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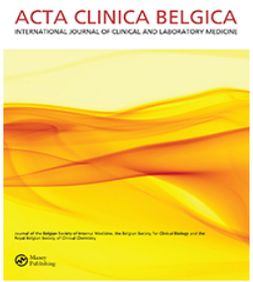

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Prognostic value of the Surprise Question for one-year mortality in older patients: a prospective multicenter study in acute geriatric and cardiology units

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ABSTRACT

Objectives: To determine the prognostic value of the Surprise Question (SQ) in older persons.
Methods: A multicenter prospective study, including patients aged 75 years or older admitted to acute geriatric (AGU) or cardiology unit (CU). The SQ was answered by the treating physician. Patients or relatives were contacted after 1 year to determine 1-year survival. Logistic regression was used to explore parameters associated with SQ. Summary ROC curves were constructed to obtain the pooled values of sensitivity and specificity based on a bivariate model.
Results: The SQ was positive (death within 1 year is no surprise) in 34.7% AGU and 33.3% CU patients (p = 0.773). Parameters associated with a positive SQ were more severe comorbidity, worse functionality, significant weight loss, refractory symptoms and the request for palliative care by patient or family. One-year mortality was, respectively, 24.9% and 20.2% for patients hospitalized on AGU and CU (p = 0.319). There was no difference in sensitivity or specificity, respectively, 64% and 77% (AUC 0.635) for AGU versus 63% and 76% (AUC 0.758) for CU (p = 0.870). A positive SQ is associated with a significant shorter time until death (HR 5.425 (95% CI 3.332–8.834), p < 0.001) independently from the ward.
Conclusion: The Surprise Question is moderately accurate to predict 1-year mortality in older persons hospitalized on acute geriatric and cardiologic units.

KEYWORDS
Prognosis; palliative care; older person; advance care planning; one-year mortality

Background

The last decades, the mean life expectancy has continuously increased and will further increase, leading to more older people suffering and dying from multiple chronic diseases [1–3]. These chronic conditions lead to higher frequencies of frailty, physical disabilities and cognitive decline that are affecting the quality of life especially during the last years of life [2,4]. Therefore, it is important that palliative care is timely offered [5–7]. Palliative care was defined by the World Health Organisation as 'an approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, psychical, psychosocial and spiritual' [8]. Where palliative care used to be implemented only in the last few weeks of life, there is a shift to early integration because patients and their families can experience more complex problems earlier in the disease trajectory [3,6,9,10]. In a recent qualitative study, studying early integration of palliative care, cancer patients and caregivers reported feeling supported and guided with personalised symptom management, holistic support, preparation for the future and reduction of depressive symptoms in family caregivers [11,12]. Although most studies were conducted within a group of cancer patients and their caregivers, the World Health Organisation recommends offering palliative care and discussing advance care planning for all older people in a timely manner [3].

Despite the known benefits of early integration of palliative care, the older patient is at risk of not receiving this [3]. An Australian review stated that one-third of older patients received non-beneficial treatments at the end of life [13]. Some of these treatments can compromise the quality of life [14]. One of the main reasons for the lack of early integration of palliative care remains the unpredictable trajectory of dying [3,15–18]. It would be interesting to find a tool facilitating prognostication in the older patient [17].

The Surprise Question (SQ) was suggested for the first time in 2005 by Joanne Lynn to identify patients who might benefit from palliative care services and advance care planning [19]. The SQ is a very easy-going and feasible way to identify patients with palliative needs and has shown to be relevant in patients with chronic kidney disease, cancer and heart failure but it may lack accuracy with an over-classification of

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patients with palliative needs [20–25]. The SQ is now included in 'The Gold Standard Framework (GSF) Proactive Identification Guidance (PIG)', NECPAL-COMMS-ICO© Tool and routinely used in some hospitals, hospices and general practices [26,27]. In oncology, nephrology and cardiology patients, SQ is more often validated as a prognostic tool [20–23]. However, until now, there is few validation of the SQ as a prognostic tool in the older hospitalized persons.

