in the general primary care of community dwelling adults older than sixty five years of age.[43] Elderly patients that present to the ED, however, are a very distinct subset of this population. In 2009, The Society of Academic Emergency Medicine Geriatric Task Force strongly recommended cognitive assessment in this vulnerable patient population.[59] They outlined 6 quality indicators for a cognitive assessment, which included the documentation of: 1) the cognitive assessment; 2) acuity of cognitive impairment, if present; 3) support within the home for patients with acute cognitive impairment who are discharged home; 4) medical follow-up for those with acute cognitive impairment who are discharged home; 5) past history of cognitive impairment; and 6) referral for outpatient evaluation if a new diagnosis of impairment is established. More recently, the American College of Emergency Physicians, the American Geriatrics Society, the Emergency Nursing Association and the Society for Academic Emergency Medicine produced consensus guidelines for the geriatric ED.[60, 61] They recommended the use of validated screening tools to identify elderly ED patients presenting with altered mental status. Similar recommendations are found in ED guidelines in the United Kingdom and Australia.[62-64]

1.4.3 Barriers to Screening for Altered Mental Status in the Emergency Department

Screening for altered mental status in elderly ED patients is necessary to mitigate poor outcomes associated with this common condition. Yet studies have shown that physicians do not do so on a regular basis.[65, 66]

To explore this further, Kennelly et al conducted a self-administered questionnaire to medical, surgical and ED physicians to assess their knowledge, skills and attitudes towards evaluation of cognitive impairment in elderly ED patients. Although 78% of physicians felt that cognitive screening in the ED was important, less than one quarter did so on a regular basis. Amongst those surveyed, there was no consensus regarding who was responsible for screening. They also cited lack of a screening tool, lack of privacy, too much noise and time constraints as barriers to a cognitive assessment in the ED.[66]

Given the constraints of the ED environment, a simple, quick tool that requires no extra equipment, is easy to score and has been validated in the elderly ED population would be more likely to be adopted by ED physicians.

1.5 Screening Tools for Altered Mental Status

There have been greater than fifty cognitive screening instruments identified within the literature.[67, 68] However, selecting the correct tool for a specific situation can be challenging. Not only must the diagnostic properties of the test be evaluated but its validity and feasibility in the target population must be taken into consideration. The following is a summary of the more commonly known brief cognitive screening tools for elderly ED patients.

1.5.1 Mini-Mental State Exam

The Mini-Mental State Exam (MMSE) is the most commonly used tool for diagnosing impaired cognition.[30, 67-69] It consists of questions relating to orientation,

registration, attention and calculation, recall, language and complex commands. The test is scored out of thirty, with a score less than 24 or 25 indicative of cognitive impairment. A recent study pooled estimates from 14 studies yielding a sensitivity of 88.3% and specificity of 86.2%.[69] It is widely accepted as the criterion standard in ED studies. However, it has never been explicitly validated in this population.[23] It has been criticized for being language and education sensitive. More importantly, it is not feasible for use in the ED because of its length, taking greater than 7 minutes to complete and the need for paper and pen.[70]

1.5.2 Brief Alzheimers Screen

The Brief Alzheimer Screen was derived from data in the Consortium to Establish a Registry for Alzheimer's Disease. The screen consists of 4 items: 1) **R**ecall of 3 items; 2) number of **A**nimals stated in 30 seconds; 3) today's **D**ate; and 4) **S**pelling WORLD backwards. Backward logistic regression was utilized to derive its scoring formula: 3.03**R**ecall + 0.67**A**nimal + 4.75**D**ate+ 2.01**S**pelling. A score less than 26 signifies cognitive impairment. Two different validation data sets yielded a sensitivity of 99% and specificity of 87%.[71] In an observational cohort study of elderly ED patients, the Brief Alzheimers Screen demonstrated a sensitivity of 95% and a specificity of 52%.[72] Its simplicity of testing is offset by its complicated scoring algorithm, making it less than ideal for bedside use.

1.5.3 Mini-Cog

The Mini-Cog is a cognitive screening test that incorporates three word recall and the Clock Drawing Test. It takes on average just over three minutes to administer and employs a relatively simple scoring algorithm. The initial derivation was conducted in a geriatric, multi-cultural community cohort. It demonstrated a sensitivity of 96-97% and specificity of 93-95% when compared with a diagnosis of probable dementia based on clinical, medical and cognitive tests.[70, 73] Subsequently, multiple community/primary care validation studies have been undertaken with reported sensitivities of 60-100% and specificities of 54-100%.[43, 74-78] In an ED study, it demonstrated a moderate sensitivity of 75% with a specificity of 85%.[79] The clock drawing component requires pen, paper, use of corrective glasses and mobility in arms, all which limit feasibility in the ED.

1.5.4 Six-Item Screener

The Six-Item Screener is a cognitive screening test derived from components of the MMSE – three-item recall and three-item temporal orientation (what is the year, the month and the day of the week). Each correct response is awarded 1 point. It takes only one to two minutes to administer. The initial derivation in a community based cohort yielded a sensitivity of 88.7% and a specificity of 88.0% using a cut-off of 2 or more errors. The gold standard was diagnosis of dementia made by a geriatrician or neurologist based upon a comprehensive battery of tests.[80] A retrospective validation in a community based cohort demonstrated a sensitivity and specificity of 88.5% and 78.3%, respectively.[81] An initial single site prospective cohort of elderly ED patients showed promise, with a sensitivity of 94% and specificity of 86% compared with the MMSE.[79] However, these results were not

reproducible. In further ED studies, the sensitivity of the Six-Item Screener was found to be markedly reduced at 63-74%, with a corresponding specificity of 77-81% when compared with a criterion standard of the MMSE (cut-off score of 23 or less).[82, 83]

1.5.5 Quick Confusion Scale

The Quick Confusion Scale is a weighted six question scale with questions relating to orientation, memory and concentration that was adapted from the Brief Mental Status Examination. When applied to ED patients over the age of fifty five, it showed moderate correlation with the MMSE (Pearson's r=0.78) and took less than 3 minutes to administer.[84] A larger ED validation study found a sensitivity of 64% and specificity of 82%.[85] Thus the Quick Confusion Scale is restricted by its poor sensitivity and complicated weighted scoring system.

1.5.6. Blessed Orientation Memory Concentration Test

This test is also known as the Short Blessed Test and Six-Item Cognitive Impairment test. It was derived from the Blessed Mental Status Test and consists of 6 items relating to memory, calculation and orientation. It was initially validated in nursing home and community dwelling seniors.[86] Gerson et al assessed its feasibility in the ED and found that it took on average 1.9 minutes to complete the test.[17] Carpenter et al reported a 95% sensitivity and 65% specificity in elderly ED patients.[72] Although this screening test requires minimal time to utilize and demonstrates good sensitivity and specificity in its target population, its use in the ED would likely be limited by its complicated weighted scoring system.

1.6 Ottawa 3DY Scale:

The Ottawa 3DY Scale is a simple, four question tool that screens for altered mental status in elderly persons. The patient is asked each of the following: 1) What **D**ay of the week is it? 2) What is today's **D**ate? 3) Spell WORL**D** backwards; 4) What is the **Y**ear? The patient is awarded one point for each correct question, to a maximum score of four. A total score less than 4 is consistent with a positive screen for altered mental status.

1.6.1 Derivation of the Ottawa 3DY Scale

The Ottawa 3DY Scale was derived by Molnar et al.[87] They wished to develop a tool for cognitive screening that was 'clinically sensible', in other words, a tool that is simple and fast to implement, does not require a complicated scoring algorithm and suggests a course of further action. To do this, they analyzed data collected for the Canadian Study of Health and Ageing (CSHA), a national study on the prevalence of dementia in Canada conducted during 1991-1992.[88] The resultant database contained cognitive information on 10,263 randomly selected community and long-term care dwelling Canadians 65 years of age and older. All participants were screened with the Modified Mini-Mental State Examination (3MS). A positive screen on the 3MS was considered a score of less than or equal to 77. All participants who screened positive (N=1600) and a random sample of 494 individuals who screened negative underwent a full battery of medical, neurological and neuropsychological testing. Based on the results of the testing, a clinical consensus was reached, classifying participants into three groups: 1) no cognitive impairment; 2) cognitive impairment but no dementia; and 3) dementia. For derivation of the Ottawa 3DY Scale,

patients from long term care and those with severe dementia were excluded. Because the premise of the tool was clinical feasibility, questions from the 3MS which took greater than thirty seconds to administer or required any instruments, such as pen and paper or glasses were excluded. Questions with a statistically significant association with cognitive status, determined by a univariate analysis, were put into a logistic regression serial weighting algorithm to generate 2-4 question tests. Sensitivities, specificities and area under the receiver operator curve using various cut points were analyzed to determine the test with the best overall diagnostic properties. The questions of date, day, WORLD spelt backward and year, thus named the Ottawa 3DY Scale, using a cut point of one or more errors, had a sensitivity of 82% and specificity of 55%. An external validation was then performed using two different databases: 1) Canadian Study of Health and Aging-2, a follow up study of the surviving CSHA patients completed in 1996-97; and 2) The Ottawa General Hospital Memory Disorder Clinic database, which contained medical and neuropsychological tests from patients who attended the Disorder Clinic between 1988 and 1994. Sensitivities of 80-83% and specificities of 60-61% were reported when comparing the Ottawa 3DY Scale with cognitive status.

1.6.2 Validation of the Ottawa 3DY Scale

The Ottawa 3DY Scale was prospectively validated in the ED environment by Wilding et al.[89] Geriatric Emergency Management (GEM) nurses assessed 238 patients, 75 years and older presenting to two Canadian academic, tertiary care. Their neurocognitive assessment included the MMSE and the Animal Fluency Test. The Ottawa 3DY Scale score was abstracted from the questions in the MMSE. The MMSE, with a cut-off of less than 25,

was used as the criterion standard. The Ottawa 3DY Scale demonstrated a sensitivity of 93.8% and a specificity of 23.5%, with overall agreement between the two tests of 75.6% in this elderly ED patient cohort.

Carpenter et al conducted an observational cross-sectional cohort study of patients 65 years and older presenting to an academic ED in the United States to evaluate the diagnostic accuracy of the Ottawa 3DY Scale, the Brief Alzheimers Screen (BAS), the Short Blessed Test (SBT) and the caregiver-completed AD8 (cAD8).[72] Using the MMSE as a criterion standard, they found the following sensitivities and specificities: Ottawa 3DY (95%, 51%), BAS (95%, 52%), SBT (95%, 65%) and cAD8 (83%, 63%). While they reported that the SBT had the best test characteristics, they acknowledged that both the BAS and SBT were 'onerous to remember…and requires computations that limit their usefulness in the ED'.[72]

1.7 Study Rationale

Currently, patients 65 years or older represent up to 25% of ED visits. With the aging population, this number will continue to increase significantly. Cognitive impairment, delirium and dementia, is common in elderly ED patients and is seen in up to 48% of this vulnerable patient population. Patients with altered mental status are not able to provide reliable histories or accurately remember discharge instructions. They are more likely to require the services of an ED, be admitted to hospital, be admitted to ICU, have longer length of stays, be institutionalized and have higher mortality rates. This significant co-morbidity is often under recognized and thus patients present with no prior history of impairment or documentation within their medical record. Physicians are poor at recognizing altered

mental status, identifying it less than 35% of the time. This is likely in part due to the lack of a widely accepted, ED validated feasible screening tool for altered mental status; one that is easy to remember, score and does not require any extra instruments to administer.

The Ottawa 3DY Scale is a simple four question screening tool to identify altered mental status. It was rigorously derived and has been prospectively validated in an elderly ED patient population. The next step is to evaluate the implementation of the Ottawa 3DY Scale by frontline nurses and physicians. We feel that it has great potential for screening elderly ED patients for altered mental status which could ultimately lead to improved outcomes in this vulnerable patient population.

CHAPTER 2: GOALS AND OBJECTIVES

2.1 Study Goal

The overall goal of this study is to improve screening for cognitive impairment in patients 75 years or older presenting to the ED.

2.2 Specific Objectives

1) To assess implementation of the Ottawa 3DY Scale in elderly ED patients through:
    a) Determination of compliance (proportion of patients screened) by nurses and physicians;
    b) Exploration of barriers and facilitators to use of the Ottawa 3DY Scale and its overall acceptability as a screening tool for altered mental status in elderly ED patients;
    c) Calculation of the interrater reliability between nurse and physician Ottawa 3DY Scale scores;
    d) Evaluation of the classification performance of the Ottawa 3DY Scale compared with the MMSE when used by frontline providers;
2) To document the prevalence of mental status impairment in elderly ED patients;
3) To describe patient characteristics associated with altered mental status;
4) To describe the clinical outcomes in patients with altered mental status in terms of ED disposition, referral for further assessment of cognitive function, 30 day return to ED rates and 30 day mortality.

CHAPTER 3: METHODS

3.1 Study Design:

We conducted a prospective cohort study and enrolled a consecutive sample of eligible patients presenting to the Emergency Department beginning June 17th and ending August 16, 2013.

3.2 Study Setting:

The study was undertaken in the Emergency Department of the Civic Campus of the Ottawa Hospital, a tertiary care, academic centre. This campus sees more than 75,000 patients annually; 17 % (approx. 12, 700) of patients are 75 years of age or older.

3.3 Study Population:

3.3.1 Inclusion criteria:

a) We included all patients 75 years or older who presented to the ED Monday to Friday between 0800 and 1600 hours. It was felt that patients 75 years of age and older were the most appropriate cohort to screen, given the low prevalence of altered mental status in younger patients. The study hours were determined by the restricted resources and availability of the research assistant.

