Journal of Acute Medicine 10(1): 20-26, 2020
DOI:10.6705/j.jacme.202003_10(1).0003
Original Article

The Association Between Emergency Department Revisit and Elderly Patients

Di-You Guo[1], Kai-Hua Chen[2,3], I-Chuan Chen[1,4], Kuan-Yu Lu[2], Yu-Ching Lin[3,5,6], Kuang-Yu Hsiao[1,7,*]

[1]Department of Emergency Medicine, Chang Gung Memorial Hospital, Chiayi, Taiwan
[2]Department of Physical Medicine and Rehabilitation, Chang Gung Memorial Hospital, Chiayi, Taiwan
[3]School of Medicine, Chang Gung University, Taoyuan, Taiwan
[4]Department of Nursing, Chang Gung University of Science and Technology, Chiayi, Taiwan
[5]Department of Respiratory Care, Chang Gung University of Science and Technology, Chiayi, Taiwan
[6]Division of Pulmonary and Critical Care Medicine, Chang Gung Memorial Hospital Chiayi, Taiwan
[7]Department of Optometry, Shu-Zen Junior College of Medicine and Management, Kaohsiung, Taiwan

Background: Emergency department (ED) revisits may be associated with a higher percentage of adverse events and increased costs. Our hospital is a university affiliation hospital accepted regional referral patients, and located in the region in Taiwan with the highest percentage of elderly people. In this study, we attempted to identify whether old age was a risk factor of ED revisit.
Methods: Patients who visited the ED from July 2011 to June 2016 were included. Factors associated with revisit were collected from medical information database. A total of 239,405 patients were included in our study, with 13,272 having ED revisits within 72 hours. Chi square and independent t test were applied for univariable factors, and a logistic regression model was used for multivariable analysis.
Results: Old age (age ≥ 65 years) was found to be a risk factor for ED revisit (odds ratio [OR]: 1.14; 95% confidence interval [CI]: 1.09–1.19). Diagnosis, pulse rate, diastolic blood pressure, fever, pain management, paracentesis, triage level, registration category, male gender, discharge status, and major illness may have some effect on ED revisit.
Conclusions: In our patients, old age is a risk factor for ED revisit; however, only a weak association was found.

Key words: *emergency service, geriatrics, revisits*

Introduction

Among patients visiting the emergency department (ED), approximately 3.4–5.5% are revisits within 72 hours, and it may increase to 8.2% if including those who revisit after visiting the ED at another institution.[1-3] Previous studies found that patients revisiting the ED were associated with a higher percentage of adverse events and increased costs.[3-5] Diagnosis, age group and the personal background of patients who visited the ED were reviewed.[6-8] The characteristics of revisits were evaluated, and various factors, including patient-related, disease-related or medical practice-related factors, contributed to ED revisits.[2,9] Most concerning were revisits because of medical errors.[10,11] Patients revisiting the ED also had a higher percentage of misdiagnosis or persistent symptoms.[12] Patients revisiting the ED had a complication rate of 21% (including death), and 12.1% of those complications were related to inadequate diagnosis during

Received: December 30, 2018; Revised: July 11, 2019; Accepted: July 31, 2019.
*Corresponding author: Kuang-Yu Hsiao, MD, Department of Emergency Medicine, Chang Gung Memorial Hospital, No. 6, West Sec., Chia-Pu Rd., Putz City, Chiayi County 613, Taiwan. E-mail: richard_smith@mail2000.com.tw

the initial visit.[9] Some adverse effects and death were preventable, according to a study focusing on ED revisit.[13] Some strategies to reduce ED revisits included risk stratification tools or resources utility adjustment.[10,14,15]

Our hospital is in south western Taiwan. This region has the highest percentage of elderly people in Taiwan, and this age group is considered to have higher ED revisit and hospital mortality rates.[7] However, there was limited data focusing on the ED revisits in our region. To improve the outcomes of ED patients and combining with the characteristic of regional patients, we conducted this study to identify whether old age is a risk factor of ED revisits. Thus, we may conduct more researches and strategy to the issue of ED revisits.