Worldwide, older patients may be hospitalized in acute geriatric units, known for coordinated care for the older persons focusing on their specific health problems including physical, mental, social and spiritual care [15]. However, older persons are also hospitalized in disease-specific wards. This is why we choose to validate the SQ in older hospitalized patients both in geriatric units and in disease-specific wards.

In this multicentre prospective study, we aimed to answer the following questions:

(1) What is the prognostic value of SQ for 1-year mortality in older persons admitted to the acute hospital?
(2) Is the prognostic value different in older persons admitted to the acute geriatric ward in comparison with a disease-specific ward?
(3) Which patient and ward characteristics are independently associated with a positive SQ (death is no surprise)?

Methods

Study design, participants and setting

This is a multicentre prospective study conducted simultaneously at four hospitals in Belgium, two in the French-speaking part of Belgium (Cliniques universitaires Saint-Luc Brussels and CHU-UCL Namur) and two in the Dutch-speaking part (AZ Alma Eeklo and UZ Gent). Data collection took place both in acute geriatric (AGU) and cardiology (CU) unit of each hospital.

All patients, 75 years or older, were screened for inclusion. Exclusion criteria were as follows: patients already included on prior admission, patients dying on admission, patients staying less than 48 hours in the hospital and patients who stayed more than 48 hours on another ward before being transferred to AGU or CU.

When a patient was eligible for the study, informed consent was asked by the researcher (junior physician) to the competent patient or to the legal representative of the incompetent patient.

This study was approved by the medical ethics committee with Belgian registration number B670201734351.

Data collection and measurements

Patients were included from January to July 2018. After informed consent, socio-demographic information, functionality and comorbidity were obtained by reviewing the medical record using validated instruments; palliative care needs were informed through a standardized interview with patients and/or relatives. Data collection was conducted by trained researchers blinded from the treating physician.

Functionality was assessed by basic and instrumental activities of daily living (ADL), using KATZ index [28] and Lawton index, respectively [29]. Comorbidity was measured by Charlson Comorbidity Index (CCI) [30]. Palliative care needs were assessed by researcher using the first part of the SPICT questionnaire screening for six general indicators of poor or deteriorating health (Supportive and Palliative Care Indicators Tool, version 2017) [31].

The treating physician, who was blinded for all the collected data, was asked if he would be surprised if the patient would die within 6 months to 1 year. If death is no surprise, SQ is noted as positive.

After 1 year, patients or relatives were contacted by telephone to assess the 1-year mortality and time of death.

Outcome measures

One-year mortality is the primary outcome measure. Timing of death is used as a secondary outcome.

Statistical analysis

Statistical analysis was performed using IBM® SPSS® Statistics 25.0. Mean and standard deviation were computed for continuous data, while percentage was used for categorical data. Differences between two groups were compared using Pearson Chi-Square for categorical variables, Fisher Exact 2-sided for dichotomous variables and Independent-Samples T-Test or Levene's test for equality of variances for continuous variables. The exact p-values are reported with statistical significance defined as $p \leq 0.05$. To determine parameters associated with a positive SQ, multiple logistic regression was conducted. We included the variables hospital, type of ward (AGU versus CU), age, gender, CCI, Katz index and Lawton index total score, and palliative care needs (SPICT part 1) in a multiple logistic regression model and performed a backward stepwise procedure until all variables had a p-value < 0.200. We also tested interactions between ward and age, ward and CCI, ward and SPICT score.

A multivariable Cox regression was used to assess the time-dependent association between SQ and mortality adjusted for age, gender and ward (fixed effects), and using hospital as a random effect.

To assess diagnostic accuracy to predict 1-year mortality based on SQ, paired forest plots for sensitivity and specificity in four hospitals were created. Finally, summary ROC curves (SROC) were constructed to obtain the pooled values of sensitivity, specificity and AUC based on a bivariate model. Bivariate modelling for sensitivity, specificity and AUC together was performed in R (version 3.5.2), using the mada package (version 0.5.8) (https://cran.r-project.org/web/packages/mada/vignettes/mada.pdf). Differences in mean sensitivity and specificity between subgroups were assessed by means of a meta-regression.