3.3.2 Exclusion criteria:

a) Patients who have been previously enrolled on a prior visit within thirty days were excluded, as this information would be documented as part of the thirty day return ED visits;

b) Patients with known history of cognitive impairment or obviously altered/delirious were excluded as screening tests are used to identify those with a condition previously unrecognized;

c) Patients with communication barriers including: non English or French speaking, auditory, verbal or visual impairment severe enough to effect cognitive testing; Patients who have a decreased level of consciousness such that they are not able to respond to verbal questioning;

d) Patients triaged as Canadian Triage and Acuity Scale level 1 or judged by their attending ED nurse/physician to be too critically ill were excluded as evaluation may not be appropriate in those being acutely resuscitated; and

e) Patients from long term care/nursing homes and transfers from other hospitals.

3.4. Staff Training:

3.4.1 ED Nurses

There are 2 ED nurse educators at the Civic campus of the Ottawa Hospital responsible for the ongoing clinical teachings of approximately 120 ED nurses. The principal investigator met with the nurse educators to provide background to the study, the proposed implementation plan and the Ottawa 3DY Scale screening forms. The week prior to study roll out, an email was sent out to all the ED nurses from the principal investigator,

explaining the goal of the study and providing a copy of the screening tool (Appendix A). This was followed by an email from the clinical manager, endorsing the study and encouraging participation. For three days of the first week of the study, the principal investigator and/or research assistant held teaching sessions during the morning nursing breaks wherein coffee and muffins were provided, the study rationale was explained in further detail and the Ottawa 3DY Scale, including inclusion and exclusion criteria, was reviewed. Throughout the study, individual questions were answered by the research assistant who was in the Department throughout study hours. Posters of the Ottawa 3DY Scale were placed at the nursing stations. Biweekly emails were sent by the principal investigator, reminding them of the study and providing feedback on overall patient enrollment rates to date. Two times during the course of the study, all of the nurses' names were entered into a random draw for a fifty dollar restaurant gift certificate.

3.4.2 ED physicians

Two weeks prior to the start of the study, the principal investigator presented grand rounds to emergency medicine physicians and residents on altered mental status in elderly ED patients. A large part of the presentation was devoted to this study. The rationale, objectives and methods were described in detail. During the week prior to study initiation, the principal investigator sent out an email to all emergency physicians working at the Civic Emergency Department, explaining the goals of the study and providing a copy of the study protocol and Ottawa 3DY Scale screening tool. The Academic Chair of the Emergency Medicine Department also sent out an email endorsing the study and encouraging

participation. Ottawa 3DY Scale posters were posted in the emergency physicians' charting area and office. Biweekly emails were sent by the principal investigator, reminding them of the study and providing feedback on overall patient enrollment rates to date. Two times during the course of the study, all of the physicians' names were entered into a random draw for a fifty dollar restaurant gift certificate.

3.4.3 Research assistant

The research assistant was a first year medical student. She worked closely with the principal investigator, gaining a comprehensive understanding of the study rationale and protocol. She underwent 2 weeks of intensive training with the GEM nurses. Her training consisted of didactic teaching, observed interactions and supervised patient assessments wherein she completed a structured patient history, the Folstein Mini-Mental State Exam, the Identification of Seniors at Risk Tool and the Confusion Assessment Method.

3.5 Screening Tools:

The cognitive screening assessment consisted of the:

a) Ottawa 3DY Scale (Appendix B): This cognitive screening tool consists of 4 questions. The patient is awarded one mark for every correct answer. A score less than 4 is suggestive of cognitive impairment.

b) Folstein Mini-Mental State Exam (MMSE) (Appendix C): This cognitive screening tool has a possible 30 points. A cut-off score of 24 or less will be considered consistent with cognitive impairment and used as our criterion standard.

c) Identification of Seniors at Risk (ISAR) Tool (Appendix D): This tool consists of six self-report questions used to screen for functional decline/adverse health outcomes. A score of 2 or more is indicative of increased risk.[34]

d) Confusion Assessment Method (CAM) (Appendix E): This is the most widely used screening tool for delirium and the only delirium screening tool that has been validated in the ED.[90, 91] The diagnosis of delirium is based on the patient demonstrating both acute onset of change in mental status and inattention, as well as either disorganized thinking or altered level of consciousness.

3.6 Enrolment Protocol:

3.6.1 Placement of Screening Forms

Upon patient registration, the ED clerks are responsible for making the patient's chart. During study hours, two Ottawa 3DY Scale screening forms and envelopes were placed in all charts for patients who were 75 years of age or older. Ottawa 3DY Scale posters were posted in the patient registration area to serve as reminders to the clerks for the study.

3.6.2 Patient Enrollment

The bedside nurse and the treating physician determined patient eligibility and independently completed the Ottawa 3DY Scale screening form after assessing the patient. The forms were placed in sealed envelopes on the chart to keep their assessment blind. The research assistant would monitor the ED electronic white board, a tracking system for all registered ED patients, for all patients 75 years of age or older. Using this information, the research assistant then retrieved the Ottawa 3DY screening forms from the relevant charts. The research assistant compiled a master list for all potential patients. The following information was collected: date of visit, patient name and unique hospital number, area of the emergency department and completion of the Ottawa 3DY Scale screening form.

The patient algorithm was determined by their score on the Ottawa 3DY Scale. If the Ottawa 3DY score, as assessed by either the nurse or physician, was less than four (i.e. below normal), the research assistant then assessed the patient by taking a structured history and completing the MMSE, ISAR and the CAM. If the research assistant determined, based on their assessment, that a complete geriatric assessment was indicated, they referred to the GEM team for a more comprehensive evaluation. Ten percent of those with an Ottawa 3DY Scale score equal to four (i.e. normal) were randomly selected to be evaluated by the research assistant. These patients were scored on the MMSE, ISAR and CAM. If any concerns were identified, they were referred to the GEM team for further evaluation. Finally, the treating physician, as per their usual practice, referred to the GEM team, regardless of the patient's Ottawa 3DY score, if they felt it was indicated.

3.7 Acceptability Survey:

In order to evaluate the acceptability of the Ottawa 3DY Scale as a screening tool for altered mental status in elderly ED patients, we administered a survey to a random sample of nurses (N=54) and all the ED physicians (N=46), at the end of the prospective data collection. The goal was to gain insight into barriers and facilitators of screening for altered mental status in general and use of the Ottawa 3DY Scale in particular.

3.7.1 Survey development

The survey was designed on Survey Monkey Inc., a web-based survey development company.[92] The questionnaire consisted of 7 questions (Appendix F). The first six were related to respondent demographics, including age, gender, profession, type of employment and length of practice in the ED. The seventh question, consisted of a series of sixteen statements. The respondent was asked to indicate their level of agreement on a 7 point Likert scale ranging from strongly disagree to strongly agree and including no opinion/don't know. This series of statements was derived from the Ottawa Acceptability of Clinical Decision Rules Instrument (OADRI), a validated tool that evaluates the acceptability of Clinical Decision Rules among clinicians.[93] In addition, informal feedback from nurses and physicians regarding their use of the Ottawa 3DY Scale was incorporated into the acceptability survey.

3.7.2. Survey Administration

The survey was administered by email using Dillman's Tailored Design method.[94] Accordingly, all participants were sent a prenotification email from the principal investigator (Appendix G). Three days later, the first personalized cover letter with attached survey link was sent (Appendix H). The program allowed tracking of responses. Non responders were sent personalized email reminders with survey link each week to a maximum of three reminders. Data was collected by the Survey Monkey Inc. website and then exported in MS Excel spreadsheets for analysis. Completion of the survey was accepted as implied consent for participation.

3.8 Ethical Considerations:

We received approval from the Ottawa Hospital Research Ethics Board to conduct this study without the need for individual patient explicit written consent. Individual consent was not required because assessment of mental status is a standard part of all patient assessments and the Ottawa 3DY is a non-invasive assessment. There was no risk that the participant incurred as a result of participation in this research. The possible benefit was identification of cognitive impairment which was then referred for further assessment by the GEM team.

3.9 Data Management:

3.9.1 Data Collection

Our sources of information included the patient's ED chart, electronic hospital records and the provincial coroner's record. The research assistant and principal investigator collected the following information and recorded it on the Case Record Form (Appendix I):

1) *Baseline Demographic and Clinical Data:* including date of birth, gender, current living situation, highest level of education, marital status, past medical history and number of home medications.
2) *ED Disposition:* including final diagnosis, referral to the GEM team while in the ED and discharge disposition. Final diagnosis was sorted into the following categories: cancer, cardiovascular, endocrinology, failure to cope/social, gastrointestinal, infection, musculoskeletal, renal, trauma and other. For example: non-ST elevation myocardial infarction, congestive heart failure, hypertension were classified as cardiovascular; and urinary tract infection, pneumonia, cellulitis and sepsis were classified as infection. Discharge disposition included discharged home, respite care or admission to hospital (general ward or intensive care, length of stay and discharge to higher level of care was documented).
3) *30 Day Follow-up:* including repeat ED visits to either campus of The Ottawa Hospital and mortality. Information collected on repeat ED visits was the same as for the index visit.
4) *Cognitive Assessment:* including Ottawa 3DY Scale scores, Folstein Mini-Mental State Exam score, Identification of Seniors at Risk score and Confusion Assessment Method.

3.9.2 Data Entry

Data from the Case Record Form was entered into an Excel database, created by one of the data managers at the Ottawa Hospital Research Institute. The first 200 cases were entered by the principal investigator; the remainder of the cases were entered by a data entry clerk. The data entry used consisted primarily of pull down menus, to minimize data input error. Accuracy of input was further verified with frequency reports.

3.10 Data Analysis:

Data was analyzed using SPSS (IBM SPSS Statistics for Windows, Version 22.0 Armonk, NY: IBM Corp).

1) *Simple descriptive statistics* were used to assess level of implementation, acceptability of the Ottawa 3DY Scale, prevalence of altered mental status in the ED in elderly patients, and 30 day clinical outcomes (objectives 1a,b, 2,4). Means with standard deviations and proportions with confidence intervals were utilized for continuous and categorical variables, respectively.
2) *Cohen's Kappa coefficient* with linear weighting was calculated to express the interrater reliability or level of agreement between the nurse and physician scoring of the Ottawa 3DY Scale (objective 1c).[95] Scores were then collapsed into more clinically relevant categories of normal (Ottawa 3DY Scale score = 4) and abnormal (Ottawa 3DY Scale Score <4) and unweighted kappa was performed.
3) *Simple univariate analysis* was used to evaluate the relationship between patient characteristics and altered mental status (objective 3). The level of significance was set

at $p<0.05$. We wished to evaluate characteristics of all patients with altered mental status, not just those identified on screening, thus patients were considered to have altered mental status if they had: 1) a history of dementia; 2) an abnormal Ottawa 3DY Scale score (<4) confirmed with abnormal MMSE; or 3) an abnormal Ottawa 3DY Scale score who did not have an MMSE completed. The appropriate technique was chosen according to the type of data: for nominal data, the chi-square test with continuity correction; for ordinal variables, the Mann-Whitney U test; and for continuous variables, the unpaired 2-tailed t-test, using pooled or separate variance estimates as appropriate.

4) *Sensitivity and specificity with 95% confidence intervals* will be calculated for the Ottawa 3DY, performed by the bedside nurse and ED physician, using the MMSE with a cut off of 25 (≤ 24) as the criterion standard (objective 1d).

3.11 Sample Size:

3.11.1 Feasibility

The average number of patients 75 years or older seen at the Civic Campus of the Ottawa Hospital is 1058/month. It is likely that approximately 35% (or 370 patients) are seen during the hours of 0800 and 1600. Over the 2 month study period, this will yield 740 potential patients.

3.11.2 Sample size calculation

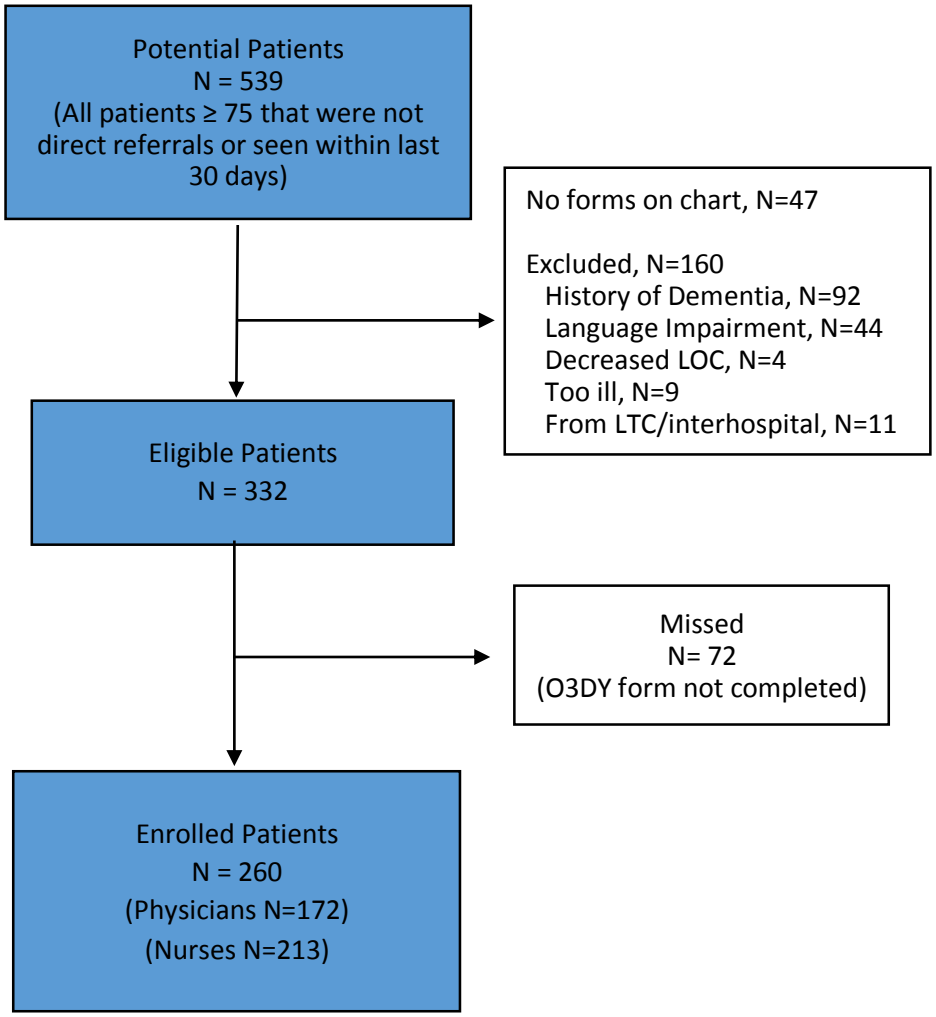
No hypothesis is being tested, thus sample size can be determined based on estimation of the precision around the proportion of patients that we anticipate will undergo cognitive screening (our primary outcome). Using standard sample size estimation for a single proportion, assuming a conservative estimate of 50% enrolment, 700 patients will yield an acceptable margin of error of +/- 3.5%.