Methods

Patient Selection

Our hospital is in south western Taiwan. In this region, Chiayi County, the percentage of elderly residents is the highest in Taiwan.[16] Our hospital is a university-affiliated general hospital, and we receive regional referral patients. Approximately 70,000 patients visit our ED annually, and approximately 3.5% are revisits. There are 1,300 acute care beds and 100 beds in the intensive care units (ICUs) in the hospital. We defined elderly as age ≥ 65 years. To identify the association between elderly patients and ED revisit within 72 hours, the study included patients who visited our ED from July 2011 to June 2016. Each ER visit was calculated as an independent data. Patients who revisited our ED for non-medical problems were excluded. Because these patients usually did not revisit the ED within 72 hours, we also excluded patients who visited the ED and (1) died at ED; (2) were subsequently admitted to our ward or ICU; (3) were referred to other hospitals (Fig. 1).

The present study was approved by the Institutional Review Board (IRB) of our hospital (No. 201700002B0). Under the approval of IRB, informed consent was not necessary because this study was a respectively medical chart review study from databank.

Data Analysis

Information about patient personal profiles, presenting conditions, laboratory data, examination reports, medications, surgical procedures, medical managements, clinical course, discharge status and subsequent medical condition was extracted from our electrical medical record system. We defined these variables as follows: body temperature, body temperature recorded by ED triage; systolic blood pressure, systolic blood pressure recorded by ED triage; diastolic blood pressure, diastolic blood pressure

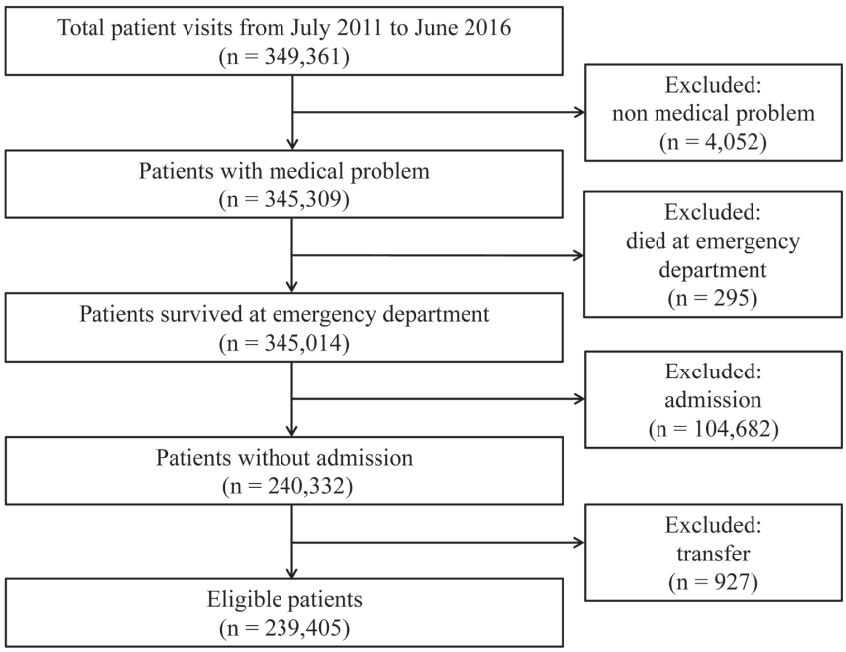

Fig. 1. Flow chart of patient selection.

recorded by ED triage; pulse rate, pulse rate recorded by ED triage; against advice discharge (discharge status), leave ED against medical advice; escape (discharge status), leaving ED without notification; fever, body temperature ≥ 38.0°C record by ED triage; abnormal Glasgow Coma Scale (GCS) score, GCS score recorded by ED triage less than 15; major illness, major illness designated by Taiwan National Health Insurance Administration; diagnosis, ED diagnosis code of the International Statistical Classification of Disease and Related Health Problems (ninth revision). In our information system, a major diagnosis should be assigned for each patient, and we adopted the major diagnosis for further diagnosis classification.

Because risk factors of revisit were our major concern, the above variables were extracted from medical records from initial ED visits. All ED visits were divided into two groups on the basis of revisiting or not revisiting the ED within 72 hours. Differences between the two groups were assessed using the chi-square test for categorical variables, and the independent t test was used to analyse the differences for continuous variables. The logistic model was applied for variables with *p*-value less than 0.1 for the differences between the two groups. Because old age was the major factor to be identify, this factor was put into the logistic regression model. The odds ratio for factors influencing outcome was estimated by logistic regression.

All statistical assessments were two-sided and evaluated at the 0.05 level of significant difference. Statistical analysis was performed using statistical analysis software (SAS) version 9.4 (SAS Institute, Inc., Cary, NC, US).