Results

Overall study population

Of the 2136 older patients admitted during the study period, 634 were excluded mostly because their admission time was less than 48 hours (most on CU) or that they were admitted more than 48 hours on another ward before coming to AGU or CU. Of 1502 patients who were eligible for the study, 933 were not included as the including physician was absent or due to lack of time. We have no data on the patients that were not included. Furthermore, 42 patients refused to participate in the study and 69 incompetent patients did not have a legal representative, leaving 458 patients for the study.

There were 79 missings on SQ thus further analysis was performed on 379 patients. Characteristics of the missings on SQ in comparison to the included study population show more missings in patients with a shorter length of stay, who were less care dependent and admitted to hospital 4 or CU (Table 1).

As represented in Table 2, 190 patients were included on AGU and 189 on CU. AGU patients had more palliative care needs as assessed by SPICT except for the SPICT item 'persistent symptoms despite optimal treatment' which was comparable with CU patients. CU patients were significantly younger with more male representatives and a majority of patients living at home. One-year mortality did not differ between the two groups.

Patient characteristics associated with positive SQ

SQ was positive (i.e. no surprise) in 34.7% on AGU and in 33.3% in CU patients (p = 0.773). Univariate analysis of characteristics related with the answer to SQ is shown in Table 3. Multivariate analysis by multiple regression after stepwise removal of gender, age, length of stay and KATZ index score showed no difference in the answer to the SQ between AGU and CU (Table 4). Interactions between ward and age, ward and CCI, ward and SPICT score were all found to be non-significant and were therefore excluded from the model. A positive SQ was associated with higher CCI, lower Lawton index score, i.e. higher instrumental ADL dependence, and a higher number of four out of six palliative care needs, among four of the six items collected: significant weight loss, poor performance status, persistent symptoms despite optimal treatment of underlying condition and the request for palliative care by patient or family.

Predictive value of the SQ

Pooled sensitivity, specificity and AUC were, respectively, 64%, 77% and 0.64 on AGU patients, while, respectively, 63%, 76% and 0.76 on CU patients. Summary ROC curve based on bivariate modelling showed comparable sensitivity and specificity between AGU and CU (Likelihood ratio test p = 0.870, figure 1). Positive predictive value (PPV) on, respectively, AGU and CU is 51% and 42%. Negative predictive value (NPV) is, respectively, 88% and 90% for AGU and CU. One-year mortality was 25% and 20% for, respectively, AGU and CU patients (p = 0.319). Time to death is significantly associated with a positive SQ (HR 5.425, 95% CI (3.332–8.834), p < 0.001) independently from the ward (figure 2).

Figure 1 and 2 near here

Discussion

To the best of the authors' knowledge, this is the first study showing and comparing the prognostic accuracy of the Surprise Question (SQ) in older hospitalized patients on AGU and CU. SQ was positive in 1 out of 3 patients. Patients with a positive SQ die 5 times sooner compared to SQ negative patients. We conclude a moderate accuracy in predicting 1-year mortality with comparable results on AGU and CU and with a better negative predictive value than positive predictive value. Both on AGU and CU, a positive answer to SQ was associated with more serious comorbidity, more dependency from others and more palliative care needs.

Despite the significant association between 1-year mortality and a positive SQ in our study, our results suggest that more than one third of people dying within 1 year are not detected by SQ and thus potentially missing these benefits of early integration of palliative care. However, the high specificity (77% for AGU and 76% for CU) and high negative predictive value (respectively 88% and 90%) indicate a low risk of causing harm by undertreating patients with a good prognosis. However, the positive predictive value of SQ (51% on AGU and 42% on CU) indicates that half of SQ positive patients are still alive after 1 year. Using SQ for

Table 1. Comparison between SQ answered and SQ missings.