CHAPTER 4: RESULTS

4.1 Study Participants

Figure 1 shows the patient flow diagram. Five hundred and eighty four patients that were 75 years or older presented to the Civic Campus of The Ottawa Hospital Emergency Department between 0800 and 1600 hours on Monday to Friday between June 17, 2013 and August 16, 2013. Forty five patients were referred directly to other specialties and thus were not assessed by the emergency physician. Forty seven potential patients did not have the Ottawa 3DY Study forms placed on their chart and 160 patients were excluded. Ninety two had a history of dementia documented in their medical history. Forty four patients were excluded as English or French was not their native language or they had another language impairment such as aphasia. Four patients presented with a decreased level of consciousness and nine patients were too ill to be questioned. Eleven patients were from long term care or an interhospital transfer. Thus, 332 patients were eligible for the study. In total, 260 patients were enrolled in the study. The physicians screened 172 patients for altered mental status, using the Ottawa 3DY Scale. Nurses screened 213 patients.

Figure 1. Study Flow Diagram for Elderly ED Patients



4.2 Patient Demographics

Table 1 illustrates patient demographics, ED final diagnosis, ED disposition and 30 day outcomes for potential patients, missed patients, excluded patients and enrolled patients. A total of 260 patients were enrolled and had these characteristics: mean age 83.7 (standard deviation 5.9) years and 60.0% female. For those patients in whom full demographics were known, 36.6% lived alone, 41.3% had a post-secondary education and 40.5% were currently married. The most common co-morbidities were hypertension, dyslipidemia and atrial fibrillation, found in 58%, 27% and 24%, respectively. Most frequent final diagnoses, as determined by the emergency physician, were: cardiovascular 18.8%, infection 13.5% and trauma 13.5%. Sixty seven patients (25.8%) were admitted to hospital. Thirty day outcomes included: ED recidivism 17.7% and mortality rate of 2.7%.

Overall, the demographics of missed patients is similar to those enrolled. While the initial acuity of their illness, as inferred by their triage location, was similar, patients that did not have any documented screening for altered mental status had a slightly higher discharge rate (79.2 % vs 73.5%). A higher proportion of missed elderly patients were more likely to return to the ED within 30 days (33.3% vs 17.7%). Mortality was lower (1.4% vs 2.7%).

Table 1. Elderly Emergency Department Patient Demographics, Emergency Department Diagnosis, Emergency Department Disposition and Thirty Day Outcomes.

PATIENT CHARACTERISTICS	Potential Patients N = 539	No Form on Chart N=47	Excluded Patients N=160	Missed N=72	Enrolled Patients N=260
Female Gender: (%)	331 (61)	31 (66)	101 (63)	42 (58)	156 (60)
Mean Age: (SD)	84.1 (5.9)	83.3 (5.6)	85.6 (6.0)	83.1 (5.6)	83.7 (5.9)
Current living situation: N (%)					
Unknown	110 (20)	15 (32)	29 (18)	22 (31)	44 (17)
Live alone	143 (27)	11 (23)	30 (19)	23 (32)	79 (30)
Live in own home with family	167 (31)	13 (28)	47 (29)	16 (22)	91 (35)
Live in retirement residence	101 (19)	8 (17)	36 (23)	11 (15)	46 (18)
Live in nursing home	18 (3)	0 (0)	18 (11)	0 (0)	0 (0)
Highest level of education: N (%)					
Unknown	373 (69)	41 (87)	133 (83)	65 (90)	134 (52)
Primary school (1-7)	37 (7)	2 (4)	8 (5)	0 (0)	27 (10)
Secondary school (8-12)	65 (12)	2 (4)	12 (8)	4 (6)	47 (18)
Post secondary school	64 (12)	2 (4)	7 (4)	3 (4)	52 (20)
Marital Status: N (%)					
Unknown	146 (27)	17 (36)	42 (26)	31 (43)	55 (21)
Married	146 27)	11 (23)	34 (21)	18 (25)	83 (32)
Divorced/separated/widowed	234 (43)	19 (40)	80 (50)	22 (31)	111 (43)
Never married/single	16 (3)	0 (0)	4 (3)	1 (1)	11 (4)
Past Medical History: N (%)					
Unknown	18 (3)	1 (2)	2 (1)	3 (4)	12 (5)
Diabetes	104 (19)	7 (15)	41 (26)	14 (19)	42 (16)
Hypertension	321 (60)	29 (62)	102 (64)	38 (53)	152 (58)
Dyslipidemia	142 (26)	13 (28)	42 (26)	17 (24)	70 (27)
Atrial fibrillation/flutter	127 (24)	8 (17)	42 (26)	14 (19)	63 (24)
Stroke/TIA	81 (15)	5 (11)	24 (15)	7 (10)	45 (17)
Coronary artery disease	95 (18)	8 (17)	26 (16)	15 (21)	46 (18)
Myocardial Infarction	56 (10)	2 (4)	15 (9)	4 (6)	35 (13)
Congestive Heart Failure	72 (13)	3 (6)	19 (12)	11 (15)	39 (15)
COPD	66 (12)	6 (13)	19 (12)	17 (24)	24 (9)
Location: N (%)					
Unknown	1 (<1)	0 (0)	0 (0)	0 (0)	1 (<1)
Resus/Emergent	133 (25)	9 (19)	42 (29)	13 (22)	63 (24)
Observation	228 (42)	15 (32)	79 (55)	35 (40)	99 (38)
Urgent Care	177 (33)	23 (49)	23 (16)	34 (39)	97 (37)

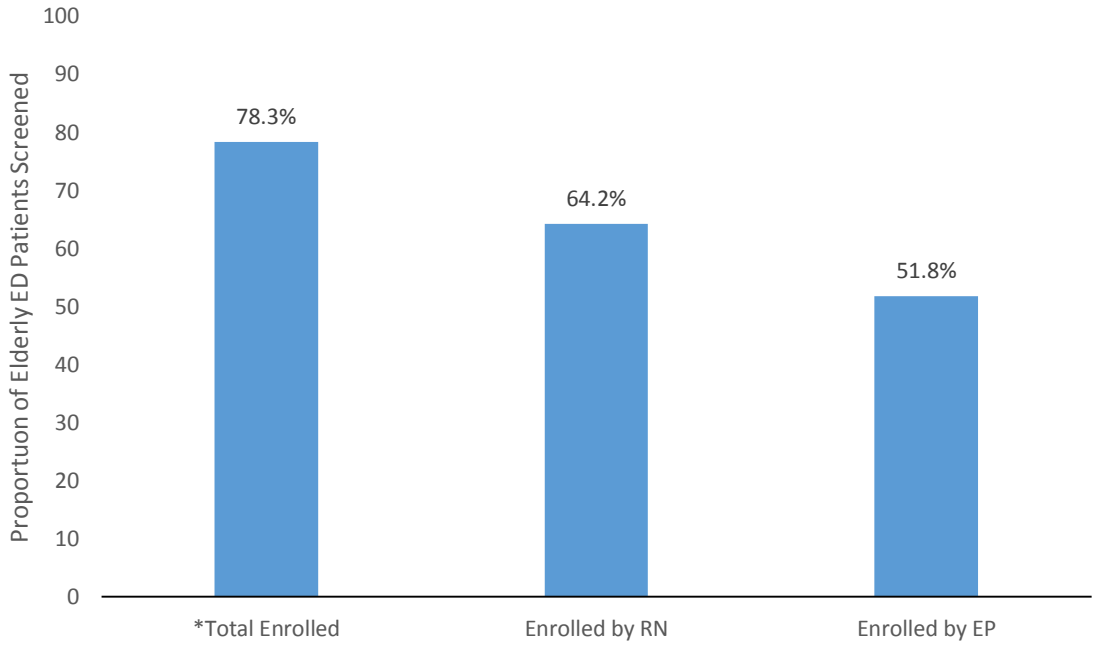
ED Final Diagnosis N (%)					
Cancer	2 (<1)	0 (0)	1 (1)	0 (0)	1 (<1)
Cardiovascular	80 (15)	7 (15)	16 (10)	8 (11)	49 (19)
Endocrinological	2 (<1)	0 (0)	0 (0)	1 (1)	1 (<1)
Failure to cope/social/weakness	17 (3)	1 (2)	2 (1)	5 (7)	9 (3)
Gastrointestinal	51 (10)	4 (9)	15 (9)	6 (8)	26 (10)
Infectious	86 (16)	3 (6)	36 (23)	12 (17)	35 (13)
Musculoskeletal	62 (12)	3 (6)	14 (9)	9 (13)	36 (14)
Neurological	36 (7)	4 (9)	16 (10)	1 (1)	15 (6)
Renal	20 (4)	5 (11)	6 (4)	3 (4)	6 (2)
Trauma	65 (12)	8 (17)	16 (10)	6 (8)	35 (13)
Other	118 (22)	12 (26)	38 (24)	21 (29)	47 (18)
ED Disposition					
Discharged Home	370 (69)	33 (70)	89 (56)	57 (79)	191 (74)
Respite Care	2 (<1)	0 (0)	1 (1)	0 (0)	1 (<1)
Admitted	165 (31)	14(30)	69 (43)	15 (21)	67 (26)
ICU	5 (1)	1 (2)	3 (4)	0 (0)	1 (<1)
Ward	157 (29)	13 (28)	65 (94)	15 (100)	64 (99)
Median Length of Stay	6.0	5.0	7.0	6.5	6.0
Return to ED within 30 days	110 (20)	10 (21)	30 (19)	24 (33)	46 (18)
1 visit within 30 days	89 (17)	10 (21)	27 (17)	21 (19)	31 (12)
2 visits within 30 days	12 (2)	0 (0)	1 (1)	2 (3)	9 (3)
3 visits within 30 days	4 (1)	0 (0)	0 (0)	1 (1)	3 (1)
4 visits within 30 days	4 (1)	0 (0)	1 (1)	0 (0)	3 (1)
5 visits within 30 days	1 (<1)	0 (0)	1 (1)	0 (0)	0 (0)
30 Day Mortality	16 (3)	1 (2)	7 (4)	1 (1)	7 (3)

ED = Emergency Department
SD = standard deviation

4.3 Implementation of the Ottawa 3DY Scale

Figure 2 illustrates the proportion of patients that had the Ottawa 3DY Scale applied by the bedside nurse and physician. Overall, 260 out of a possible 332 patients were screened for altered mental status with the Ottawa 3DY Scale. Thus, 78% of eligible patients were screened. Two hundred and thirteen out of a possible 332 patients (64.2%) were screened by the bedside nurse, while 172 patients (51.8%) were screened by the physician.

Figure 2. Proportion of Patients that were Enrolled with Ottawa 3DY Scale by the Bedside Nurse and Physician, N=332



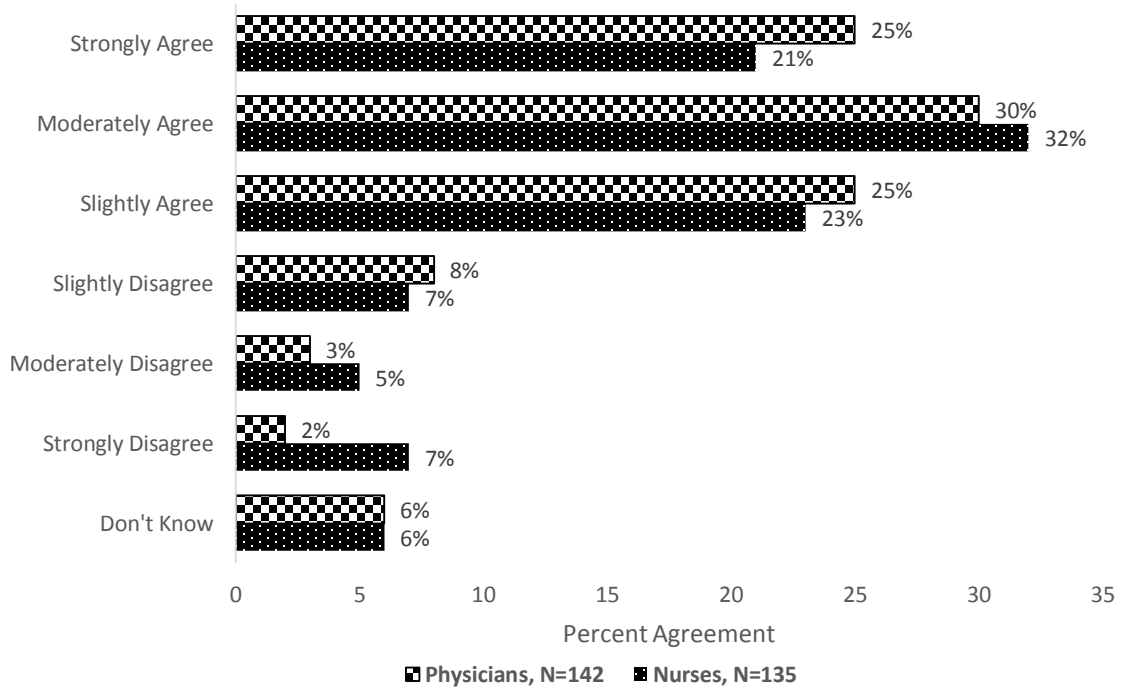
RN = Registered Nurse
EP = Emergency Physician
*112 Patients were enrolled by both RN and EP

4.4 Acceptability as a Screening Tool

4.4.1 Usefulness Question on Ottawa 3DY Scale Form

At the bottom of the Ottawa 3DY Scale Form the nurse/physician were asked to rate their level of agreement with the following statement, "The Ottawa 3DY Scale is useful to my practice" on a seven point Likert Scale, ranging from strongly disagree to strongly agree. **Figure 3** shows the responses by profession. The pattern and proportion of agreement was similar between the nurses and physicians. At the time of completion of the Scale, 80% of nurses and 76% of physicians agreed that the Ottawa 3DY Scale was useful to their practice.

