ORIGINAL ARTICLE

Unscheduled returns to the emergency department: an outcome of medical errors?

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Background: The causes of unscheduled returns to the emergency department (ED) within 72 hours of discharge are unclear. A study was undertaken to identify factors associated with this quality care indicator.

Methods: 250 cases and 250 controls from the ED were prospectively studied. Outcomes measured were unscheduled returns, post-ED destination, and patient dissatisfaction. Possible medical errors (in diagnosis, treatment, prognosis or patient information) and errors in follow up care were identified. Other factors examined included chief complaint at presentation, discharge diagnosis, level of triage, category of treating physician, observation or not, application of emergency treatment, ancillary studies, accessibility to ED, ED time band or work shift, day of the week, past medical history, and demographic data (age, sex, educational level and economic status).

Results: The main factor associated with unscheduled returns was error in prognosis (odds ratio 18.62, 95% CI 9.60 to 36.09). Advanced age and a chief complaint of dyspnoea were also associated with unscheduled returns and with admission to hospital. Post-ED destination worsened by 0.61 (95% CI 0.33 to 0.90) with diagnostic errors and by 0.60 (95% CI 0.30 to 0.90) with errors in follow up care. Patient dissatisfaction increased by 0.68 (95% CI 0.55 to 0.80) with information errors, by 0.63 (95% CI 0.17 to 1.09) with errors in follow up care, and by 0.52 (95% CI 0.09 to 0.94) with diagnostic errors.

Conclusion: Unscheduled returns are associated with medical errors in prognosis, treatment, follow up care, and information. A worse post-ED destination is associated with these medical errors and patient factors (dyspnoea and advanced age). Patient dissatisfaction is associated with medical errors, level of triage or care zone, patient educational level and ED time work shift. Most of these factors are modifiable.

As emergency departments (EDs) are forced to take on ever greater responsibilities, the organization of emergency medical services has become the subject of heated academic debate and great public interest.[1–3] Unscheduled returns to the ED are a known quality care indicator. An unscheduled return is defined as a patient presentation for the same chief complaint within 72 hours of discharge from the ED.[4 5] A rate of less than 1% has been proposed as acceptable for this quality care indicator, although this standard is not universally accepted.[6–8] Unscheduled return rates over a certain level reflect malfunctioning of the ED, and the underlying causes should be investigated.[9 10]

One useful way of analyzing unscheduled returns is to divide the factors associated with this event into those are modifiable and those that are not.[11] Modifiable factors are aspects of the ED that can be improved by an intervention on the organization. They include the physical layout of the ED, triage priority strategies, staffing levels, the existence of an observation ward, pre-hospital coordination, waiting time, and ensuring patients' right to privacy and confidentiality.[12] Factors that are not modifiable include the unpredictable nature of demand, the acuity of presenting complaints, the number of patients, the frequency of stressful situations, and the consequences of decisions taken in other hospital departments.[13 14]

The main aim of this study was to identify modifiable factors associated with unscheduled returns to the ED. Specifically, we hypothesize that unscheduled returns are associated with errors in diagnosis, prognosis, lack of treatment in ED, and errors in follow up care.

There is a close relationship between unscheduled returns to the ED and the post-ED destination and dissatisfaction of the returned patient. This study therefore had two secondary objectives: to explore the factors associated with a worse post-ED destination and with the dissatisfaction of the returned patient.

METHODS

A prospective unmatched case-control study was performed at the ED of University Hospital NS Candelaria, Santa Cruz de Tenerife, Canary Islands, Spain.

Patients

The annual census of University Hospital NS Candelaria ED is approximately 115 000 patients. The patient to doctor ratio in the ED is 25 and the rate of examination by the doctors is 3 patients/hour. These parameters are within the international standards.[15]

Of 32 523 eligible patients presenting to the ED between 1 January and 30 April 2004, 250 unscheduled returns were identified. The control group consisted of 250 patients who did not return; these comprised the next consecutive patient after each case in an attempt to balance cases and controls with respect to the influence of the attendance team, patient census, day of the week, work shift, and other external factors. Exclusion criteria were age <14 years, obstetric/gynecological emergencies, erroneous referral, voluntary withdrawal, and incomplete or unavailable data in the medical records at the hospital or health center.