		SQ missing (n = 79)	SQ answered (n = 379)	p-value
Hospital	1	3 (2.8%)	103 (97.2%)	<0.001°
	2	9 (6.3%)	133 (93.7%)	
	3	0 (0.0%)	73 (100%)	
	4	67 (48.9%)	70 (51.1%)	
Ward	AGU	19 (9.1%)	190 (90.9%)	<0.001°
	CU	60 (24.1%)	189 (75.9%)	
Gender	Male	42 (18.6%)	184 (81.4%)	0.461*
	Female	37 (15.9%)	195 (84.1%)	
Age	75–79	23 (23.5%)	75 (76.5%)	0.122°
	80–84	29 (19.9%)	117 (80.1%)	
	85–89	19 (14.2%)	115 (85.8%)	
	90–94	7 (10.6%)	59 (89.4%)	
	95–100	1 (7.1%)	13 (92.9%)	
Residence	Home	74 (17.8%)	342 (82.2%)	0.705°
	Nursing home	5 (11.9%)	37 (88.0%)	
Palliative care needs (first part of SPICT questionnaire)				
Unplanned hospital admissions	No	15 (24.6%)	46 (75.4%)	0.105*
	Yes	64 (16.1%)	333 (83.9%)	
Performance status is poor or deteriorating with limited reversibility	No	66 (18.8%)	285 (81.2%)	0.143*
	Yes	13 (12.1%)	94 (87.9%)	
Depends on others for care or person's carer needs more help and support	No	56 (20.7%)	215 (79.3%)	0.023*
	Yes	23 (12.3%)	164 (87.7%)	
Significant weight loss over the last few months or remains underweight	No	58 (16.5%)	294 (83.5%)	0.464*
	Yes	21 (19.8%)	85 (80.2%)	
Persistent symptoms despite optimal treatment of underlying conditions	No	64 (18.0%)	291 (82.0%)	0.462*
	Yes	15 (14.6%)	88 (85.4%)	
Patient/family asks palliative care; chooses to reduce, stop or not have treatment or wishes focus on QoL	No	78 (17.6%)	365 (82.4%)	0.486*
	Yes	1 (6.7%)	14 (93.3%)	
Length of stay	Mean	9.56	11.96	0.021
	SD	8.054	9.419	
Katz total score	Mean	8.66	9.24	0.220
	SD	3.859	3.846	
Charlson comorbidity score (CCI)	Mean	7.28	7.11	0.579
	SD	2.552	2.361	
iADL score	Mean	4.01	3.54	0.085
	SD	2.227	2.195	

p-value = Pearson chi-square test(°) or Fisher exact 2-sided(*) for categorical variables. Levene's test for equality of variances for continues variables (length of stay, KATZ, Charlson comorbidity score, iADL).
AGU = Acute Geriatric Unit;
CU = Cardiology Unit;
KATZ ADL (Activities of Daily Living) scored 6–24, a higher score indicates more dependency from others;
iADL (instrumental Activities of Daily Living) scored 0–7, a higher score indicates a more independent patient;
CCI (Charlson Comorbidity Index) higher values suggest more comorbidities with a higher 10-year mortality risk;
SPICT (Supportive and Palliative Care Indicators Tool).

limiting treatment should happen with caution [32] and thus further assessment in SQ positive patients is required. SQ could initiate end-of-life discussions but these discussions could also be initiated on patient's demand or based on palliative care needs. This result is confirmed by a study from Haydar et al. already proving that SQ is feasible and useful in facilitating advance care planning discussions but with 55% of the responders having a concern about accuracy of their answer to the SQ [33].

When compared to existing literature, comparable values for prognostic accuracy of SQ are seen in a meta-analysis from Downar et al. [25]. This meta-analysis included 16 studies in a broad study population in multiple medical specialties without age restrictions and concluded a pooled sensitivity of 67%, specificity of 80%, PPV of 37% (which is lower compared to our study because lower prevalence of dying) and a comparable NPV of 93%. An important finding of our study was that prognostic accuracy was similar to AGU and CU. This suggests that SQ might be suitable for broad implementation in the heterogeneous older hospitalized population.