Results

As shown in Table 1, continuous factors including mean body temperature, pulse rate and diastolic blood pressure were factors with a statistically significant difference. Categorical factors are showed in Table 2; male gender, registration category, discharge status, triage level, fever, pain management, paracentesis, major illness, abnormal GCS score, diagnosis of infectious and parasitic diseases, diagnosis of neoplasms, diagnosis of nervous system and sense organs, diagnosis of diseases of respiratory system, diagnosis of mental behavior and neurodevelopmental disorders and diagnosis of injury and poisoning showed significant differences between the two groups. We performed logistic regression to analyse these factors. In Table 3, age ≥ 65 years (odd ratio OR: 1.14, 95% CI 1.09–1.19), male gender (OR: 1.40), discharge against medical advice (OR: 1.93, ref. normal discharge) or escape (OR: 1.94, ref. normal discharge), triage level (Level 1 OR: 1.65, Level 2 OR: 1.70, Level 3 OR: 1.85, Level 4 OR: 2.36, all compared to Level 5), fever (OR: 1.28), pain management (OR: 2.19), paracentesis (OR: 1.70), major illness (OR: 1.63), pulse rate (OR: 1.01), diastolic blood pressure (OR: 1.00), diagnosis of infectious and parasitic diseases (OR: 1.16) and diagnosis of neoplasms (OR: 1.41) were factors related to revisit within 72 hours. Patients with ED registration categories of trauma (OR: 0.48, ref. adult non-trauma), initial diagnosis of nervous system and sense organs (OR: 0.56) or injury and poisoning (OR: 0.54) were less likely to revisit the ED within 72 hours.

Discussion

This study was conducted to evaluate whether old age is a risk factor associated with revisit to the ED within 72 hours. In this study, old age is an isolated risk factor for ED revisit within 72 hours; however, this factor has weak association to ED revisit (OR

Table 1. The comparison of continuous variables between revisit group and non-revisit group

	Total (n = 239,405)	Revisit group (n = 13,272)	Non-revisit group (n = 226,133)	*p* value
Age (years)	44.16 (26.45)	44.49 (26.79)	44.14 (26.43)	0.14
Body temperature (°C)	36.52 (0.867)	36.66 (0.990)	36.5 (0.860)	< 0.01*
Pulse rate (bpm)	93.23 (24.17)	99.39 (26.60)	92.87 (23.97)	< 0.01*
Systolic blood pressure (mmHg)	140.30 (30.17)	140.19 (30.96)	140.31 (30.12)	0.67
Diastolic blood pressure (mmHg)	85.48 (16.45)	86.05 (17.00)	85.44 (16.42)	< 0.01*

All data was expressed as mean (standard deviation).
*Significantly different ($p < 0.05$).

Table 2. The comparison of categorical variables between revisit group and non-revisit group

	Total (n = 239,405)	Revisit group (n = 13,272)	Non-revisit group (n = 226,133)	*p* value
Sex				< 0.01*
Male	126,845 (52.98)	8,168 (61.54)	118,677 (52.48)	
Female	112,560 (47.02)	5,104 (38.46)	107,456 (47.52)	
Age ≥ 65 years	65,866 (27.51)	3,688 (27.79)	62,178 (27.50)	0.47
Registration category				< 0.01*
Adult, non-trauma	155,608 (64.50)	9,607 (72.39)	146,001 (64.56)	
Trauma	39,397 (16.46)	680 (5.12)	38,717 (17.12)	
Pediatric	44,306 (18.51)	2,982 (22.47)	41,324 (18.27)	
Obstetrics, antepartum	94 (0.04)	3 (0.02)	91 (0.04)	
Discharge status				< 0.01*
Normal discharge	229,197 (95.74)	12,184 (91.8)	217,013 (95.97)	
Against advice discharge	9,712 (4.06)	1,038 (7.82)	8,674 (3.82)	
Escape	496 (0.21)	50 (0.38)	446 (0.20)	
Triage				< 0.01*
Level 1	5,098 (2.13)	400 (3.01)	4,698 (2.08)	
Level 2	22,322 (9.32)	1,243 (9.37)	21,079 (9.32)	
Level 3	180,091 (75.20)	9,856 (74.23)	170,235 (75.28)	
Level 4	27,797 (11.61)	1,697 (12.79)	26,121 (11.55)	
Level 5	4,097 (1.71)	97 (0.73)	4,000 (1.77)	
Fever	19,170 (8.01)	1,755 (13.22)	17,415 (7.70)	< 0.01*
Pain management,	55,095 (23.01)	4,679 (35.25)	50,416 (22.29)	< 0.01*
Paracentesis	1,524 (0.64)	161 (1.21)	1,363 (0.60)	< 0.01*
Major illness	10,078 (4.21)	1,036 (7.81)	9,042 (4.00)	< 0.01*
Diagnosis group of ICD				
Infection	6,081 (2.54)	499 (3.76)	5,582 (2.47)	< 0.01*
Neoplasms	3,021 (1.26)	238 (1.79)	2,638 (1.17)	< 0.01*
Endocrine	2,976 (1.24)	173 (1.30)	2,803 (1.24)	0.52
Blood	668 (0.28)	41 (0.31)	627 (0.28)	0.50
Mental	2,053 (0.86)	140 (1.05)	1,913 (0.85)	0.01*
Nervous	7,870 (3.29)	218 (1.64)	7,652 (3.38)	< 0.01*
Circulatory	6,028 (2.52)	310 (2.34)	5,718 (2.53)	0.17
Respiratory	27,343 (11.42)	1,967 (14.82)	25,376 (11.22)	< 0.01*
Digestive	23,082 (9.64)	1,315 (9.91)	21,767 (9.63)	0.28
Injury	43,634 (18.23)	819 (6.17)	42,815 (18.93)	< 0.01*
Abnormal GCS score	7,482 (3.13)	371 (2.80)	7,111 (3.14)	0.03*