Three outcome measures were examined and associated factors were identified.

Primary outcome measures

- Unscheduled return: defined as an unscheduled visit to the ED within 72 hours of discharge for the same reason.

- Post-ED destination: defined as home, ED observation ward, hospital admission, surgical theatre, intensive care unit, or death (in this order).
- Patient dissatisfaction with ED attention: the subjective sensation of comfort of the patient during his or her stay in the ED measured on a scale of 0–10 by telephone survey 1 week after the last ED visit where 10 represents not satisfied at all and 0 represents very satisfied.

Associated factors

- Diagnostic errors were evaluated by blinded external assessors: for the cases by comparing the medical records of the first and second visit to the ED and for the controls by comparing the medical record of the only visit to the ED with that of the primary health care center. The objective criterion used was the discordance between the first and final diagnosis in ED records for cases or the primary health care medical records for controls.
- Treatment errors were evaluated by blinded external assessors: for the cases by comparing the medical records of the first and second visit to the ED and for the controls by comparing the medical record of the only visit to the ED with that of the primary health care center. The objective criteria used were non-evidence based treatment, patient non-compliance with treatment, and the absence of a therapeutic plan.
- Prognostic errors were evaluated by blinded external assessors: for the cases by comparing the medical records of the first and second visit to the ED and for the controls by comparing the medical record of the only visit to the ED with that of the primary health care center. The objective criterion used was unfavourable development of disease that could reasonably have been foreseen.
- Information errors were evaluated by telephone survey 1 week after the last ED visit. It was measured on a scale of 0–10 where 10 indicated that the patient understood the received information very well and 0 meant that the patient did not understand the received information at all. A score of less than 5 points was considered an error.
- Follow up care errors were evaluated by a blinded external assessor by reviewing the primary health care record. The objective criterion used was health care 72 hours after discharge from the ED.

The post-ED destination was also obtained from the medical record. Economic status and education level were also evaluated by telephone survey. All other data were obtained from the medical records.

Other factors

We also considered the following factors as potentially confounding variables which were placed in order of best to worst outcome: diagnosis at index visit (according to International Classification of Diseases, 9th Revision, Clinical Modification, and a variable for each diagnosis $\geqslant$1%); chief complaint at the index visit (categorized as dermatological, abdominal pain, psychiatric disorder, worsening of general state, pain at other sites, fever, abdominal pain affecting general state, trauma, haemorrhage, neurological changes, chest pain, dyspnoea, and a variable for each category);[16] and past medical history (arthritis, gastrointestinal, social habits, dyslipaemia, hypertension, diabetes, nephropathy, neoplasia, immunosuppression, neuropathy, bronchopulmonary disease, cardiomyopathy, and a variable for each diagnostic category). In addition, examined the effect of the level of triage in the ED (resuscitation, boxes, triage) and the level of physician training (emergency specialist, ED staff, resident). Other factors analysed included: measurement of vital signs (yes/no); admission to observation ward (yes/no); use of emergency pharmacological treatment (yes/no); ancillary studies (CT scans, ultrasound, radiography, ECG, blood test, urine test; and a variable for each test); ED accessibility (home to hospital travel time $>$80, 61–80, 41–60, 21–40, $\leqslant$20 minutes); ED time band or work shift (night time 22.00–08.00 hours, daytime 08.01–15.00 hours, and evening 15.01–21.59 hours); day of the week (Sunday to Saturday); ED medical record completed by physician (yes/no); ED medical record completed by nurse (yes/no); age in years; sex (male/female); educational level (high, medium, low, unschooled); economic status (high: $>$19 000 US$, medium: $\geqslant$7500–$\leqslant$19 000 US$, low: $<$7500 US$ annual income[17]).

