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Running head: Clinical impression of vulnerability in the ED

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ABSTRACT:

Objectives To investigate whether the clinical impression of vulnerability (CIV) and the Dutch Safety Management Program (VMS), a screening instrument on four geriatric domains (ADL, falls, malnutrition, delirium), are useful predictors of 1-year mortality in older patients in the Emergency Department (ED).

Methods This was a prospective observational study in the ED of a tertiary care teaching hospital. Patients aged 65 years and older visiting the ED, and their attending physicians and nurses were included. CIV appraised by physician and nurse and the VMS-screening were recorded.

Results We included 196 patients of whom 64.8%, 61.7%, and 52.6% were considered vulnerable based on the CIV of physicians, nurses, and VMS-screening respectively. Agreement between CIV of physicians and nurses, and VMS-screening were both fair (overall agreement 63.3% for both, and respectively kappa 0.32 and kappa 0.31). CIV of physicians, nurses, and VMS-screening had a sensitivity of respectively 94%, 86%, and 73% for predicting 1-year mortality. A positive CIV was associated mostly with factors which can be observed directly during first patient contact after arrival to the ED, such as age, nutritional status and functional impairment.

Conclusion The CIV is a simple dichotomous question which can be used as a first step in the identification of vulnerable older ED patients, whereas the more time-consuming VMS-screening is more specific for detection of vulnerability. The CIV is therefore useful in a busy ED environment where time and resources are limited.

Key words: clinical impression; emergency department; vulnerability; aged; frailty; screening

Introduction

Older patients are at increased risk for adverse outcomes such as functional decline and premature death after hospitalisation.[1] They may benefit from early identification, preferably in the Emergency Department (ED), followed by patient-tailored interventions to decrease the risk of adverse health outcomes.[2-4] A comprehensive geriatric assessment (CGA) in the ED resulting in a coordinated and integrated plan for treatment, decreased functional decline and ED readmission, and was associated with lower hospitalisation following the ED visit in patients aged 85 years and older.[5,6] Although a complete CGA in the ED has been successfully carried out in research setting with research assistants appointed solely to this task, it has not been implemented in the daily ED practice of Dutch hospitals due to the time- and resource-consuming nature of the assessment. [5,6]

Much research has been dedicated to the design of screening tools to assist with identification of vulnerable older patients, although a limited number has been designed for the ED setting specifically.[7] Unfortunately, none of these tools seem to have the robust predictive properties needed to identify these vulnerable older patients.[8] Additionally, the screening tools are infrequently utilized in daily practice.[8] In a survey among health care professionals attending a frailty symposium, only 26% of the respondents used a standardized screening tool.[9] Reasons mentioned for not using screening tools are their time consuming nature, and health care professionals prefer to rely on their own clinical judgment.[9] Also, most of the screening tools for identification of vulnerable older patients, such as the Clinical Frailty Scale, are designed to identify frailty, i.e. the syndrome of decreased reserve and resistance to stressors causing vulnerability to adverse outcomes. [10,11] Identification of frailty demands a thorough investigation and should preferably be done by professionals with experience in geriatric medicine. To our knowledge, a

dichotomous clinical judgment as a screening tool for vulnerability, i.e. the state of being susceptible for an adverse (hospital) outcome, has never been investigated. In our opinion, physicians and nurses have an intuition regarding an older patient being vulnerable or not without further specification of the cause of this vulnerability, similar to the gut feeling used by general practitioners.[12]The aim of this study is to examine the clinical judgment of physicians and nurses in assessing vulnerability compared to a nationwide applied screening tool applied in hospitals to detect vulnerability. We investigated the diagnostic value of the clinical impression of vulnerability (CIV) and Safety Management Program (in Dutch: VeiligheidsManagement Systeem (VMS)) screening for vulnerability in predicting 1-year mortality in older ED patients; the agreement between the CIV and the VMS-screening; and the characteristics associated with a positive CIV.

Methods

Study design and setting

This prospective observational study was conducted between August 21 and September 3 2017 in the ED of the University Medical Centre Groningen, a tertiary teaching hospital in the Netherlands with ~30,000 ED visits annually. The ED staff consists of interns in their final year of medical education before becoming a resident, residents, attending physicians (hereafter all referred to as physicians), and ED registered nurses, and ED nurses in training (hereafter all referred to as nurses). The study was approved by the Medical Ethical Committee of the University Medical Centre Groningen, the Netherlands (METc 201700530).