All data was expressed as number (%).
Significantly different ($p < 0.05$).
Blood: diseases of the blood and blood-forming organs; Circulatory: diseases of the circulatory system; Digestive: diseases of the digestive system; Endocrine: endocrine, nutritional and metabolic diseases, and immunity disorders; GCS: Glasgow Coma Scale; ICD: The International Statistical Classification of Disease and Related Health Problems; Infection: infectious and parasitic diseases; Injury: injury and poisoning; Mental: mental, behavioral and neurodevelopmental disorder; Nervous: diseases of the nervous system and sense organs; Respiratory: diseases of the respiratory system.

Table 3. The odd ratio for factors associated revisit within 72 hours, calculated by logistic regression model

	OR (95% CI)	*p* value
Sex, male	1.40 (1.35–1.46)	< 0.01*
Registration category (adult, non-trauma)		
Trauma	0.48 (0.43–0.53)	< 0.01*
Pediatric	1.04 (0.98–1.11)	0.20
Obstetrics, antepartum	0.89 (0.28–2.81)	0.84
Discharge status (normal discharge)		
Against advice discharge	1.93 (1.80–2.06)	< 0.01*
Escape	1.94 (1.47–2.62)	< 0.01*
Triage (level 5)		
Level 1	1.65 (1.31–2.08)	< 0.01*
Level 2	1.70 (1.37–2.10)	< 0.01*
Level 3	1.85 (1.51–2.27)	< 0.01*
Level 4	2.36 (1.91–2.90)	< 0.01*
Fever	1.28 (1.20–1.36)	< 0.01*
Pain management	2.19 (2.10–2.29)	< 0.01*
Paracentesis	1.70 (1.43–2.02)	< 0.01*
Major illness	1.63 (1.51–1.76)	< 0.01*
Diagnosis group of ICD		
Infection	1.16 (1.05–1.27)	< 0.01*
Neoplasms	1.41 (1.26–1.59)	< 0.01*
Mental	1.13 (0.95–1.35)	0.18
Nervous	0.56 (0.49–0.65)	< 0.01*
Respiratory	1.01 (0.96–1.07)	0.61
Injury	0.54 (0.49–0.60)	< 0.01*
Abnormal GCS score	0.93 (0.83–1.04)	0.20
Pulse rate	1.01 (1.01–1.01)	< 0.01*
Diastolic blood pressure	1.00 (1.00–1.00)	< 0.01*
Age ≥ 65 years	1.14 (1.09–1.19)	< 0.01*

*Significantly different ($p < 0.05$).
CI: confidence interval; GCS: Glasgow Coma Scale; ICD: The International Statistical Classification of Disease and Related Health Problems; Infection: infectious and parasitic diseases; Injury: injury and poisoning; Mental: mental, behavioral and neurodevelopmental disorder; Nervous: diseases of the nervous system and sense organs; OR: odd ratio; Respiratory: diseases of the respiratory system.