Figure 3. Proportion of Agreement by Nurses (N=135) and Physicians (N=142) that Ottawa 3DY Scale is Useful to their Practice, N = 277



4.4.2. Survey Response Rate and Respondent Demographics

The overall response rate for the Ottawa 3DY Scale Acceptability Survey was 79%. The Survey was completed by 39/54 nurses (72%) and 40/46 ED physicians (87%). **Table 2** shows the respondent demographics. The nurses were: 23.1% male with 35.9% between 25 and 34 years of age. Three quarters worked full-time with 59.0 % percent working ten years or less in the ED. The physicians were 52.5% male and 42.5 % were between 35 and 44 years of age. All worked fulltime. Two thirds were CCFP-EM designation with years of experience split equally between 0-5, 6-10, 11-15 and greater than 15 years.

Table 2. Ottawa 3DY Scale Survey Respondent Demographics, N=79

	Overall (N=79)	**Nurse** (N=39)	**Physician** (N=40)
Gender, n (%)			
Male	30 (38)	9 (23)	21 (53)
Female	49 (62)	30 (77)	19 (48)
Age, n (%)			
25 - 34	24 (30)	14 (36)	10 (25)
35 - 44	30 (38)	13 (33)	17 (43)
45 – 54	19 (24)	9 (23)	10 (25)
55 – 64	6 (8)	3 (8)	3 (8)
65 to 74	0 (0)	0 (0)	0 (0)
Physician Professional Designation, n (%)		n/a	26 (65)
CCFP-EM			14 (35)
FRCPC			
Employment Status, n (%)			
Full-time	70 (89)	30 (77)	40 (100)
Part-time	9 (11)	9 (23)	0(0)
Years Worked in the ED, n (%)			
0 – 5 years	22 (28)	11 (29)	11 (28)
6 – 10 years	22 (28)	12 (32)	10 (25)
11 – 15 years	18 (23)	8 (21)	10 (25)
16 – 20 years	9 (12)	3 (8)	6 (15)
> 20 years	7 (9)	4 (11)	3 (8)

4.4.3 Survey Results

The nurse's responses to the Ottawa 3DY Acceptability Scale are illustrated in **Table 3**. Screening for altered mental status was rated as an important part of the assessment of an elderly ED patient by 85% of nurses, 87% reported that it was their responsibility to screen and 71% felt that the Ottawa 3DY Scale was useful to their practice. The feasibility of the scale was strongly endorsed with 97% moderately or strongly agreeing that the Ottawa 3DY Scale is easy to learn and use and 94% reporting that it is easy to remember. The minority, 11% of respondents, moderately or strongly agreed that the work environment or workload makes it difficult to use the Ottawa 3DY.

Table 3. Nurse Responses to Ottawa 3DY Acceptability Scale, N=39

Statement, %	**Strongly Disagree**	**Mod. Disagree**	**Slightly Disagree**	**Slightly Agree**	**Mod. Agree**	**Strongly Agree**	**No Opinion/ Don't Know**
The O3DY Scale is easy to learn.	0	0	0	0	10	87	3
The O3DY Scale is easy to use.	0	0	0	0	10	87	3
The O3DY Scale is easy to remember.	0	0	0	3	25	69	3
The O3DY Scale is useful in my practice.	0	0	0	21	38	33	8
The wording of the O3DY Scale is clear and unambiguous.	0	3	8	3	26	56	5
Patients benefit from use of the O3DY Scale.	0	0	3	26	39	16	16

Statement, %	Strongly Disagree	Mod. Disagree	Slightly Disagree	Slightly Agree	Mod. Agree	Strongly Agree	No Opinion/ Don't Know
The questions in the O3DY Scale are too difficult for the patient.	15	36	5	23	8	5	8
The environment I work in makes it difficult to use the O3DY Scale.	21	33	13	21	3	8	3
I would consider using the O3DY Scale in the future.	3	3	3	13	38	33	8
The O3DY Scale is too rigid to apply to individual patients.	21	41	18	10	0	3	8
My heavy workload makes it hard to use the O3DY Scale.	13	26	29	18	8	3	3
It is hard for me to learn new ways of doing things.	47	34	13	0	3	0	3
My clinical judgement is as good or better than the O3DY Scale for detecting altered mental status.	5	23	10	23	13	15	10
All elderly ED patients should be screened for altered mental status.	0	3	8	10	21	49	10
It is my responsibility to screen for altered mental status.	0	0	3	3	32	55	8
Cognitive screening is an important part of the assessment of elderly ED patients.	0	0	0	3	24	61	13

The emergency physician's responses to the Ottawa 3DY Acceptability Scale are illustrated in **Table 4**. Eighty three percent felt that screening for altered mental status is an important part of the assessment of an elderly ED patient and that it was their responsibility as an emergency physician to screen. Seventy percent reported that all elderly ED patients should be screened for altered mental status. Ninety eight percent, 95% and 88% of physician respondents judged the Ottawa 3DY Scale to be easy to learn, to use, and to remember, respectively. Although only 18% moderately or strongly agreed with the statement that their clinical judgement was as good as, or better than the Ottawa 3DY Scale for detecting altered mental status, only 31% of respondents felt the patient would benefit from use of the Scale. Sixteen percent reported the work environment and 23% reported heavy workload would make use of the Scale difficult.

Table 4. Emergency Physician Responses to Ottawa 3DY Acceptability Scale

Statement, n (%)	Strongly Disagree	Mod. Disagree	Slightly Disagree	Slightly Agree	Mod. Agree	Strongly Agree	No Opinion/ Don't Know
The O3DY Scale is easy to learn.	0	0	0	3	25	73	0
The O3DY Scale is easy to use.	0	0	0	3	30	65	3
The O3DY Scale is easy to remember.	0	0	5	8	43	45	0
The O3DY Scale is useful in my practice.	0	0	13	23	30	20	15
The wording of the O3DY Scale is clear and unambiguous.	0	3	0	18	30	48	3

Statement, %	Strongly Disagree	Mod. Disagree	Slightly Disagree	Slightly Agree	Mod. Agree	Strongly Agree	No Opinion/ Don't Know
Patients benefit from use of the O3DY Scale.	0	0	0	30	28	3	40
The questions in the O3DY Scale are too difficult for the patient.	15	33	38	5	3	3	5
The environment I work in makes it difficult to use the O3DY Scale.	13	28	35	10	8	8	0
I would consider using the O3DY Scale in the future.	0	0	5	13	48	30	5
The O3DY Scale is too rigid to apply to individual patients.	13	30	38	10	5	0	5
My heavy workload makes it hard to use the O3DY Scale.	5	30	25	15	15	8	3
It is hard for me to learn new ways of doing things.	18	35	23	8	10	3	5
My clinical judgement is as good or better than the O3DY Scale for detecting altered mental status.	3	18	25	23	15	3	15
All elderly ED patients should be screened for altered mental status.	0	3	8	18	25	45	3
It is my responsibility to screen for altered mental status.	0	0	3	15	40	43	0
Cognitive screening is an important part of the assessment of elderly ED patients.	0	0	3	15	35	48	0

Figure 4. Proportion of Physician and Nurse Agreement (Moderately and Strongly agree) to Barriers and Facilitators of the Ottawa 3DY Scale as a Screening Tool for Altered Mental Status in Elderly Emergency Department Patients

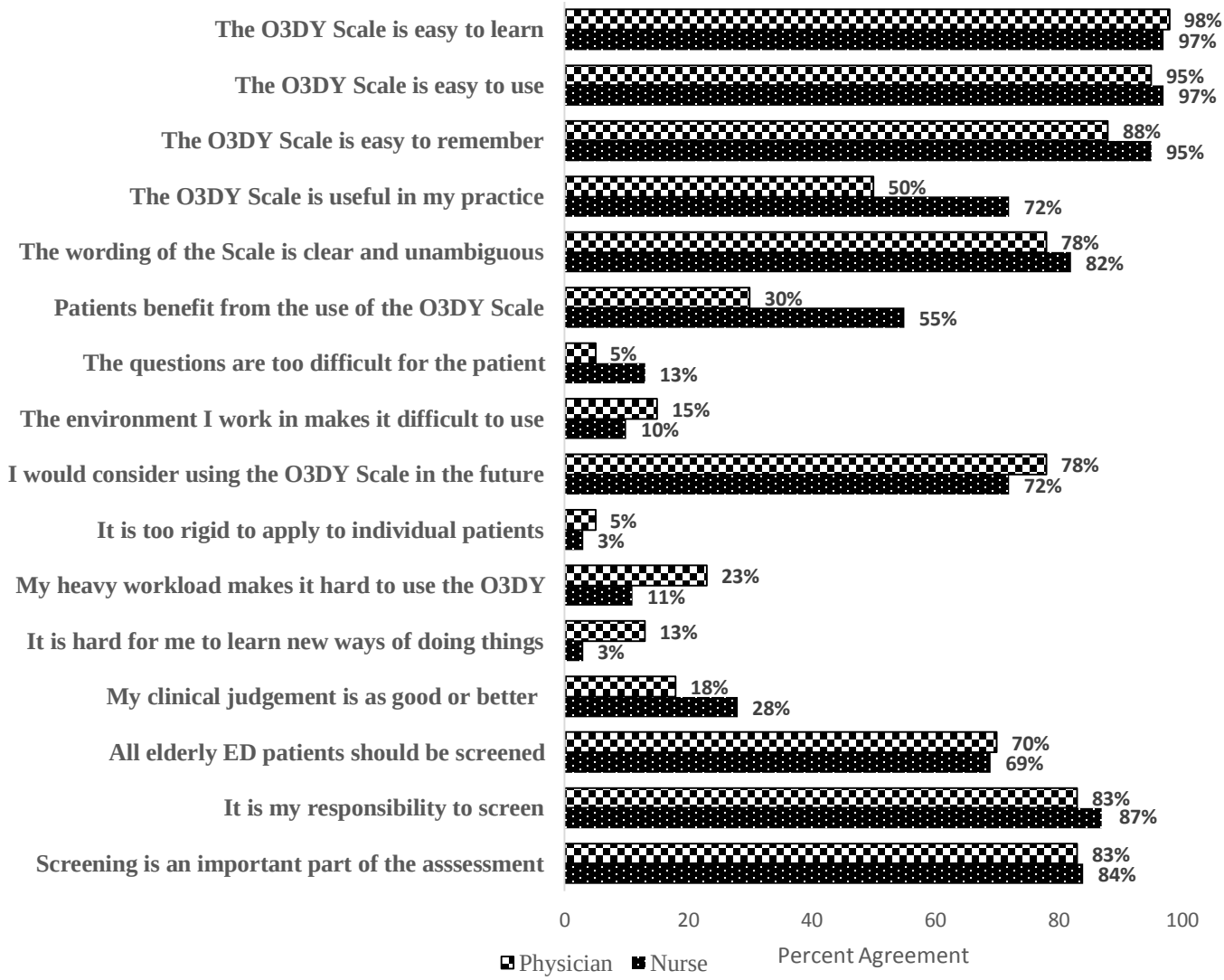


Figure 4 compares the level of agreement between nurse and physician responses to statements regarding screening for altered mental status in elderly ED patients and use of the Ottawa 3DY Scale. The greatest differences are seen in: 1) usefulness of the Ottawa 3DY Scale, where 72% of nurses compared with 50% of physicians felt the Scale would be useful

in their practice; and 2) patient benefit, where 55% of nurses compared with 30% of physicians felt patients would benefit from use of the Scale.

4.5 Inter rater reliability between Nurse and EP Ottawa 3DY Scale Scores

Interrater agreement was assessed on 112 pairs of observations. **Table 5a** shows the interrater reliability of nurse and physician Ottawa 3DY Scale score. **Table 5b** shows the inter-rater reliability of nurse and physician scores that differentiate between impaired (<4) and normal (=4). When discriminating between altered vs normal cognitive status, agreement was high at 83.9%. Cohen's Kappa for both specific scores and dichotomized scores (abnormal <4 and normal =4) were calculated. They were similar with linear weighted Kappa of 0.67 (CI 0.55 – 0.79) and unweighted Kappa of 0.65 (0.51-0.80) indicating a substantial level of agreement between nurse and physician scores.