Study population and protocol

ED patients, physicians and nurses participated in this study. All consecutive patients aged ≥ 65 years with an acute medical or surgical problem presenting to the ED between 8 a.m. and 10 p.m. were eligible. Reasons for exclusion were inability to participate due to medical reasons (e.g. cardiac arrest, severe hemodynamic instability), inability of patient and/or caregiver to answer questions (e.g. language barrier, aphasia), and the patient not being a formal ED patient (e.g., a scheduled visit for replacement of a urinary catheter by the ED nurse). Patients were identified by a member of the research team by use of a real-time digital overview chart of all patients currently in the ED, and were approached as soon as they were appointed an examination room. After the patient and/or caregiver consented, the VMS-screening was conducted by the member of the research team. This risk assessment tool is used to identify older patients who are at an increased risk for adverse outcomes in an early phase of hospitalization, and to initiate targeted interventions to prevent functional decline and premature death. The selected combination of items in the

VMS-screening was originally based on expert opinion and consists of 13 risk-related items grouped in four domains: risk of falling, malnutrition, delirium, and functional impairment.[13,14] Fall risk is evaluated with a single question on whether the patient had fallen in the past six months. Malnutrition is assessed by the Short Nutritional Assessment Questionnaire (SNAQ).[15] Risk of delirium is quantified by a positive answer to one or more of the following items: presence of memory problems, need for help with self-care during the last 24 hours, and/or previous delirium. Functional status is assessed by the original six-item Katz Index on Independence in Activities in Daily Living (ADL) based on the situation two weeks prior to ED presentation.[16] The dichotomous outcome of VMS-screening is positive in case patients score on three or more VMS-domains if aged 70-80 years or in one or more VMS-domains if aged 80 years and older, and forms an efficient instrument to identify older hospitalized patients at risk of adverse outcomes.[13] Informal caregivers of patients were allowed to assist by answering the VMS-screening.

The physician and nurse involved in the ED care of the patient were asked to give their CIV after their first patient contact. They were asked the following questions: [1] Do you consider this older patient to be vulnerable? (yes/no), [2] Do you have experience with screening instruments in older patients (for example the VMS-screening)? (yes/no), and [3] How many years of clinical experience do you have? We aimed to collect this information as soon as possible after the first contact patient contact. As a result, the CIV of the nurse was based on a short assessment consisting of a limited history, measurement of vital parameters and blood was obtained if necessary. The CIV of physicians was based on a history and (limited) examination. Physicians and nurses were questioned in a random order and blinded to each other's answers and to the result of the VMS-screening. Results of previous VMS-screening in the electronic medical patient record were not accessible. Both

physicians and nurses did not have to provide their CIV within a predefined time frame as this was not feasible.

Patient characteristics, medical or surgical specialty, Emergency Severity Index (ESI) category, discharge or hospital admission from the ED, number of home medication (verified by physician or hospital pharmacist), and number of ED presentations in the past twelve months, were obtained from the electronic medical patient record after taking the assessment.[17] Mortality data were acquired from the municipal record. All data were collected by members of the research team, which consisted of three residents in internal medicine trained in geriatric medicine, and two internists trained in acute medicine.

Outcome measures

The primary outcome of this study was 1-year mortality. Secondary outcomes included the agreement between the CIV and VMS-screening, and factors associated with a positive CIV by physicians and nurses.

Statistical methods

Standard descriptive statistics were used. Cases with missing data for the CIV were excluded. Missing data to compute the VMS-score were imputed as negative as we assumed the answer to be negative when the patient/caregiver did not know the answer to a question. The analysis was repeated with missing items of the VMS-score imputed as positive, and without cases with missing VMS-score data, to explore their effect on the outcomes.

Agreement between the CIV and VMS-screening was calculated with Cohens' kappa using bootstrap 95% confidence interval (CI).

The diagnostic value of the CIV and VMS-screening in predicting 1-year mortality was determined by calculating sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) with 95% CI. One-year mortality was chosen as reference standard, because this could be considered as an ultimate stage of vulnerability.