SQ on an emergency department in 207 patients aged 65 and older also showed an increased odds for 1-year mortality in SQ positive patients (OR 4.4 [95% CI 2.1–9.5]) [34]. However, a higher sensitivity of 77% and a lower specificity of 56% are measured in comparison to our study with a lower PPV of 32% and a similar NPV of 90%. The predictive value of SQ is also described in

Table 2. Comparison of patients' characteristics between acute geriatric unit (AGU) and cardiology unit (CU).

		AGU (n = 190)	CU (n = 189)	p-value
Hospital	1	60 (31.6%)	43 (22.8%)	0.015°
	2	62 (32.6%)	71 (37.6%)	
	3	27 (14.2%)	46 (24.3%)	
	4	41 (21.6%)	29 (15.3%)	
Age, years	75–79	18 (9.5%)	56 (29.6%)	<0.001°
	80–84	64 (33.7%)	53 (28.0%)	
	85–89	62 (32.6%)	54 (28.6%)	
	90–94	37 (19.5%)	22 (11.6%)	
	95–100	9 (4.7%)	4 (2.1%)	
Gender	Female	113 (59.5%)	82 (43.4%)	0.002*
Residence	Home	162 (85.3%)	180 (95.2%)	0.010°
	Nursing home	28 (14.7%)	9 (4.8%)	
ADL total score (Katz index/24) 1 missing	mean	10.56	7.91	<0.001
	SD	4.290	2.767	
iADL total score (Lawton index/7) 1 missing	mean	2.74	4.33	0.539
	SD	2.022	2.052	
Charlson Comorbidity Index (/37) 1 missing	mean	7.42	6.82	0.004
	SD	2.527	2.141	
Palliative care needs, % present (first part of SPICT questionnaire)				
Unplanned hospital admissions		182 (95.8%)	151 (79.9%)	<0.001*
Performance status is poor or deteriorating with limited reversibility		60 (31.6%)	34 (18.0%)	0.003*
Depends on others for care or person's carer needs more help and support		115 (60.5%)	49 (25.9%)	<0.001*
Significant weight loss over the last few months or remains underweight		51 (26.8%)	34 (18.0%)	0.048*
Persistent symptoms despite optimal treatment of underlying conditions		46 (24.2%)	42 (22.2%)	0.715*
Patient/family asks palliative care; chooses to reduce, stop or not have treatment or wishes focus on QoL		12 (6.3%)	2 (1.1%)	0.011*
One-year mortality (11 missings)		46 (24.9%)	37 (20.2%)	0.319*

p-value = Pearson Chi-Square test (°) or Fisher exact 2-sided(*). P-value of KATZ, iADL and CCI = Levene's test for equality of variances
SPICT (Supportive and Palliative Care Indicators Tool);
QoL (Quality of Life).

119 older patients with acute surgical conditions [35]. They described an increased odds ratio of 4.8 (95% CI 2.1–11.1) for 1-year mortality in SQ positive patients, also with a higher sensitivity of 81% and lower specificity of 51% (PPV 52%, NPV 64%). Straw et al. studied SQ in CU patients with heart failure without age restrictions, the average age was 71 years [22]. They also concluded a significant association between SQ and all-cause 1-year mortality with a hazard ratio of 2.8 (95% CI 1.0–7.9) with a PPV and NPV comparable to our study, respectively, 52% and 88% but a higher sensitivity of 85% and specificity of 59%. A study of 1737 patients in primary care had an odds ratio for 1-year mortality of 4.36 (95% CI 2.63–7.22) in SQ positive patients however with a poor sensitivity of 20.5%, high specificity of 94.4% and positive and negative predictive value, respectively, 20.2% and 94.5% (AUC 0.57) [36]. Also, recently, the double SQ was introduced in a general practice in the Netherlands. In this study, the first SQ ('Would you be surprised if the patient would die in 6 months until 1 year?'), when answered with 'no' showed a high sensitivity of 92% with only a moderate specificity (49%). However, the second surprise question ('Would you be surprised of this patient is still alive in one year') was associated with a high specificity (91%) and lower sensitivity (42%) when answered with 'yes' [37].