Table 5a. Linear Weighted Kappa Agreement between Nurse and Physician Ottawa 3DY Scale (O3DY) Scores

	Physician O3DY Score					
Nurse O3DY Score	**0**	**1**	**2**	**3**	**4**	**Total**
0	3	1	0	0	0	**4**
1	1	3	1	0	1	**6**
2	0	0	3	3	2	**8**
3	0	2	3	11	5	**21**
4	0	0	0	10	63	**73**
Total	**4**	**6**	**7**	**24**	**71**	**112**

Agreement between Nurse and Physician Score (95%CI): 0.74 (0.65 – 0.82)
Kappa with Linear Weighting (95% CI): 0.67 (0.55 - 0.79)

Table 5b. Binary Kappa Agreement between Nurse and Physician Ottawa 3DY Scale (O3DY) Scores

	Physician O3DY Score		
Nurse O3DY Score	**Abnormal**	**Normal**	**Total**
Abnormal	31	8	39
Normal	10	63	73
Total	41	71	112

Agreement between Nurse and Physician Score (95% CI): 0.84 (0.76 – 0.90)
Kappa (95% CI): 0.65 (0.51 - 0.80)

4.6 Classification performance of the Ottawa 3DY Scale compared with the MMSE

The MMSE was completed on 98 patients. The score for attention was based on either spelling the word world backwards or performing serial 7's (counting backward from one hundred by sevens). A score less than twenty five was used as the reference standard for cognitive impairment. Sensitivities and specificities were calculated for the Ottawa 3DY Scale score, using a score less than four, as performed by the beside nurse and physician. These are illustrated in **Tables 6a and 6b.**

Table 6a. Sensitivity and Specificity of Ottawa 3DY Scale Score Completed by the Bedside Nurse Compared with Mini-Mental State Exam in Elderly Emergency Department Patients

	MMSE < 25 World Reversal		
O3DY <4	Yes	No	Total
Yes	22	22	44
No	4	26	30
Total	26	48	74

Agreement O3DY Score and MMSE = 64.9%
Sensitivity (95% CI): 84.6% (64.3 - 95.0)
Specificity (95% CI): 54.2% (39.3 - 68.4)

	MMSE < 25 Serial 7's		
O3DY <4	Yes	No	Total
Yes	22	15	37
No	5	20	25
Total	27	35	62

Agreement O3DY Score and MMSE = 67.7%
Sensitivity (95% CI): 81.5% (61.3 - 93.0)
Specificity (95% CI): 57.1% (39.5 – 73.2)

Table 6b. Sensitivity and Specificity of Ottawa 3DY Scale Score Completed by the Emergency Physician Compared with Mini-Mental State Exam in Elderly Emergency Department Patients

	MMSE < 25 World Reversal		
O3DY <4	Yes	No	Total
Yes	15	20	35
No	4	13	17
Total	19	33	52

Agreement O3DY Score and MMSE = 53.8%
Sensitivity (95% CI): 78.9% (53.9 – 93.0)
Specificity (95% CI): 39.4% (23.4 – 57.8)

	MMSE < 25 Serial 7's		
O3DY <4	Yes	No	Total
Yes	14	15	29
No	6	8	14
Total	20	23	43

Agreement O3DY Score and MMSE = 51.2%
Sensitivity (95% CI): 70.0% (45.7 – 87.2)
Specificity (95% CI): 34.8% (17.2 – 57.1)

The Ottawa 3DY Scale performed better when it was completed by the nurses, with a sensitivity of 81.5 - 84.6% and a specificity of 54.2 - 57.1%. In comparison, the sensitivity and specificity of the Ottawa 3DY Scale when completed by the physician was 70.0 - 78.9% and 34.8 - 39.4%, respectively. For both, the sensitivity was greater when compared with the test of attention where the patient is required to spell the word, world, backwards. The overall level of agreement between the Ottawa 3DY Scale scores and the MMSE was fair, ranging from 51.2% with physicians to 64.9% with nurses.

4.7 Prevalence of Altered Mental Status in Elderly ED patients

Ninety two patients (17.1%) had documentation of dementia in their medical history. Altered mental status was identified in 116 elderly ED patients (abnormal Ottawa 3DY Scale and abnormal MMSE in 43 patients and abnormal O3DY, not confirmed with MMSE, in 72 patients). Therefore, the prevalence of altered mental status in all potential elderly patients was 38.4% (95% CI 0.34 – 0.43).

The nurses performed the Confusion Assessment Method on 19 patients; four had a positive result indicating delirium. The research assistant performed the CAM on 102 patients; two were positive. Overall, the documented prevalence of delirium was 1.2%.

4.8 Patient Characteristics Associated with Altered Mental Status

Table 7 shows the univariate correlation of patient demographics with mental status. Patients' living situation, level of education and ED location were associated with altered mental status. Approximately one quarter of elderly patients were triaged to the resuscitation and emergent area regardless of mental status. However, a higher proportion of patients with altered mental status were triaged to the observation area than the patients without mental status impairment (54% vs 36%). With respect to current living situation and level of education, a higher proportion of patients with altered mental status lived in a retirement residence (29% vs 18%) and a smaller proportion attended post secondary education (32% vs 52%). Patient gender, mean age and marital status had no association with mental status in our study.

Table 7 Univariate Correlation of Patient Demographics with Altered Mental Status in Elderly Emergency Department Patients, N=351

Characteristic	No Altered Mental Status N=149	Altered Mental Status N=202	P-Value
Age in year, mean (SD)	83.0 (5.8)	85.7 (6.1)	0.695
Gender			0.772
Female (N, %) (N=351; 351)	93 (62)	123(61)	
ED Location, n (%)			0.001
Emerg/Resus	38 (26)	49 (24)	
Observation	54 (36)	109 (54)	
Urgent Care	57 (38)	44 (22)	
Living Situation, n (%) *(N=351; 286)*			0.010
Home alone	45 (40)	50 (29)	
Own home with family	48 (43)	65 (38)	
Live in Retirement Residence	20 (18)	58 (29)	
Highest Level of Education, n (%) *(N=351; 144)*			0.043
Primary school	8 (15)	24 (26)	
Secondary school	17 (33)	39 (42)	
University/College	27 (52)	29 (32)	
Marital Status, n (%) *(N=351; 277)*			0.431
Married/living with partner	45 (42)	58 (34)	
Divorced/Separated/Widowed	58 (54)	104 (62)	
Never married/Single	5 (5)	7 (4)	

ED = Emergency Department
SD = standard deviation

4.9 ED Disposition and Thirty Day Outcomes Associated with Altered Mental Status

Mental status was correlated with patient ED disposition and thirty day outcomes. **Table 8** illustrates that hospitalization, location of admission (Intensive Care Unit vs ward bed) and death in 30 days were associated with mental status. A larger proportion of patients

with altered mental status were admitted to hospital (37% vs 21%). They had a greater thirty day mortality rate (5% vs <1%). Approximately 17% of elderly ED patients returned to the ED within thirty days of their incident visit and no association with mental status was found.

Table 8 Univariate Correlation of ED Disposition and Thirty Day Outcomes with Altered Mental Status in Elderly Emergency Department Patients, N=351

Characteristic	No Altered Mental Status N=149	Altered Mental Status N=202	P-Value
Disposition, n (%)			
Discharged Home	117 (79)	126 (62)	0.001
Hospitalized	32 (21)	74 (37)	0.002
Respite Care	0 (0)	2 (1)	0.223
Admission Location, n (%)			0.007
ICU	0	1	
Ward	31	72	
Median Length of Stay, days	6.0	7.0	0.772
Return ED Visit in 30 Days, n (%)	,		0.709
Yes	25 (17)	37 (18)	
No	124 (83)	165 (82)	
Death in 30 Days			0.023
Yes	1 (<1)	10 (5)	
No	148 (99)	192 (95)	

ICU = Intensive Care Unit
ED = Emergency Department
SD = standard deviation

Part 5: Discussion

5.1 Objective 1a: Implementation of the Ottawa 3DY Scale

We evaluated the implementation of the Ottawa 3DY Scale, a previously validated screening tool for altered mental status, by bedside emergency physicians and nurses on patients 75 years and older presenting to the ED. We achieved an overall screening rate of 78%. This is a significant increase compared with current reported levels of evaluation. In two recent surveys, physicians involved in care of the elderly in the ED, reported screening for altered mental status in only one quarter of patients.[65, 66]

Individually, the screening rates were 64.2% and 51.8%, for nurses and physicians, respectively. To maximize efficiency, screening should be undertaken by one health care provider. However, it is unclear who is best to perform this evaluation for altered mental status. Other studies have utilized multiple clinicians within the circle of care to perform the screening, including: triage nurse[27], bedside nurse[96], bedside physician[83], social worker[17], or a team that screens for multiple geriatric syndromes.[65] However implementation has never been studied. Ultimately, screening for altered mental status in elderly ED patients needs to be performed in a standardized way as part of the initial assessment since, depending on the outcome, it may influence further workup of the patient, disposition decisions and outpatient follow up. How this is implemented may vary depending on the resources available in an individual Emergency Department.

Previous studies on cognitive screening tools for altered mental status in elderly ED patients have focussed on the test characteristics (sensitivity and specificity) of the screening

tools. To our knowledge, this is the first reported implementation study of a cognitive screening tool in the ED. Implementation studies are needed to bridge the gap between knowledge generation and knowledge utilization. Ultimately, the implementation studies show the true utility of the test. By successfully implementing the Ottawa 3DY Scale, we increased the screening for altered mental status by 300%. This is particularly important because without a formalized assessment tool physicians are poor at recognizing altered mental status. By increasing screening, using a validated tool, clinicians are more likely to identify altered mental status in their elderly ED patients. This should lead to an improvement in outcomes for this vulnerable patient population.

We were able to demonstrate that the Ottawa 3DY Scale is a feasible screening tool that increases the level of screening for altered mental status in elderly patients presenting to the ED.

5.2 Objective 1b: Barriers and Facilitators of Ottawa the 3DY Scale

5.2.1 Facilitators of the Ottawa 3DY Scale

Greater than 88% of physicians and nurses reported that the Ottawa 3DY Scale is easy to learn, use and remember. The Ottawa 3DY Scale is a simple four question tool that does not require any additional instruments (pens, paper) and is easy to score. These are key features in a cognitive screening tool. Many other cognitive screening tools are limited by their length, their need for pen, paper, for visual acuity or their complicated scoring algorithm.[72] The Ottawa 3DY Scale was derived specifically to address these barriers.[87] Its inherent feasibility is reflected in the survey results.

Consistent with previous studies, the majority of respondents, >80%, agreed that screening for altered mental status is an important part of the assessment of elderly ED patients. Encouragingly, both the physicians and nurses felt it was their responsibility to screen.[65, 66]

5.2.2 Barriers to the Ottawa 3DY Scale

5.2.2.1 Usefulness of Ottawa 3DY Scale as a Barrier to Screening

In spite of their strong endorsement for screening, only 50% of physicians moderately or strongly agreed that the Ottawa 3DY Scale was useful to their practice. This is a key barrier that needs to be addressed as perceived utility will greatly affect use, particularly in an environment such as the ED where there are significant time constraints. The possible explanation to this may lay in responses to the statement regarding the physicians' clinical ability to detect altered mental status and their opinion of patient benefit.

This does not appear to be a barrier for nurses, as nearly ¾ reported that the Ottawa 3DY Scale would be useful to their practice. Nurses routinely screen for altered mental status using questions of orientation, and as such may appreciate the value of a standardized screening tool more readily than their physician colleagues.

5.2.2.2 Perceived Clinical Judgement as a Barrier to Screening

Forty percent of physicians and 50% of nurses slightly, moderately or strongly agreed that their clinical judgement was as good or better than the Ottawa 3DY Scale for detecting

altered mental status. Kennelly et al. conducted a survey assessing the skills, knowledge and attitudes of physicians with respect to cognitive evaluation in elderly ED patients.[66] In their study, half of ED physicians reported that they lacked the clinical expertise to perform screening. Furthermore, the literature is clear that physicians are very poor at identifying altered mental status in elderly ED patients, missing it up to 80% of the time.[20, 28, 97] Without use of a specific screening tool, even when prompted, 65% of patients with delirium are missed. Elie et al examined the sensitivity and specificity of the standard emergency physician evaluation for detection of delirium, using the diagnosis of delirium by psychiatrist (based on the MMSE and CAM) as gold standard. Using a chart review and a mental status checklist completed by the emergency physician, the conventional ED evaluation had a sensitivity of 35.3%.[98] In our study, with the use of the Ottawa 3DY Scale, physicians achieved a sensitivity of 70-79% for detection of altered mental status. Clearly, use of the Ottawa 3DY Scale can significantly improve recognition of altered mental status in the geriatric ED population.

5.2.2.3 Perceived Patient Benefit as a Barrier to Screening

The majority of physicians did not perceive a strong benefit of screening for altered mental status with the Ottawa 3DY Scale; 40% reported they did not know if the patient would benefit and 30% only slightly agreed they would benefit. This was less of a barrier for nurses, as the majority agreed there was benefit to patients.

When assessing the benefit, a distinction must be made between dementia and delirium. Because the very nature of dementia is a slow progressive cognitive decline, the

benefits of early identification are not immediately apparent or easily measurable from an ED perspective. However, this is not to say that they do not exist. The literature is clear about the adverse consequences of unrecognized delirium in the ED. Kakuma et al showed in their study that identification of delirium alone, improves mortality compared with those that are not identified.[36] Intuitively, this makes sense, as delirium is known to be the result of an underlying medical condition. If the delirium is recognized and the underlying illness treated, we would expect a better outcome.

5.2.2.4 Attitudes toward Screening for Altered Mental Status as a Barrier

Approximately 10% of nurses and physicians disagreed that all elderly ED patients should be screened and 18% of physicians and 10% of nurses only slightly agreed. If not all elderly ED patients are screened, should there be targeted screening for those at increased risk?[28, 99] Kennedy et al derived a risk score for prediction of delirium.[22] It consists of six predictors (age, history of dementia, history of ischemic stroke or transient ischemic attack, respiratory rate >20, suspected infection and intracranial hemorrhage) which are weighted and then summed. The score then predicts low, moderate or high risk of delirium. The benefit of a complex risk score is likely limited, when the actual screening test is simple, feasible and fast. While a targeted approach is appropriate in certain situations (targeted HIV screening in the ED for high risk populations[58]), screening for altered mental status should be performed on all elderly ED patients because of the high prevalence (up to 40%) and the well documented risks associated with altered mental status.

Anecdotally, I received the following statement from physicians, "I may not get the date correct all the time, but I do not have altered mental status". The issue of validity of the Scale and concern for false positives was not addressed in the survey, however, it may be a barrier. Education regarding the validation of the Scale and its sensitivity and specificity could alleviate those concerns.