1.14) even though previous studies disagreed whether old age was a risk for ED revisit within 72 hours.[17] Besides elderly patients may more likely to revisit ED within 72 hours, these patients may also need more frequent hospital admission and longer lengths of stay in the ED, which may contribute to ED overcrowding.[18,19]

In addition to old age, we found additional factors that may be associated with ED revisits. Male patients were more likely to have ED revisits. Similar findings were found in another study,[17] but specific etiology needed further study to explain the reason. Triage level of the initial ED visit may be a factor in ED revisit. Diagnosis at the initial ED visit may also influence the rate of subsequent ED revisit, and this finding was also reported in a previous study.[7] In our study, patients with a particular diagnosis, such as neoplasms, at the initial ED visit may have a higher revisit rate, but an initial ED diagnosis of injury or neurologic diseases was found to have a lower rate for ED revisit. Patients with a major illness, as designated by the National Health Insurance Administration in

Taiwan, also have a higher ED revisit rate. We considered patients with major illness and/or neoplasm more likely to revisit the ED due to influences of the disease or complications of treatments.

Although patients with an initial diagnosis of infectious disease had weakly impact to ED revisit, patients with high body temperature at triage during the initial ED visit were more likely to revisit. A similar finding was also noted in a previous study.[20] Some patients with infectious disease may not need to be admitted to the hospital, but they will have fever for days. These patients may return to the ED if they still have fever after discharge during the course of their disease. Some may develop complications and need admission, but others may not require another ED visit. Follow-up in the clinic or outpatient department may prevent unnecessary ED revisits in this patient group.

Discharge status may also be a risk factor for ED revisit. We found that patients with discharge status of against medical advice or discharge by leaving the ED without notification (escape) had a higher chance for ED revisit. A previous study also found that patients leaving the ED against medical advice had a higher percentage of subsequent ED revisits and admissions.[21] These patients possibly did not receive a complete risk survey or adequate treatment. They may need further medical attention and tend to use ED resources with return visits.

We also found that patients who needed pain management and paracentesis visited the ED more frequently. Some patients visited the ED for issues such as pain management, paracentesis for symptom relief, or nasogastric tube replacement. These procedures may also be available in an outpatient clinic; however, patients and family tend to visit the ED for convenience and saving time. This behavior may relate to the limited cost in Taiwan for patients and families to visit the ED. In Taiwan, most medical costs are covered by national health insurance, which may influence the way patients access medical care.

There are some limitations to this study. Our data may not be applicable to other medical institutions because there may be differences in culture and habits of access to medical services. National health insurance in Taiwan provides easily available care and limited co-payments, which may encourage patients to visit the ED with non-emergent or non-acute complaints. Another limitation is the manner of data collection. Our data was collected from our medical information database, which has some challenges in extracting data. Setting search criteria and clarifying the accuracy of extracted data can be difficult.

Conclusions

In our study, we found that old age is a risk factor for ED revisit, although it was a weak association. We also found some risk factors regarding revisit to the ED. To improve the quality of ED care, we suggest that further study regarding ED revisit is warranted.

Acknowledgments

We thank the Health Information and Epidemiology Laboratory of our hospital for their support of this project.

Funding

This research was supported by our hospital.

Conflict of Interest Statement

All authors have no conflict of interest in connection with this article.

References

1. Keith KD, Bocka JJ, Kobernick MS, Krome RL, Ross MA. Emergency department revisits. *Ann Emerg Med* 1989;18:964-968. doi:10.1016/S0196-0644(89)80461-5
2. Wu CL, Wang FT, Chiang YC, et al. Unplanned emergency department revisits within 72 hours to a secondary teaching referral hospital in Taiwan. *J Emerg Med* 2010;38:512-517. doi:10.1016/j.jemermed.2008.03.039
3. Duseja R, Bardach NS, Lin GA, et al. Revisit rates and associated costs after an emergency department encounter: a multistate analysis. *Ann Intern Med* 2015;162:750-756. doi:10.7326/M14-1616
4. Sauvin G, Freund Y, Saïdi K, Riou B, Hausfater P. Unscheduled return visits to the emergency department: consequences for triage. *Acad Emerg Med* 2013;20:33-39. doi:10.1111/acem.12052
5. Patterson BW, Venkatesh AK, AlKhawam L, Pang PS. Abdominal computed tomography utilization and 30-day revisitation in emergency department patients presenting with abdominal pain. *Acad Emerg Med* 2015;22:803-810. doi:10.1111/acem.12698
6. Ngai KM, Grudzen CR, Lee R, Tong VY, Richardson LD, Fernandez A. The association between limited English proficiency and unplanned emergency department re-

visit within 72 hours. *Ann Emerg Med* 2016;68:213-221. doi:10.1016/j.annemergmed.2016.02.042