The heterogeneous results when examining sensitivity and specificity of SQ can have several explanations. First, there is a large difference between the study populations. The studies conducted on the emergency department and in patients with acute surgical conditions showed a higher sensitivity which can be explained by the fact that these patients had a higher risk of mortality due to an acute illness and higher prevalence of frailty. This can also explain the higher sensitivity of Straw et al., who included patients with decompensated heart failure. Secondly, there is a difference in pre-existing knowledge of the patient and patient's file before answering the SQ. This is a possible reason for the lower sensitivity of SQ in primary care because physicians may be too optimistic about the patient's survival when they know the patient better [38]. However,

Table 3. Characteristic population: surprise question 'death would we a surprise' vs. 'death would be no surprise'. Univariate analysis.

		Surprise question		
	Total (N = 379)	Death would be a surprise = SQ non-identified (n = 250)	Death to be expected = SQ identified (n = 129)	p-value*
Hospital				
1	103 (27.2%)	77 (30.8%)	26 (20.2%)	
2	133 (35.1%)	89 (35.6%)	44 (43.1%)	0.001
3	73 (19.3%)	34 (13.6%)	39 (30.2%)	
4	70 (18.5%)	50 (20.0%)	20 (15.5%)	
Ward				
Acute geriatric ward	190 (50.1%)	124 (49.6%)	66 (51.2%)	0.773
Cardiology ward	189 (49.9%)	126 (50.4%)	63 (48.8%)	
Age				
75–79 y.o.	74 (19.5%)	59 (23.6%)	15 (11.6%)	
80–84 y.o.	117 (30.9%)	81 (32.4%)	36 (27.9%)	0.006
85–89 y.o.	116 (30.6%)	72 (28.8%)	44 (34.1%)	
90–94 y.o.	59 (15.6%)	33 (13.2%)	26 (20.2%)	
95–100 y.o.	13 (3.4%)	5 (2.0%)	8 (6.2%)	
Gender – male	184 (48.5%)	119 (47.6%)	65 (50.4%)	0.607
Residence				
Home	342 (90.2%)	238 (95.2%)	104 (80.6%)	
Acute hospital	1 (0.3%)	0 (0.0%)	1 (0.8%)	<0.001
Short-term stay in non-acute setting	9 (2.4%)	2 (0.8%)	7 (5.4%)	
Nursing home	27 (7.1%)	10 (4.0%)	17 (13.2%)	
Charlson Comorbidity Index (range in sample, mean, SD)	3–15, 7.12, 2.36	3–15, 6.60, 2.22	4–15, 8.13, 2.30	<0.001
Katz total score (range in sample, mean, SD/1 missing)	0–23, 9.24, 3.85	1–21, 8.67, 3.27	0–23, 10.37, 4.59	<0.001
iADL total score (range in sample, mean, SD/1 missing)	0–7, 3.53, 2.18	0–7, 3.93, 2.06	0–7, 2.76, 2.22	<0.001
Total length of stay (range in sample, mean, SD) 1 missing)	1–91, 12.85, 11.04	1–69, 11.62, 9.57	1–91, 15.22, 13.16	0.003
Palliative care needs (first part of SPICT questionnaire)				
Unplanned hospital admissions	333 (87.9%)	216 (86.4%)	117 (90.7%)	0.225
Performance status is poor or deteriorating	94 (24.8%)	45 (18.0%)	49 (38.0%)	<0.001
Depends on others for care due to increasing physical and/or mental health problems	164 (43.3%)	96 (38.4%)	68 (52.7%)	0.008
Significant weight loss over the last few months or remains underweight	85 (22.4%)	46 (18.4%)	39 (30.2%)	0.009
Persistent symptoms despite optimal treatment of of underlying conditions	86 (23.2%)	43 (17.2%)	45 (34.9%)	<0.001
Patient/family asks for palliative care; chooses to reduce, stop or not have treatment	14 (3.7%)	4 (1.6%)	10 (7.8%)	0.003

p-values: Chi-square test for categorical variables, Independent-Samples T-Test for continuous variables.
SD (standard deviation).
KATZ ADL (Activities of Daily Living) scored 6–24, a higher score indicates more dependency from others.
iADL (instrumental Activities of Daily Living) scored 0–7, a higher score indicates a more independent patient.
CCI (Charlson Comorbidity Index) higher values suggest more comorbidities with a higher 10-year mortality risk.
SPICT (Supportive and Palliative Care Indicators Tool).