The study survey has highlighted knowledge gaps around screening for altered mental status that are barriers to utilization of a screening tool for cognitive changes in elderly ED patients. Without the use of a validated screening tool, these patients are at risk of suffering adverse outcomes from undetected mental status changes.

5.2.2.5 Environmental Factors as a Barrier to Screening

Not surprising, environmental factors were also identified as barriers. One in four physicians and one in three nurses slightly, moderately or strongly agreed that their work environment made it difficult to use the Ottawa 3DY Scale, with up to 40% identifying their workload as a barrier. The Ottawa 3DY Scale takes less than 1-2 minutes to perform. This is very short. The average physician patient encounter in the ED is less than 8 minutes, thus proportionately, screening may take a significant percentage of the patient evaluation.[100] In the Kennelly et al. study, 70% of respondents noted time to be a barrier to evaluation of altered mental status.[66]

Other environmental factors specific to the ED setting may have played a role but were not investigated. The study was conducted at an academic, teaching hospital. All staff physicians will supervise at least one resident while on shift and therefore may not assess

each patient themselves. While all residents were informed of the study and asked to complete the forms, residents from services other than the ED may have been less likely to participate as: 1) they may not be used to being involved in studies; and 2) their knowledge base may not include assessment of elderly ED patients. The study site has Canada's most robust, productive ED research teams. As such, while there is a culture within our ED to participate with research endeavors, it also lends itself to research fatigue; the physicians may get tired of completing research forms. There were seven other ED studies running concurrently with this study and it would not be uncommon for an individual patient to be eligible for more than one study. Finally, the role of patient volumes was not assessed. It is conceivable that on days with high patient volumes, the treating clinicians may be less likely to perform the Ottawa 3DY and complete the subsequent study form.

This survey contributes substantially to our understanding of barriers and facilitators of screening for altered mental status in general and use of the Ottawa 3DY Scale in particular. It is the only study that surveyed ED practitioners exclusively. A better understanding of these barriers will facilitate improved implementation strategies and lead to an increased level of screening and ultimately improving patient care.

5.3 Objective 1c: Interrater Reliability between Nurse and Physician Scores

5.3.1 Interrater Reliability of the Ottawa 3DY Scale

This study found there was a high level of interrater agreement and reliability between the nurse and physician Ottawa 3DY Scale scores when assessing elderly ED patients for altered mental status. The proportion of agreement was higher when scores were dichotomized to normal vs. abnormal altered mental status. This is relevant because clinicians need to know if the patient has altered mental status, not the degree of said impairment. The strong interrater agreement is further substantiated by the number of nurses and physicians involved in the study. A combination of 50 physicians and nearly 100 nurses assessed the elderly patients. Cohen's kappa demonstrated substantial agreement for both the ordinal and dichotomized assessments. Although kappa is affected by prevalence of the characteristic in question (altered mental status), the prevalence of altered mental status in our elderly ED cohort is consistent with the literature, and thus the results should be applicable to EDs with similar prevalence of altered mental status.[101]

5.3.2 Interrater Reliability of other Cognitive Screening Tools

Two community based studies, have evaluated the interrater reliability of the Clock Drawing Test (CDT). Evaluators were asked to score the completed CDT and in both studies, excellent interrater reliability was demonstrated.[73, 78] Those studies differed from the current study in several aspects: 1) they were community based cohorts; 2) they were scored by evaluators, not bedside clinicians; and 3) the interrater reliability was based on a completed outcome, not on the administration of the CDT. It is unclear how this would

translate in the clinical ED setting. Interrater reliability of the Six-Item Screener was assessed on a very small (20 patient) ED cohort. While excellent interrater reliability was found, it is not meaningful because the screening test was found to have a low sensitivity in the ED setting.[84, 85]

Our data shows there is a high level of agreement between nurse and physician Ottawa 3DY Scale scores and clinicians can consistently differentiate between altered and normal cognitive status with use of the Ottawa 3DY Scale.

5.4 Objective 1d: Classification Performance of Ottawa 3DY Scale

5.4.1 Classification Performance of the Ottawa 3DY Scale with MMSE

When compared with the Mini-Mental State Exam, our reference standard, the Ottawa 3DY Scale performed moderately well. The Scale performed better when applied by nurses compared with physicians. Both the sensitivity and the specificity of the Ottawa 3DY Scale was higher when patients were assessed by nurses.

When scoring the MMSE, evaluation of attention may be assessed by either asking the patient to recite the word WORLD backwards or count backwards from 100 by sevens (serial sevens). When comparing the sensitivity with the alternate forms of the MMSE, we found the sensitivity was higher when comparing Ottawa 3DY Scale scores with MMSE scores using WORLD reversed compared with serial sevens. This is not surprising given that exact question is part of the Ottawa 3DY Scale.

5.4.2 Use of the MMSE as Criterion Standard

The MMSE was used as our criterion standard. While the gold standard of a psychiatric diagnosis would be ideal, it is impractical in the ED setting where flow and care of the patients could not be disrupted by a lengthy evaluation. The MMSE has several well documented weaknesses, including educational, language, and cultural biases.[102-105] It has never been explicitly validated in the ED population yet continues to be the most widely used cognitive tool in ED studies. There is some variation in the optimum cut point.[106] The majority of ED studies have used a cut off of ≤ 23.[83] We have utilized a cut off of ≤ to 24 as this was used in the derivation phase of the Ottawa 3DY Scale.

5.4.3 Misclassification Bias

The Ottawa 3DY Scale was implemented with little training of the nurses and physicians. While the questions of the Scale, are quite simple at first glance, there are some subtleties that may have led to misclassification. For example, the correct response to 'What is today's date?' includes both the exact date, as well as one day before and after. If the nurse/physician were to accept only the exact date, the patient's answer could erroneously be scored as incorrect. In this study, the patient was screened using the Ottawa 3DY Scale up to two times prior to completion of the MMSE by the research assistant. Thus, it is possible that learning could have occurred such that the patient performed better on the MMSE than during the initial screening. Both of these factors could have contributed to the high false positive rate.

5.4.4 Classification Performance compared with Previous Studies

The sensitivities in the current study are lower compared with two previous studies. In the initial validation, GEM nurses achieved a sensitivity of 94%. Two differences in that study may have contributed to the higher sensitivity. First, the GEM Nurses would have significantly more training in cognitive assessments and second, the four questions of the Ottawa 3DY Scale were asked only once, with the responses being incorporated into the MMSE scoring algorithm.[89] In the study by Carpenter et al. comparing four cognitive screening tools, a sensitivity of 95% was attained. In that study, the Ottawa 3DY Scale score was also constructed from responses to the MMSE conducted by a trained research assistant.[72]

The Ottawa 3DY Scale performed equally well with the Blessed Orientation Memory Concentration Test and the Brief Alzheimers Test, when implemented by a research assistant however it is not limited by a complex scoring algorithm.[72] The Ottawa 3DY Scale has comparable sensitivity to the Mini-Cog but does not require the use of pen, paper and functional visual acuity.[79] Its sensitivity is superior to the Six Item Screener and the Quick Confusion Scale when performed within the ED environment.[82, 83, 85]

In most studies, the screening was performed by trained research assistants.[25, 26, 28, 107] It is difficult to know how this will translate when implemented by front-line health care workers. One of the strengths of our study is that screening for altered mental status in elderly patients presenting to the ED was performed by the bedside nurse and physician. When compared to other short cognitive screening tests for use in the elderly ED patient population, the Ottawa 3DY Scale, when implemented by bedside nurses and physicians with little training, is the only test that offers clinical feasibility with moderate sensitivity.

There are several factors that determine what an acceptable sensitivity level. Clinical decision rules that involve high risk pathologies such as traumatic head injuries or cervical spine injuries demand much higher sensitivities because of the potential adverse consequences of missing a case.[108-111] Sensitivities of screening tests are often lower than for a diagnostic test.[112, 113] In the ED literature, clinicians identify altered mental status in 18-45% of elderly patients.[20, 28] Use of the Ottawa 3DY Scale significantly increases identification of altered mental status to 78.9% - 84.6%.

5.5 Objective 2: Prevalence of Altered Mental Status

5.5.1 Overall Prevalence of Altered Mental Status

The overall prevalence of altered mental status in our elderly ED patient population was 40%. This is consistent with what is reported in the literature.[114] However, what was unusual in our study was the very low prevalence of documented delirium. Only 1.2% were found to have a positive CAM score compared with most studies which report a prevalence around 10%.[20, 29, 37, 96, 98, 115] In our study, the reported low incidence of detected delirium is more likely due to a combination of under recognition (where a delirium assessment is not performed in a patient with altered mental status) and under documentation (where the cause of the delirium is listed, such as sepsis, or medication side effect, but the acutely altered mental status is not).

5.5.2 Prevalence of Delirium

Less than 10% of elderly patients with altered mental status underwent a delirium assessment by the bedside nurse or physician, as determined by the presence of The Ottawa Hospital CAM form on the chart. The research assistant completed a delirium assessment using the CAM on a further 75 patients with altered mental status and identified two more patients with a positive CAM score indicative of delirium. This very low screening rate by treating clinicians is concerning because without use of a standardized assessment, delirium has been shown to be greatly under recognized in the ED.[20, 23, 97, 98] Furthermore, in one study of patients when admitted to hospital, only 6.2% of patients with delirium were subsequently diagnosed.[28]

In the patients that were screened with the CAM, the incidence of delirium was low at 6%. Could this be attributed to missed delirium within this cohort? Flaherty et al. advocate that mental status should be considered a vital sign.[116] Vital signs, like temperature, heart rate and blood pressure, should be taken repeatedly during the course of the ED encounter, as abnormalities indicate a change in the patient's clinical status. Similarly, cognitive status should be assessed more than once in patients at risk or patients in the ED for many hours. Delirium, by definition has a fluctuation in the level of consciousness and therefore may not be evident on the first evaluation. Two studies by Han et al. have in fact found this to be true. In one study, 9.4% had a positive CAM-ICU on initial presentation. Three hours later, 26.4% underwent a second delirium evaluation and 6.7% were found to have a positive CAM-ICU at that time point.[107] In the other study, upon initial assessment, 6.9% of those assessed had a positive CAM-ICU. Three hours later, 27.1% of patients were reassessed and a further 4.9% of those had a CAM-ICU positive

score for an overall delirium rate of 8.3%.[28] This demonstrates that patients with delirium will be missed unless assessments of cognitive status are repeated during their ED stay.

There was a low rate of completion of CAM for detection of delirium within our elderly cohort. Thus, the true rate of delirium within the cohort is unknown. As such, we were not able to perform any analyses comparing delirium and dementia. The effect of dementia and delirium on outcomes may be different, and we are unable to tease this out without confidence in our data on delirium.

Delirium was not the focus of this study. Our findings point to a significant gap in quality of care in the assessment of delirium, placing this elderly ED patient cohort at risk for the significant morbidity and mortality associated with delirium. Further study in this area is warranted. In particular, examining the knowledge, attitudes towards assessment of delirium as well as barriers to implementation of the CAM as a screening tool.

5.6 Objective 3: Patient Characteristics Associated with Altered Mental Status

In our study, ED location, place of residence and level of education were associated with altered mental status. Previous studies have identified demographic (age, nursing home residency), functional (hearing impairment, functional status) and clinical (systemic inflammatory response syndrome, severity of illness) features associated with altered mental status.[15, 17, 28]

5.6.1 Altered Mental Status and ED Triage Location

ED location was based on initial triage evaluation. The higher the severity of illness, the more likely the patient is to be assigned to a higher acuity area in the ED. Similarly, patients that have a poor baseline functional status, are less likely to be triaged to our ambulatory area. Thus in some respects, the patient ED location is a reflection of the patient's illness severity and their overall functional status. It is not surprising, therefore, that ED location was associated with altered mental status, with almost double the proportion of patients with normal cognition triaged to our urgent care, ambulatory zone compared with patients with altered mental status.

5.6.2. Altered Mental Status and Place of Residence

Although patients from nursing homes were excluded in this study, place of residence was associated with altered mental status. As expected, patients with altered mental status were less likely to live at home and more likely to live in a retirement residence where services supporting their instrumental activities of daily life, such as meal preparation and cleaning are available.

5.6.3 Altered Mental Status and Educational Level

The cognitive reserve hypothesis proposes that individuals with higher educational levels have a higher cognitive reserve function and though they may suffer the same neurodegenerative insults, clinically, they are less likely to manifest as dementia.[117-119] A recent large European study has given substantial credence to this hypothesis. They

examined dementia, brain weight and pathology from autopsy and years of education. They found that education did not protect against neurodegenerative pathology however it did mitigate the association between brain pathology and dementia.[120] Consistent with this, in our elderly cohort, patients with normal mental status were less likely to only have a primary school education and more likely to have had postsecondary education.

5.6.4 Altered Mental Status and Age

Interestingly, unlike previous studies, age was not associated with altered mental status. Perhaps this was because we had an older cohort, with screening starting at the age of 75 compared with most studies that utilized 65 years of age.

Patients from retirement residences, those not triaged to an ambulatory zone and patients with lower levels of education are more likely to present with altered mental status in the ED. These characteristics should alert the treating clinician to the increased risk of altered mental status in these elderly patients.

5.7 Objective 4: ED Disposition and Thirty Day Outcomes Associated with Altered Mental Status

Consistent with existing literature, our elderly ED patients with altered mental status were more likely to be admitted to hospital, be admitted to ICU or die within thirty days on the initial ED visit. Compared with other studies involving elderly ED patients, we had a lower hospitalization rate, with greater than 60% of elderly ED patients with altered mental status being discharged back to the community.[25] The reasons for this are likely complex

and could be a combination of different health populations, different access to primary care and different medical cultures (many of the studies were undertaken in the United States).

Within our cohort, patients with altered mental status were almost twice as likely to be admitted. Previous studies have shown that altered mental status is associated with increased length of stay upon admission.[25, 121] Our study, while showing a trend in this direction with a difference of 1 day, did not meet statistical significance. While a significant association was found between altered mental status and ICU admission, given our N of one, it is not appropriate to draw conclusions from this result.

