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Clinical impression for identification of vulnerable older patients in the Emergency Department

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Published in:
European journal of emergency medicine

DOI:
[10.1097/MEJ.0000000000000632](https://doi.org/10.1097/MEJ.0000000000000632)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Final author's version (accepted by publisher, after peer review)

Publication date:
2019

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Calf, A. H., Lubbers, S., van den Berg, A., van den Berg, E., Jansen, C. J., van Munster, B. C., ... ter Maaten, J. C. (Accepted/In press). Clinical impression for identification of vulnerable older patients in the Emergency Department. *European journal of emergency medicine*, 27(2), 137-141.
<https://doi.org/10.1097/MEJ.0000000000000632>

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1 **Clinical impression for identification of vulnerable older patients in the Emergency**

2 **Department**

3 *Running head:* Clinical impression of vulnerability in the ED

4
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17
18 *Word count:* abstract 235 words; manuscript 2831 words

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24

- 25 *Conflicts of interest:* The authors declare no conflicts of interest.
- 26 *Funding sources:* We received an unrestricted grant from the University Medical Centre
- 27 Groningen, The Netherlands.

28 **ABSTRACT:**

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

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

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

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

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

50 **Introduction**

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

61 Much research has been dedicated to the design of screening tools to assist with
62 identification of vulnerable older patients, although a limited number has been designed for
63 the ED setting specifically.[7] Unfortunately, none of these tools seem to have the robust
64 predictive properties needed to identify these vulnerable older patients.[8] Additionally, the
65 screening tools are infrequently utilized in daily practice.[8] In a survey among health care
66 professionals attending a frailty symposium, only 26% of the respondents used a
67 standardized screening tool.[9] Reasons mentioned for not using screening tools are their
68 time consuming nature, and health care professionals prefer to rely on their own clinical
69 judgment.[9] Also, most of the screening tools for identification of vulnerable older patients,
70 such as the Clinical Frailty Scale, are designed to identify frailty, i.e. the syndrome of
71 decreased reserve and resistance to stressors causing vulnerability to adverse outcomes.
72 [10,11] Identification of frailty demands a thorough investigation and should preferably be
73 done by professionals with experience in geriatric medicine. To our knowledge, a

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

85 **Methods**

86 **Study design and setting**

87 This prospective observational study was conducted between August 21 and September 3
88 2017 in the ED of the University Medical Centre Groningen, a tertiary teaching hospital in
89 the Netherlands with ~30,000 ED visits annually. The ED staff consists of interns in their final
90 year of medical education before becoming a resident, residents, attending physicians
91 (hereafter all referred to as physicians), and ED registered nurses, and ED nurses in training
92 (hereafter all referred to as nurses). The study was approved by the Medical Ethical
93 Committee of the University Medical Centre Groningen, the Netherlands (METc 201700530).

94

95 **Study population and protocol**

96 ED patients, physicians and nurses participated in this study. All consecutive patients aged \geq
97 65 years with an acute medical or surgical problem presenting to the ED between 8 a.m. and
98 10 p.m. were eligible. Reasons for exclusion were inability to participate due to medical
99 reasons (e.g. cardiac arrest, severe hemodynamic instability), inability of patient and/or
100 caregiver to answer questions (e.g. language barrier, aphasia), and the patient not being a
101 formal ED patient (e.g., a scheduled visit for replacement of a urinary catheter by the ED
102 nurse). Patients were identified by a member of the research team by use of a real-time
103 digital overview chart of all patients currently in the ED, and were approached as soon as
104 they were appointed an examination room. After the patient and/or caregiver consented,
105 the VMS-screening was conducted by the member of the research team. This risk
106 assessment tool is used to identify older patients who are at an increased risk for adverse
107 outcomes in an early phase of hospitalization, and to initiate targeted interventions to
108 prevent functional decline and premature death. The selected combination of items in the

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

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

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

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

142

143 **Outcome measures**

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

147

148 **Statistical methods**

149 Standard descriptive statistics were used. Cases with missing data for the CIV were excluded.
150 Missing data to compute the VMS-score were imputed as negative as we assumed the
151 answer to be negative when the patient/caregiver did not know the answer to a question.
152 The analysis was repeated with missing items of the VMS-score imputed as positive, and
153 without cases with missing VMS-score data, to explore their effect on the outcomes.
154 Agreement between the CIV and VMS-screening was calculated with Cohens' kappa using
155 bootstrap 95% confidence interval (CI).