Logistic regression analysis was used to identify factors associated with a positive CIV. First, univariate logistic regression analysis was performed with age (as continuous variable), female sex (yes/no), ESI category urgent versus not urgent (category 1 and 2 versus category 3, 4 and 5), number of ED visits in the past twelve months (as continuous variable), presence of polypharmacy (more than five prescribed medications) (yes/no), and each positively scored domain of the VMS-screening (yes/no) as covariates. These covariates were determined a priori. All variables with an alpha of ≤0.25 were included in multivariate regression analysis and were entered with a backward selection procedure. Variables entered into the multivariate analysis were checked for collinearity. Both univariate and multivariate analyses were performed with the CIV by physician or nurse as dependent variable.

All statistical analyses were carried out using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, New York, USA). A two-sided p-value ≤0.05 was considered statistically significant.

Results

During the study period 268 consecutive patients aged ≥65 years presenting to the ED were eligible. Twenty-seven patients left the ED before they could be recruited, who did not differ in age and ESI category from the enrolled patients. In total, 42 patients were excluded, mainly due to inability to participate because of a medical reason, or because they were considered as not formal ED patients (see Figure, Supplemental Digital Content 1, which demonstrates the flow diagram for patient enrollment). Patients who presented outside study hours were more often triaged to an urgent ESI category compared to enrolled patients (39.5% vs. 17.3%, p<.001), no age difference was present. In total, 199 patients were enrolled, and for 196 patients information of both physician and nurse were complete. Characteristics of study participants are presented in Table 1. Patients had a median age of 72.5 years (interquartile range (IQR) 68.0-78.0), and 56.1% of the patients were admitted to the hospital. The 1-year mortality was 26.7%. In total, 89.3% of the patients were evaluated by a resident, 9.1% by an intern, and only 0.9% of the patients was evaluated by a medical specialist or certified emergency physician. Ninety-three percent of the physicians were residents with a median of 4 (IQR 3-5) years clinical experience, and 76.9% of the nurses were certified ED nurses, with a median of 12.5 (IQR 8-20) years clinical work experience. A minority of physicians and nurses working in the ED had experience with screening tools for vulnerable elderly persons (resp. 21.9% and 34.9%).

The CIV was assessed by physicians and nurses after resp. median 73minutes (IQR 50-107) and 65 minutes (IQR 38-101) after the patient arrived in the ED.

More than half of the patients were considered vulnerable by the CIV of physicians and nurses (resp. 64.8% and 61.7%) and according to the age-adjusted VMS-screening 52.6% of

198 the patients were vulnerable. Agreement between the CIV of physicians and the VMS-
199 screening was fair (overall agreement 63.3%; kappa statistic 0.32 (95% CI 0.21-0.43).
200 Agreement between the CIV of nurses and VMS-screening was also fair (overall agreement
201 63.3%; kappa statistic 0.31 (95% CI 0.21-0.40). Furthermore, agreement between physicians
202 and nurses was moderate (overall agreement 73.5%; kappa statistic 0.43 (95% CI 0.30-0.56)).
203 The CIV as assessed by physicians had a sensitivity of 0.94 (95% CI 0.84-0.99) and NPV of
204 0.96 (95% CI 0.87-0.99) for predicting 1-year mortality (Table 2). This implies 96% of the
205 patients who were qualified as not vulnerable by a physician were alive 1 year after the ED
206 visit. The nurses' CIV had a sensitivity of 0.86 (95% CI 0.74-0.94) with a negative predictive
207 value of 0.90 (95% CI 0.81-0.96). In comparison, the VMS-screening had a sensitivity of 0.57
208 (95% CI 0.42-0.71) and a NPV of 0.82 (95% CI 0.74-0.88) for mortality within 1 year.
209
210 For both physicians and nurses, the CIV was independently associated with higher patients'
211 age (Odds Ratio (OR) 1.13, 95%-CI 1.06-1.20, resp. OR 1.12, 95%-CI 1.05-1.18), presence of
212 polypharmacy (OR 2.73, 95%-CI 1.27-5.85, resp. OR 2.77, 95%-CI 1.31-5.88), increased risk of
213 malnutrition (OR 3.57, 95%-CI 1.61-7.92, resp. OR 2.74, 95%-CI 1.27-5.88), and the existence
214 of ADL impairment (OR 11.48, 95%-CI 2.48–53.06, resp. OR 4.73, 95%-CI 1.50-14.90) (see
215 Table, Supplemental Digital Content 2, which shows the results of the univariate and
216 multivariate logistic regression analysis). Additionally, in the multivariate analysis, the CIV of
217 nurses was associated with female gender of the patient (OR 2.37, 95%-CI 1.14-4.93).
218 Presence of a more urgent triage category, increased risk of delirium, and a higher number
219 of ED visits in the past year were statistically significant in the univariate analysis, but not in
220 the multivariate analysis. No collinearity was present.