McCusker et al., performed a database analysis examining 30 day outcomes in elderly patients in Quebec, Canada discharged from the ED.[122] They found a 30 day return ED visit rate of 21%. The thirty day mortality was 1% for patients discharged home from the ED. Our study had a similar level of ED return rates and was not associated with altered mental status. Our 30 day mortality was 5%. This higher rate is due to our inclusion of patients that passed away on their index ED visit/admission.

5.8 Limitations

This study is not without its limitations. The research was undertaken at an academic university, where the physicians have a strong history of supporting research. Thus, they may have been more likely to be early adopters of the Ottawa 3DY Scale, thus increasing the implementation rate. We utilized a convenience sample of elderly patients. The lack of 24 hours sampling can always be a source of bias but was unavoidable in this case due to availability of the research assistant. We expect any bias associated with the implementation

to be minimal as the same providers (nurses and physicians) work both day and night shifts, and as such their practice patterns are likely to be similar regardless of time.

Our study excluded 207 of a possible 539 patients. This proportion of excluded patients is not unusual for this type of study.[17, 25, 72, 83, 96, 107] The purpose of the screening test is to detect a clinical syndrome (in our case, altered mental status) that has been otherwise undiagnosed. Including patients with a known diagnosis is inappropriate as it would falsely elevate the sensitivity of the test. In our study, 92 elderly patients were excluded because of a known history of dementia. This documented rate of dementia is higher than has been reported previously in the literature, and may be due to our electronic charting system where past medical histories are very accessible.[83] This large proportion of excluded patients with dementia, likely contributes to the higher proportion triaged to the observation area and higher admission rates in that group. This finding is consistent with the literature on dementia patients.[123]

5.9 Clinical Implications

The Ottawa 3DY Scale is a simple screening tool for altered mental status which has been shown to be feasible for use in the ED. Implementation by bedside clinicians will increase the identification of altered mental status in elderly patients presenting to the ED.

This study has shown that the Ottawa 3DY Scale can be successfully implemented into a busy academic ED with little training or cost. Clinicians report a high level of acceptability of the tool, strongly endorsing its ease of use. We believe that this sensitive

screening tool for altered mental status in elderly patients can be widely adopted by bedside nurses and physicians in the ED.

This study has shown that the Ottawa 3DY Scale is moderately sensitive in identifying altered mental status, a condition that physicians are otherwise poor at recognizing. Identifying an acute alteration in mental status is the first step for the evaluation of delirium. It has been shown that the detection of delirium alone improves mortality in this vulnerable patient population. Identification of more chronic changes will lead to safer discharge planning in the ED as well as facilitate early treatment of dementia, decisions regarding safety to drive and advanced medical planning. Thus, improved recognition of cognitive changes through use of the Ottawa 3DY Scale could lead to improved clinical outcomes.

This study supports the widespread adoption of the Ottawa 3DY Scale as a feasible screening tool for altered mental status in elderly patients presenting to the ED. Use of this tool will lead to improved recognition and ultimately outcomes in this vulnerable patient population.

5.10 Future Research

5.10.1 Multicentre Implementation and Outcome Evaluation

Implementation research in health care covers a broad spectrum of study, with an overriding goal of facilitating the uptake of proven interventions. This may include evaluating the process of implementation, evaluating the factors that influence the implementation, or assessing the impact or outcomes of the implementation on various

stakeholders.[124, 125] This implementation study, examined the process of the implementation rather than the impact of that implementation.

There is some evidence suggesting tha the information from screening in the ED has little impact on both the ED care of the patient or subsequent follow up. Hustey et al. conducted a prospective cross-sectional study of elderly ED patients.[29] They found that the physicians identified 39% of patients with altered mental status. Furthermore, when presented with the new information regarding unrecognized altered mental status, including delirium, none of the physicians changed the patient's management plan (diagnostic work-up, disposition or referral). In fact, five patients with unrecognized delirium were discharged home. In 2009, Salen et al. in a prospective trial, evaluated the follow up initiated by the primary care physicians in response to an abnormal cognitive screen (clock drawing test) done in the ED on their elderly patients.[126] They found only 27% of those with an abnormal cognitive screen underwent further cognitive evaluation. Of those, 50% were newly diagnosed with dementia. This low rate of action in response to a positive screening test was consistent with an earlier primary care study done by Borson et al.[127] They examined the effect of implementing routine cognitive screening in primary care on rates of dementia diagnoses, specialist referrals and prescription of antidementia medications. Using research assistants, they were able to achieve a screening rate of 70%. While patients that failed the cognitive screen (Mini-Cog) were more likely to be diagnosed with dementia, be referred to a dementia specialist or prescribed a cognitive enhancing medication, only 17% of patients with a positive screening result resulted in any of these interventions. Those most likely to receive an intervention were those with poorer scores or those that were older.

To evaluate the impact of a positive screen for altered mental status on patient care, a multi-centre cluster randomized controlled study examining the implementation of the Ottawa 3DY Scale on elderly ED patients presenting to the ED will be undertaken. We will compare level of implementation, prevalence of documented altered mental status, hospitalization rates, length of stay, outpatient referral rates for further cognitive evaluation and 30 day return ED visits and mortality.

5.10.2 Delirium and Use of the Confusion Assessment Method in the ED

The CAM, used in the identification of delirium, was implemented in our ED two years prior to the start of this study. Our results show that it is not currently widely used and cases of delirium are being missed. Clearly, our current approach to delirium assessment is not working.

A new study, whose overall goal is to increase the screening for delirium in elderly ED patients, will be undertaken. It will evaluate the knowledge, skills and attitudes of nurses and physicians regarding delirium assessment and use of the CAM through a self-administered questionnaire. The facilitators and barriers identified would be utilized to develop and conduct an educational intervention, using the Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation (PRECEDE) model. This model has been shown in a recent systematic review to result in improved knowledge and changes in behaviours in delirium care.[128] In a double-centre prospective cohort study, we will evaluate the implementation of the brief Confusion Assessment Method by bedside nurses on elderly patients presenting to the ED. Primary outcomes will include: level of

implementation of bCAM; detection rates of delirium; rates of hospitalization, length of stay and 30 day return ED visits and mortality.

5.11 Conclusions

Implementation of the Ottawa 3DY Scale, a simple four question screening tool for altered mental status, significantly increased the number of cognitive assessments performed by bedside nurses and physicians. The Ottawa 3DY Scale demonstrated moderate sensitivity and specificity when compared with the MMSE and good interrater reliability. Its feasibility was strongly endorsed by both nurses and physicians, citing ease of learning, remembering and use. An overestimation of their ability to identify altered mental status and environmental factors were found to be barriers of use. The documented prevalence of delirium was very low, in large part due to lack of appropriate evaluation. Patients with cognitive impairment were less likely to be triaged to our ambulatory zone, more likely to live in a retirement residence and had a lower educational level. Patients with altered mental status were more likely to be hospitalized and die within 30 days.

Much work needs to be done to enhance delirium care in the ED. Further multi-centre studies will elucidate the impact of detection of altered mental status in elderly ED patients. This study has demonstrated that use of the Ottawa 3DY Scale can increase identification of altered mental status in elderly ED patients which could ultimately improve outcomes in this vulnerable population.

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APPENDIX A

Dear Nurses:

I'm writing to introduce a new study that I will be conducting over the next two months in the ED, entitled "Performance of the Ottawa 3DY Scale as a Screening Tool for Impaired Mental Status in Elderly Emergency Department Patients". The goal of this study is to determine if the Ottawa 3DY Scale is an acceptable, reliable and useful tool to use in screening elderly patients for altered mental status so that appropriate care and referrals can be provided more effectively. The screening tool is comprised of four simple questions (Day, Date, Dlrow, Year) and should take no more than a few minutes to complete when doing your initial intake assessment.

I have attached the screening tool for you to review; please make note of the inclusion and exclusion criteria, which are highlighted on the sheet. The screening tool will be printed on a purple sheet and will be placed in the charts of patients over the age of 75 upon registration during study hours. There will be an envelope for you to place it in upon completion. Since screening for mental status is a part of our standard of care, you are not required to obtain formal consent when administering the tool.

The study will begin Monday, June 17th. If at any time you have questions or concerns, please feel free to approach me in person or by email. My research assistant will be available 8:00-4:00 Monday to Friday in the ED.

We look forward to meeting with you next week in person to go over the study tools and any questions you may have during our informal coffee and muffins information sessions. Thank you for your support, as this study would not be possible without your help!

Sincerely,

APPENDIX B

Ottawa 3DY Scale

	Score Correct = 1; Incorrect = 0
What is the date?	/1
What day of the week is it?	/1
Spell the word WORLD backwards: DLROW	/1
What year is it?	/1
Total score	/4

Any score less than 4 is indicative of impaired cognitive function.

APPENDIX C

Mini-Mental State Examination

Orientation

Year, month, day, date, season	**_____/5**
Country, county, town, hospital, ward (clinic)	**_____/5**

Registration

Examiner names three objects (for example apple, pen, and table) Patient asked to repeat objects, one point for each	**_____/3**

Attention

Subtract 7 from 100 then repeat from result, stop after five subtractions. (Answers: 93, 86, 79, 72, 65) Alternatively if patient errs on subtraction get them to spell word backwards: DLROW Score best performance on either task	**_____/5**

Recall

Ask for the names of the objects learned earlier	**_____/3**

Language

Name a pencil and a watch	**_____/2**
Repeat: 'No ifs, and or buts'	**_____/1**
Give a three stage command. Score one for each stage (for example: Take this piece of paper in your right hand, fold it in half and place it on the table)	**_____/3**
Ask patient to read and obey a written command on a piece of paper stating: 'Close your eyes'	**_____/1**
Ask patient to write a sentence. Score correct if it has a subject and a verb	**_____/1**

Copying

Ask patient to copy intersecting pentagons Score as correct if they overlap and each has 5 sides	**_____/1**

Total Score (0-30)	**_____/30**

APPENDIX D

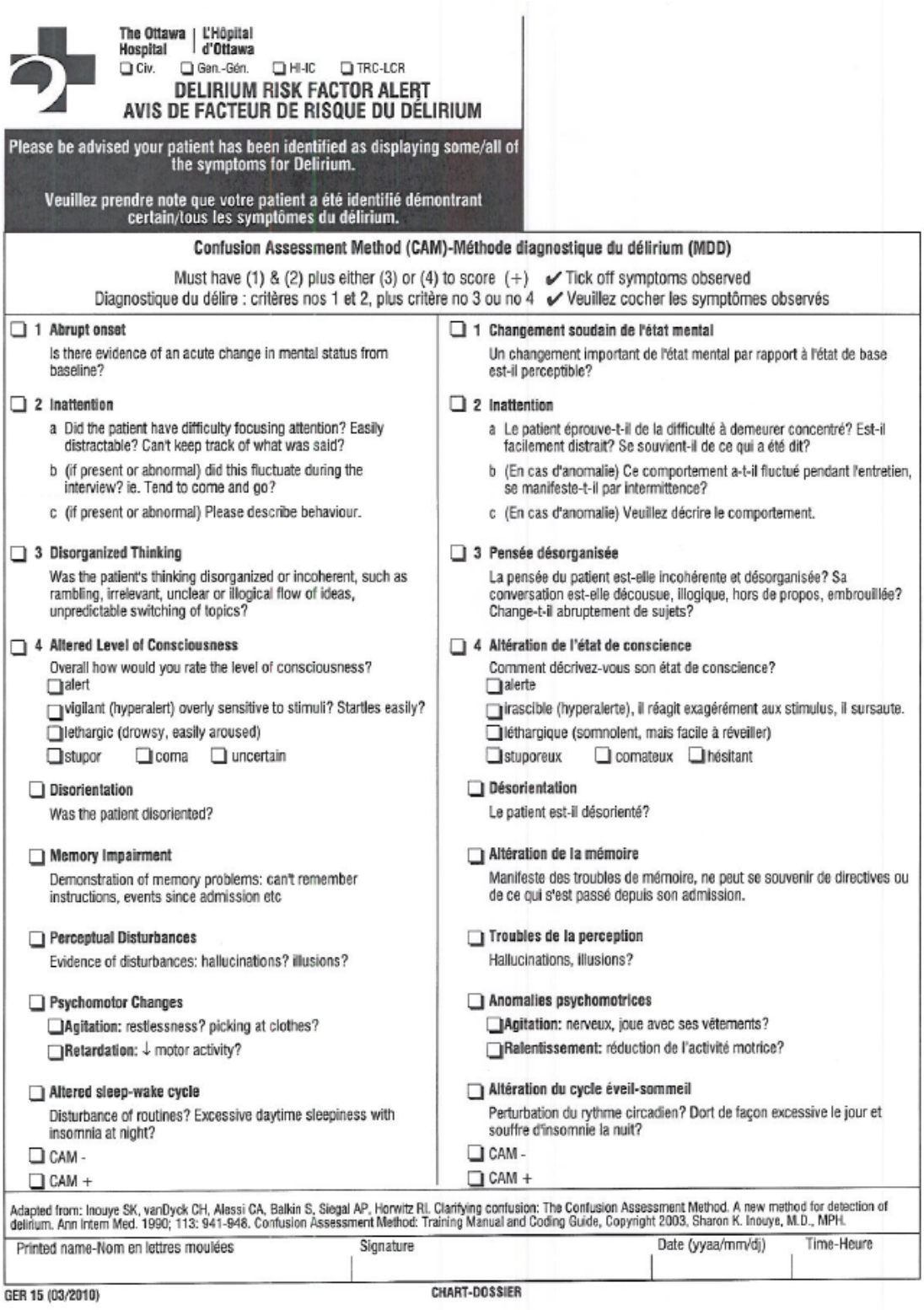
Identification of Seniors at Risk (ISAR) Tool

The ISAR tool is a self-reported questionnaire to identify older patients at risk for adverse health outcomes.