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

160 Logistic regression analysis was used to identify factors associated with a positive CIV. First,
161 univariate logistic regression analysis was performed with age (as continuous variable),
162 female sex (yes/no), ESI category urgent versus not urgent (category 1 and 2 versus category
163 3, 4 and 5), number of ED visits in the past twelve months (as continuous variable), presence
164 of polypharmacy (more than five prescribed medications) (yes/no), and each positively
165 scored domain of the VMS-screening (yes/no) as covariates. These covariates were
166 determined a priori. All variables with an alpha of ≤ 0.25 were included in multivariate
167 regression analysis and were entered with a backward selection procedure. Variables
168 entered into the multivariate analysis were checked for collinearity. Both univariate and
169 multivariate analyses were performed with the CIV by physician or nurse as dependent
170 variable.

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

174 **Results**

175 During the study period 268 consecutive patients aged ≥ 65 years presenting to the ED were
176 eligible. Twenty-seven patients left the ED before they could be recruited, who did not differ
177 in age and ESI category from the enrolled patients. In total, 42 patients were excluded,
178 mainly due to inability to participate because of a medical reason, or because they were
179 considered as not formal ED patients (see Figure, Supplemental Digital Content 1, which
180 demonstrates the flow diagram for patient enrollment). Patients who presented outside
181 study hours were more often triaged to an urgent ESI category compared to enrolled
182 patients (39.5% vs. 17.3%, $p < .001$), no age difference was present. In total, 199 patients
183 were enrolled, and for 196 patients information of both physician and nurse were complete.
184 Characteristics of study participants are presented in Table 1. Patients had a median age of
185 72.5 years (interquartile range (IQR) 68.0-78.0), and 56.1% of the patients were admitted to
186 the hospital. The 1-year mortality was 26.7%. In total, 89.3% of the patients were evaluated
187 by a resident, 9.1% by an intern, and only 0.9% of the patients was evaluated by a medical
188 specialist or certified emergency physician. Ninety-three percent of the physicians were
189 residents with a median of 4 (IQR 3-5) years clinical experience, and 76.9% of the nurses
190 were certified ED nurses, with a median of 12.5 (IQR 8-20) years clinical work experience. A
191 minority of physicians and nurses working in the ED had experience with screening tools for
192 vulnerable elderly persons (resp. 21.9% and 34.9%).

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

195

196 More than half of the patients were considered vulnerable by the CIV of physicians and
197 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.

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

224 Discussion

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

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

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

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

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

263 Unfortunately, we were not able to compare the CIV with a true gold standard for
264 recognizing vulnerability as it was not available. Although a CGA might have revealed more
265 information, performing a time consuming CGA in a hectic ED setting would not have been
266 feasible. We chose the VMS-screening as a reference standard, because it resembles daily
267 practice in the Netherlands and has a reasonable diagnostic test accuracy, correlates with
268 mortality and functional decline, and has been widely implemented in all Dutch hospitals.
269 [13,14]

270 In summary, the CIV is a simple dichotomous question which can be used as a first step in
271 the identification of vulnerable older ED patients and is better in predicting mortality within
272 1 year than the more extensive VMS-screening. A positive CIV was associated mostly with
273 factors which can be observed directly during the first patient contact after arrival to the ED.
274 Therefore, the CIV is a practical solution for a busy ED environment where time and
275 resources are often perceived as limited, even for brief screening tools.

276 **Acknowledgments**

277 The authors thank the nursing staff and physicians in the Emergency Department of the
278 University Medical Centre Groningen for their willingness to participate in this study.

279

280 **Author Contributions:**

281 AC and CJ had full access to all the study data and take responsibility for the integrity of the
282 data and the accuracy of the data analysis. Study concept and design: AC, SL, BM, SR, JM.

283 Acquisition of data: AC, SL, AB, EB, JM. Analysis and interpretation of data: AC, SL, CJ, BM,

284 SR, JM. Drafting of manuscript: AC, SL. Critical revision of manuscript: AC, SL, AB, EB, CJ, BM,

285 SR, JM. Statistical analysis: AC, BM, CJ.

286

287 **List of supplemental digital content**

288 Supplemental Digital Content 1 Figure.pdf

289 Supplemental Digital Content 2 Table.pdf

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