7. Martin-Gill C, Reiser RC. Risk factors for 72-hour admission to the ED. *Am J Emerg Med* 2004;22:448-453. doi:10.1016/j.ajem.2004.07.023
8. Freedman SB, DeGroot JM, Parkin PC. Successful discharge of children with gastroenteritis requiring intravenous rehydration. *J Emerg Med* 2014;46:9-20. doi:10.1016/j.jemermed.2013.04.044
9. Cheng SY, Wang HT, Lee CW, Tsai TC, Hung CW, Wu KH. The characteristics and prognostic predictors of unplanned hospital admission within 72 hours after ED discharge. *Am J Emerg Med* 2013;31:1490-1494. doi:10.1016/j.ajem.2013.08.004
10. Nunez S, Hexdall A, Aguirre-Jaime A. Unscheduled returns to the emergency department: an outcome of medical errors? *Qual Saf Health Care* 2006;15:102-108. doi:10.1136/qshc.2005.016618
11. Schenkel S. Promoting patient safety and preventing medical error in emergency departments. *Acad Emerg Med* 2000;7:1204-1222. doi:10.1111/j.1553-2712.2000.tb00466.x
12. Verelst S, Pierloot S, Desruelles D, Gillet JB, Bergs J. Short-term unscheduled return visits of adult patients to the emergency department. *J Emerg Med* 2014;47:131-139. doi:10.1016/j.jemermed.2014.01.016
13. Calder L, Pozgay A, Riff S, et al. Adverse events in patients with return emergency department visits. *BMJ Qual Saf* 2015;24:142-148. doi:10.1136/bmjqs-2014-003194
14. Suffoletto B, Miller T, Shah R, Callaway C, Yealy DM. Predicting older adults who return to the hospital or die within 30 days of emergency department care using the ISAR tool: subjective versus objective risk factors. *Emerg Med J* 2016;33:4-9. doi:10.1136/emermed-2014-203936
15. Jin B, Zhao Y, Hao S, et al. Prospective stratification of patients at risk for emergency department revisit: resource utilization and population management strategy implications. *BMC Emerg Med* 2016;16:10. doi:10.1186/s12873-016-0074-5
16. Ministry of Interior. Statistical Year Book of the Interior. 2017:32-37. Available at https://www.moi.gov.tw/files/site_node_file/7783/106%e5%b9%b4%e5%85%a7%e6%94%bf%e7%b5%b1%e8%a8%88%e5%b9%b4%e5%a0%b1%e9%9b%bb%e5%ad%90%e6%9b%b8.pdf. Accessed December 29, 2018.
17. Pellerin G, Gao K, Kaminsky L. Predicting 72-hour emergency department revisits. *Am J Emerg Med* 2018;36:420-424. doi:10.1016/j.ajem.2017.08.049
18. Kawano T, Nishiyama K, Anan H, Tujimura Y. Direct relationship between aging and overcrowding in the ED, and a calculation formula for demand projection: a cross-sectional study. *Emerg Med J* 2014;31:19-23. doi:10.1136/emermed-2012-202050
19. Rowe BH, Arrotta N, Hill J, Villa-Roel C, Dennett E, Harries M. Factors associated with hospital admission following asthma exacerbations: a systematic review—ERRATUM. *CJEM* 2016;18:321. doi:10.1017/cem.2016.330
20. Ortega M, Miró O, Muñoz A, López B, Coll-Vinent B, Sánchez M. Factors associated with revisit and admission in patients complaining of fever that are discharged from the emergency department. *Med Clin (Barc)* 2007;128:251-253. [in Spainsh] doi:10.1157/13099241
21. Geirsson OP, Gunnarsdottir OS, Baldursson J, Hrafnkelsson B, Rafnsson V. Risk of repeat visits, hospitalisation and death after uncompleted and completed visits to the emergency department: a prospective observation study. *Emerg Med J* 2013;30:662-668. doi:10.1136/emermed-2012-201129