Questions	**Scoring Yes=1 pt; No=0 pt**
1. Before the illness or injury that brought you to the Emergency Department, did you need someone to help you on a regular basis?	Yes ☐ No ☐
2. In the last 24 hours, have you needed more help than usual?	Yes ☐ No ☐
3. Have you been hospitalized for one or more nights during the past 6 months?	Yes ☐ No ☐
4. In general, do you have serious problems with your vision that cannot be corrected by glasses?	Yes ☐ No ☐
5. In general, do you have serious problems with your memory?	Yes ☐ No ☐
6. Do you take six or more different medications every day?	Yes ☐ No ☐

_____/6

APPENDIX E



The Ottawa Hospital | L'Hôpital d'Ottawa

☐ Civ. ☐ Gen.-Gén. ☐ HI-IC ☐ TRC-LCR

DELIRIUM RISK FACTOR ALERT
AVIS DE FACTEUR DE RISQUE DU DÉLIRIUM

Please be advised your patient has been identified as displaying some/all of the symptoms for Delirium.

Veuillez prendre note que votre patient a été identifié démontrant certain/tous les symptômes du délirium.

Confusion Assessment Method (CAM)-Méthode diagnostique du délirium (MDD)

Must have (1) & (2) plus either (3) or (4) to score (+) ✔ Tick off symptoms observed
Diagnostique du délire : critères nos 1 et 2, plus critère no 3 ou no 4 ✔ Veuillez cocher les symptômes observés

☐ **1 Abrupt onset**
Is there evidence of an acute change in mental status from baseline?

☐ **2 Inattention**
a Did the patient have difficulty focusing attention? Easily distractable? Can't keep track of what was said?
b (if present or abnormal) did this fluctuate during the interview? ie. Tend to come and go?
c (if present or abnormal) Please describe behaviour.

☐ **3 Disorganized Thinking**
Was the patient's thinking disorganized or incoherent, such as rambling, irrelevant, unclear or illogical flow of ideas, unpredictable switching of topics?

☐ **4 Altered Level of Consciousness**
Overall how would you rate the level of consciousness?
☐ alert
☐ vigilant (hyperalert) overly sensitive to stimuli? Startles easily?
☐ lethargic (drowsy, easily aroused)
☐ stupor ☐ coma ☐ uncertain

☐ **Disorientation**
Was the patient disoriented?

☐ **Memory Impairment**
Demonstration of memory problems: can't remember instructions, events since admission etc

☐ **Perceptual Disturbances**
Evidence of disturbances: hallucinations? illusions?

☐ **Psychomotor Changes**
☐ **Agitation:** restlessness? picking at clothes?
☐ **Retardation:** ↓ motor activity?

☐ **Altered sleep-wake cycle**
Disturbance of routines? Excessive daytime sleepiness with insomnia at night?

☐ CAM -
☐ CAM +

☐ **1 Changement soudain de l'état mental**
Un changement important de l'état mental par rapport à l'état de base est-il perceptible?

☐ **2 Inattention**
a Le patient éprouve-t-il de la difficulté à demeurer concentré? Est-il facilement distrait? Se souvient-il de ce qui a été dit?
b (En cas d'anomalie) Ce comportement a-t-il fluctué pendant l'entretien, se manifeste-t-il par intermittence?
c (En cas d'anomalie) Veuillez décrire le comportement.

☐ **3 Pensée désorganisée**
La pensée du patient est-elle incohérente et désorganisée? Sa conversation est-elle décousue, illogique, hors de propos, embrouillée? Change-t-il abruptement de sujets?

☐ **4 Altération de l'état de conscience**
Comment décrivez-vous son état de conscience?
☐ alerte
☐ irascible (hyperalerte), il réagit exagérément aux stimulus, il sursaute.
☐ léthargique (somnolent, mais facile à réveiller)
☐ stuporeux ☐ comateux ☐ hésitant

☐ **Désorientation**
Le patient est-il désorienté?

☐ **Altération de la mémoire**
Manifeste des troubles de mémoire, ne peut se souvenir de directives ou de ce qui s'est passé depuis son admission.

☐ **Troubles de la perception**
Hallucinations, illusions?

☐ **Anomalies psychomotrices**
☐ **Agitation:** nerveux, joue avec ses vêtements?
☐ **Ralentissement:** réduction de l'activité motrice?

☐ **Altération du cycle éveil-sommeil**
Perturbation du rythme circadien? Dort de façon excessive le jour et souffre d'insomnie la nuit?

☐ CAM -
☐ CAM +

Adapted from: Inouye SK, vanDyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI. Clarifying confusion: The Confusion Assessment Method. A new method for detection of delirium. Ann Intern Med. 1990; 113: 941-948. Confusion Assessment Method: Training Manual and Coding Guide, Copyright 2003, Sharon K. Inouye, M.D., MPH.

Printed name-Nom en lettres moulées	Signature	Date (yyaa/mm/dj)	Time-Heure

GER 15 (03/2010) CHART-DOSSIER

APPENDIX F

Acceptability of the Ottawa 3DY Scale as a Screening Tool for Cognitive Impairment in Elderly ED Patients

Please answer all questions. Mark the best answer when you are unsure how to respond.

1) Your initials _____

2) What is your Age?
☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65+

3) Are you: ☐ Male ☐ Female

4) Are you a: ☐ Nurse ☐ Physician

5) If physician: ☐ CCFP (EM) ☐ FRCPC

6) Do you work: ☐ Full-Time ☐ Part-Time

7) How many years have you been practicing Emergency Medicine?
☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 20+

The Ottawa 3DY Scale is a screening tool for altered mental status consisting of 4 questions: What is the Day; What is the Date; Spell worlD backwards; and what is the Year.

Please indicate your level of agreement with each of the following statements about the Ottawa 3DY (O3DY) Scale by checking the appropriate box. Mark the best answer when you are unsure how to respond.

Please indicate your level of agreement with each of the following statements about the Scale	**Strongly Disagree**	**Moderately Disagree**	**Slightly Disagree**	**Slightly Agree**	**Moderately Agree**	**Strongly Agree**	**No Opinion/ Don't know**
The O3DY Scale is easy to learn	☐	☐	☐	☐	☐	☐	☐
The O3DY Scale is easy to use	☐	☐	☐	☐	☐	☐	☐
The O3DY Scale is easy to remember	☐	☐	☐	☐	☐	☐	☐
The O3DY Scale is useful in my practice	☐	☐	☐	☐	☐	☐	☐
The wording of the O3DY Scale is clear and unambiguous	☐	☐	☐	☐	☐	☐	☐
Patients benefit from use of the O3DY Scale	☐	☐	☐	☐	☐	☐	☐
The questions in the O3DY Scale are too difficult	☐	☐	☐	☐	☐	☐	☐
The environment I work in makes it difficult to use the Scale	☐	☐	☐	☐	☐	☐	☐
I would consider using this Scale in the future	☐	☐	☐	☐	☐	☐	☐
It is too rigid to apply to individual patients	☐	☐	☐	☐	☐	☐	☐
My heavy workload makes it hard for me to use the O3DY Scale	☐	☐	☐	☐	☐	☐	☐
It is hard for me to learn new ways of doing things	☐	☐	☐	☐	☐	☐	☐
My clinical judgement is as good or better than the O3DY Scale for detecting altered mental status	☐	☐	☐	☐	☐	☐	☐
All elderly ED patients should be screened for altered mental status	☐	☐	☐	☐	☐	☐	☐
It is my responsibility to screen for altered mental status	☐	☐	☐	☐	☐	☐	☐
Cognitive screening is an important part of the assessment of elderly ED patients	☐	☐	☐	☐	☐	☐	☐

APPENDIX G

Subject Line: Ottawa 3DY Scale Survey Prenotification from Debra Eagles

Hello,

Thank you for participating in the Ottawa 3DY study during the months of July and August this past summer. The project set out to assess the performance of the Ottawa 3DY Scale as a screening tool for impaired mental status in elderly Emergency Department patients. It consisted of four questions: day, date, WORLD spelt backwards, and year.

Within the next three days, you will receive an email with a link to a short survey that will explore barriers and facilitators to use of the Ottawa 3DY Scale.

I would greatly appreciate the few moments it takes you to complete this survey.

Thank you for your continued efforts!

Debra Eagles, MD, MSc (c)

APPENDIX H

Hello,

Please find attached a link for a survey that will explore barriers and facilitators to use of the Ottawa 3DY Scale, a cognitive screening tool for altered mental status in elderly Emergency Department patients.

The survey is very short, it should take ***less than 3 minutes to complete***. Your answers will be kept confidential, and only reported in aggregate.
Thank you,
Debra Eagles

APPENDIX I

Case Record Form

ID #_____
Visit Date _____

ED Location ☐ Urgent Care ☐ Obs ☐ Emergency/Resus

☐ Direct Referral
☐ Enrolled
☐ Missed
- ☐ Not completed by physician and nurse
- ☐ Forms not placed on chart by clerks

☐ Excluded
- ☐ Known history of dementia or obviously impaired/delirious
- ☐ Non English speaking, severe speech, hearing or visual impairment
- ☐ Decreased level of consciousness such as not able to respond to verbal questioning
- ☐ Too critically ill, as judged by the triage nurse/attending ED physician
- ☐ From long term care nursing home or transfer from another hospital

Baseline Demographics:

Gender:
☐ Male
☐ Female

Date of birth: _____ (M/Y)
Age: _____

Current living situation:
☐ unknown
☐ live home alone
☐ live in own home with family
☐ live in retirement residence

Highest level of education:
☐ unknown
☐ primary school (1-7)
☐ secondary school (8-12)
☐ college
☐ university

Marital status:
☐ unknown
☐ married/living with partner
☐ divorced/separated/widowed
☐ never married/single

Past Medical History:
☐ none
☐ diabetes
☐ hypertension
☐ dyslipidemia
☐ atrial fibrillation/flutter
☐ stroke/TIA
☐ coronary artery disease
☐ myocardial infarction
☐ congestive heart failure
☐ COPD

Medications:
Total # of home prescription meds _____
In hospital medications:
☐ none
☐ narcotics
☐ antipsychotics
☐ benzodiazepines

Cognitive Assessments:

Ottawa 3DY Scale Score:

Completed by nurse:	☐ no	☐ yes	If yes:	time: _____	score: _____
Completed by doc:	☐ no	☐ yes	If yes:	time: _____	score: _____

MMSE completed: ☐ no ☐ yes If yes: score: _____

CAM:

Completed by nurse: ☐ no ☐ yes If yes: time: _____ ☐ neg ☐ pos

Completed by RA: ☐ no ☐ yes If yes: time: _____ ☐ neg ☐ pos

ISAR completed: ☐ no ☐ yes If yes: score: _____

ED Disposition:

GEM assessment:

☐ no ☐ yes if yes: ☐ normal cognitive function

☐ abnormal cognitive function if yes: ☐ cognitive impairment ☐ delirium

Final Diagnosis: _____

☐ cancer ☐ infection

☐ CVS ☐ msk

☐ endo ☐ renal

☐ FTC/social/weakness ☐ trauma

☐ GI ☐ other

Disposition of Sentinel ED Visit

Discharged home: ☐ no ☐ yes If yes: ☐ no followup
☐ follow-up GP
☐ follow-up specialist
☐ outpatient geriatric assessment

Respite care: ☐ no ☐ yes

Hospitalized: ☐ no ☐ yes If yes: Location: ☐ Ward ☐ ICU
Length of Stay _____ days
Discharged to higher level care: ☐ no ☐ yes

30 Day Follow-Up

Return ED within 30 days ☐ no ☐ yes if yes: how many ED visits _____
visit 1 date: _____
visit 2 date: _____
visit 3 date: _____

Death in 30 days:

☐ no ☐ yes

Further Cognitive Assessment Performed:

☐ no ☐ yes If yes: ☐ GEM
☐ outpatient geriatrician
☐ psychiatry

If yes: ☐ normal cognitive function
☐ cognitive impairment

Case Record Form – Return within 30 days

ID #_____
Visit # _____
Date: _____

ED Location ☐ Urgent Care ☐ Obs ☐ Emergency/Resus

☐ Not seen during Study hours
☐ Direct Referral
☐ Enrolled
☐ Missed
  ☐ Not completed by physician and nurse
  ☐ Forms not placed on chart by clerks
☐ Excluded
  ☐ Known history of dementia or obviously impaired/delirious
  ☐ Non English speaking, severe speech, hearing or visual impairment
  ☐ Decreased level of consciousness such as not able to respond to verbal questioning
  ☐ Too critically ill, as judged by the triage nurse/attending ED physician
  ☐ From long term care nursing home or transfer from another hospital

Cognitive Assessments:

Ottawa 3DY Scale Score:

Completed by nurse: ☐ no ☐ yes If yes: time: _____ score: _____
Completed by doc: ☐ no ☐ yes If yes: time: _____ score: _____
MMSE completed: ☐ no ☐ yes If yes: score: _____
CAM:
Completed by nurse: ☐ no ☐ yes If yes: time: _____ ☐ neg ☐ pos
Completed by RA: ☐ no ☐ yes If yes: time: _____ ☐ neg ☐ pos
ISAR completed: ☐ no ☐ yes If yes: score: _____

ED Disposition:

GEM assessment:

☐ no ☐ yes if yes: ☐ normal cognitive function
☐ abnormal cognitive function if yes: ☐ cognitive Impairment ☐ delirium

Final Diagnosis: _____

☐ cancer ☐ infection
☐ CVS ☐ msk
☐ endo ☐ renal
☐ FTC/social/weakness ☐ trauma
☐ GI ☐ other

Disposition of Sentinel ED Visit

Discharged home: ☐ no ☐ yes If yes: ☐ no followup
☐ follow-up GP
☐ follow-up specialist
☐ outpatient geriatric assessment
Respite care: ☐ no ☐ yes
Hospitalized: ☐ no ☐ yes If yes: Location: ☐ Ward ☐ ICU
Length of Stay _____ days
Discharged to higher level care: ☐ no ☐ yes