this is not confirmed in the study of double SQ, showing opposite results. Finally, mortality rates differ among the described studies, ranging from 6,4% to 39%. The heterogeneity of findings shows the need for external validation studies.

Strengths of this study are the inclusion of a geriatric population, the multicentre prospective study and the inclusion of older patients on a disease-specific ward. Limitations of this study are possible selection bias. There is no collection of patient characteristics of the missing patients except for those with a missing answer to SQ. We also did not collect characteristics of the treating physician and their grade of experience. This study only focussed on one disease-specific ward compared to AGU. Further research should focus on the influence of SQ in discussing advance care planning.

Conclusion

The surprise question is moderately accurate for prediction of 1-year mortality in the older hospitalized

Table 4. Factors related to a positive Surprise Question (death is no surprise).

			5% CI for OR		
	B	OR = Exp(B)	Lower	Upper	Sig (p)
Hospital					
2 vs 1	−0.289	0.749	0.358	1.570	0.445
3 vs 1	1.563	4.774	2.196	10.375	<0.001
4 vs 1	0.434	1.544	0.695	3.430	0.286
Ward (CU vs AGU)	0.469	1.598	0.903	2.827	0.107
Comorbidity					
Charlson Comorbidity Index (CCI)	0.262	1.299	1.148	1.471	<0.001
Functionality					
iADL (total score)	−0.191	0.826	0.714	0.956	0.010
Palliative care needs (first part of SPICT questionnaire)					
Unplanned hospital admissions	0.793	2.210	0.972	5.026	0.058
Performance status is poor or deteriorating with limited reversibility	0.711	2.035	1.042	3.974	0.037
Depends on others for care/the person's carer needs more help and support	−0.431	0.650	0.343	1.231	0.186
Significant weight loss	0.675	1.965	1.101	3.507	0.022
Persistent symptoms despite optimal treatment of underlying conditions	0.965	2.625	1.464	4.708	0.001
Patient/family asks for palliative care	1.767	5.854	1.211	28.308	0.028
Constant	−3.659	0.026			<0.001

Interactions between ward and age, ward and CCI, ward and SPICT score were all found to be non-significant and were therefore excluded from the model.
Nagelkerke R square = 0.319. Hosmer and Lemeshow Goodness-of-fit test: Sig 0.617.
OR (Odds Ratio).
SPICT (Supportive and Palliative Care Indicators Tool).