All analysis were repeated with the missing items of the VMS-screening imputed as positive, and without the cases with missing VMS-screening data, which did not materially alter the outcomes (data not shown).

Discussion

In a hectic and busy ED setting, neither time nor resources are at hand in most ED's. for conducting a CGA for the identification of vulnerable older patients. Therefore, the challenge is to effectively classify older patients based on the need for a more extensive screening for vulnerability in the ED versus screening at a later moment, for example within 24 hours after hospitalisation. In this study, we found the quick bedside CIV is a simple, feasible aid to make a first discrimination between these groups, considering the fair agreement between the CIV and VMS-screening, and the high sensitivity and NPV of the CIV with regard to 1-year mortality which could be considered as the ultimate stage of vulnerability of an older patient. Furthermore, the excellent sensitivity and NPV of the CIV of physicians, can support physicians in making treatment decisions for their older patient in the ED.

The additional value of a clinical judgment was earlier demonstrated by O'Neill et al. in an outpatient setting during a pre-operative assessment of frailty in older patients.[19] In the ED, the value of clinical judgment in predicting Intensive Care Unit (ICU) admission of patients with sepsis by physicians and nurses was just as accurate as standardized screening instruments in predicting ICU admission.[20]

In this study a number of patient-related factors were found to be associated with the CIV by physicians and nurses, including higher patient age, presence of polypharmacy, higher risk of malnutrition and presence of functional impairment. Some geriatric syndromes, for example worsened nutritional status and functional impairment, might be considered as visual cues for the CIV, since they often can be investigated easily by observation or clinical history. This is in line with results of a study in which patients with walking difficulties, falls and malnutrition were more often described as frail in their medical record.[21]

Strengths of this study are the prospective design, inclusion of both physicians and nurses for the CIV, blinding of the physicians and nurses to each other's CIV and to the results of the screening tool for vulnerable elderly persons, the broad inclusion criteria, and the attendance of the researchers for 14 hours a day during two consecutive weeks.

There are some limitations. This study was a single-centre study in a tertiary teaching hospital. Since our hospital also serves as a general hospital we consider the results generalizable to patient populations of other general hospitals. Additionally, selection bias might have occurred due to the time frame in which patients were recruited, because patients who presented outside study hours had an urgent triage category more often compared to included patients. However, the influence of ED visits during day or night on the CIV seems unlikely, because no association between the CIV and triage category was found in the logistic regression analysis. Furthermore, the absence of a predefined timeframe for the CIV might have led to variance in the amount of available information for the physicians and nurses at the moment they were asked for their CIV. In daily ED practice this variance is also inevitable, because the time interval between patient arrival and first patient contact of physician an nurse is variable.

Unfortunately, we were not able to compare the CIV with a true gold standard for recognizing vulnerability as it was not available. Although a CGA might have revealed more information, performing a time consuming CGA in a hectic ED setting would not have been feasible. We chose the VMS-screening as a reference standard, because it resembles daily practice in the Netherlands and has a reasonable diagnostic test accuracy, correlates with mortality and functional decline, and has been widely implemented in all Dutch hospitals. [13,14]

In summary, the CIV is a simple dichotomous question which can be used as a first step in the identification of vulnerable older ED patients and is better in predicting mortality within 1 year than the more extensive VMS-screening. A positive CIV was associated mostly with factors which can be observed directly during the first patient contact after arrival to the ED. Therefore, the CIV is a practical solution for a busy ED environment where time and resources are often perceived as limited, even for brief screening tools.

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Author Contributions:

AC and CJ had full access to all the study data and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: AC, SL, BM, SR, JM. Acquisition of data: AC, SL, AB, EB, JM. Analysis and interpretation of data: AC, SL, CJ, BM, SR, JM. Drafting of manuscript: AC, SL. Critical revision of manuscript: AC, SL, AB, EB, CJ, BM, SR, JM. Statistical analysis: AC, BM, CJ.

List of supplemental digital content

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