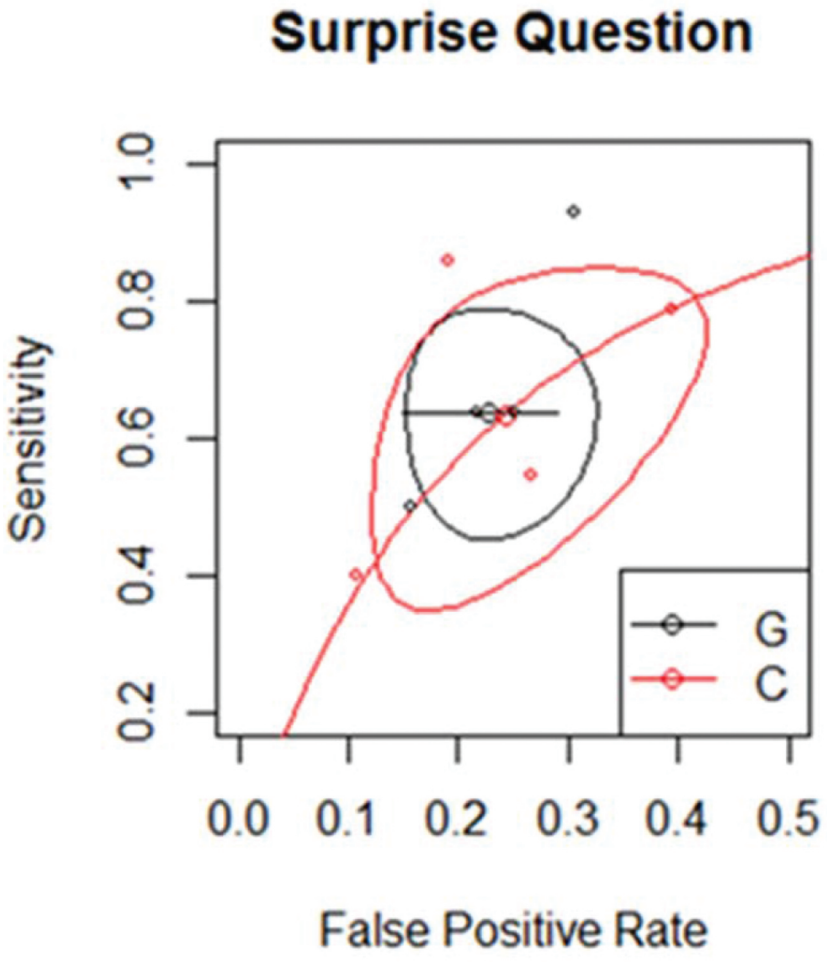

Figure 1. Summary ROC-curves for SQ. Legend: G = acute geriatric unit, C = cardiology unit. Likelihood-ratio test, LRT: p = 0.870

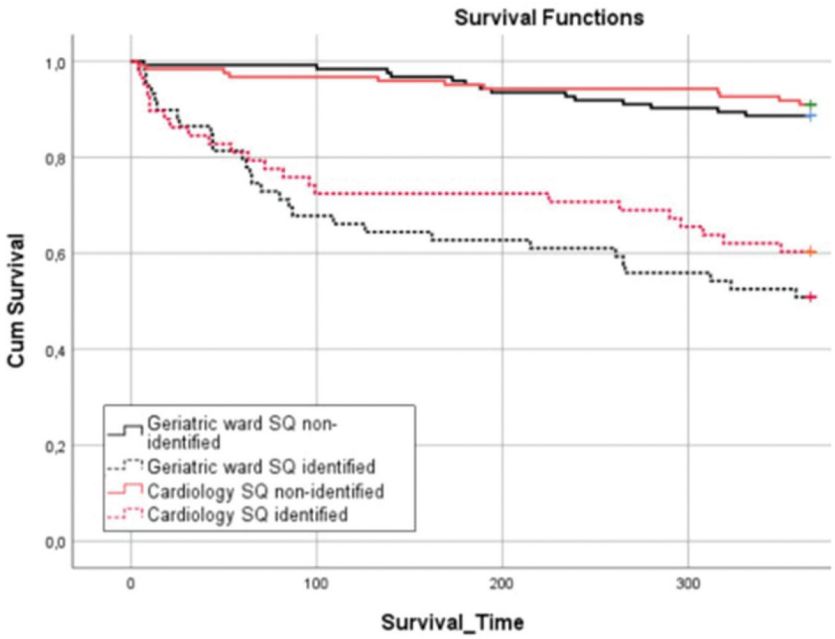

Figure 2. Time to death according to SQ and type of unit.

patient with a better specificity than sensitivity. Importantly, the prognostic accuracy is similar to acute geriatric and cardiology units, which is a strong asset when used in a heterogenous older population.

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List of abbreviations

SQ= surprise question
ADL= activities of daily living
iADL= instrumental activities of daily living
AGU= acute geriatric unit
CU= cardiology unit
PPV= positive predictive value
NPV= negative predictive value

Ethics approval and consent to participate

This study was approved by the medical ethics committee with Belgian registration number B670201734351.

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