Statistical analysis

We used an overestimate of at least 10% for each type of error for unscheduled returns for cases compared with controls. Assuming an expected frequency of error due to chance in the controls of 5%, we calculated that a sample size of 500 patients (250 cases and 250 controls) would achieve a study power of 95% at a significance level of 0.05 using two tailed tests. This sample size guarantees a power of 80% when adjusting logistic regression models for the outcome of unscheduled returns, with a minimum of 16 cases being adequate for each predictor variable to detect an odds ratio (OR) of 1.10. This sample size also guarantees a power of 85% when adjusting linear regression models for the outcomes of post-ED destination and dissatisfaction, with a minimum of 25 subjects being adequate for each predictor variable to estimate regression coefficients as small as 0.50. Logistic ORs and linear regression coefficients estimate 95% confidence intervals for the models capable of explaining variability observed in outcomes of at least 60%, with an error of no more than 10%.

The sample was described using tests appropriate for the scale type and probability distribution of each variable. Data analysis was performed after consistency or face validity testing confirmed that the data replicated known associations. Differences between groups and correlations between variables were estimated using suitable tests. Binary logistic regression models were adjusted for the unscheduled return outcome once the linearity condition of their logits was met. Linear regression models were adjusted for post-ED destination and patient dissatisfaction as outcomes once the non-colinearity condition of the included factors was met. All calculations were performed using Sample Power 2.0 and SPSS 11.5.1 statistical packages (SPSS Inc, Chicago, IL, USA).

RESULTS

The sample comprised 500 patients (250 cases and 250 controls) of median age 45 years (5–95th percentiles 18–85, range 14–97), 51% of whom were women. At least one diagnosis was noted in the past medical history of 47% of the patients, the most common being hypertension (14%), diabetes (11%), and cardiomyopathies (10%). The chief complaints most frequently reported at the index visit were: pain (33%), extremity trauma (11%), dyspnea (8%), neurological changes (7%), vomiting or diarrhea (7%), psychiatric crisis (6%), fever (5%), and hemorrhage (4%). 70% of patients were evaluated with at least one ancillary test.

Consistency or face validity testing showed that the largest number of patients (39%) presented in the daytime shift, with 38% in the evening shift and 22% in the night time shift, a result expected in the ED. The median age of patients with a previous medical history was 60 years compared with 31 years for those without ($p<0.001$, Mann-Whitney test); this is in agreement with the expected age. Of the patients in

Table 1 Diagnoses (%) at first and return visits to the ED

Diagnosis/reasons	IDC-9-CM*	All patients first visit (n = 500)	Unscheduled returns second visit (n = 250)
Abdominal pain	789	7	7
Renal colic	788.0	7	10
Gastroenteritis	009.1	4	4
Respiratory failure	518.84	5	6
Precordial pain	786.51	4	1
Upper respiratory infection	465	4	1
Anxiety attack	300.00	3	4
Urinary tract infection	599.0	3	2
Upper limb contusion	923	3	2
Conjunctivitis	372.00	3	<1
Lumbalgia/low back pain	724.2	2	2
Epistaxis	784.7	2	3
Arm/leg pain	729.5	2	2
Allergic urticaria	708.0	2	<1
Asthma attack	493.91	2	2
Sprained ankle	845.0	1	<1
Arterial hypertension	401.9	1	<1
Biliary colic	574.20	1	1
Cranial trauma	854.02	1	2
Lower limb contusion	924	1	2
Cardiac failure	428	1	3
Stroke	436	1	<1
Orthostatic hypotension	458.0	1	<1
Cervicalgia	723.1	1	1
Radius fracture	813.81	1	1
Hand wound	882	1	<1
Appendicitis	540	<1	2
Alcohol abstinence syndrome	303.9	<1	2
Psychotic disorder	298.9	<1	1
Acute myocardial infarction	410	<1	1
Pneumonia	486	<1	1
Hypoglycemia	251.2	<1	1

*International Classification of Diseases, 9th Revision, Clinical Modification.

the ED requiring radiography, 32% were trauma cases ($p<0.0001$), a finding which seems logical and is in accordance with that expected in the ED. There was an inverse correlation between age and educational level and between age and economic status ($r = -0.60$ and $r = -0.55$, respectively, $p<0.0001$ for both), which was expected in this setting. All these results allow us to assume that the data reliably reflect what is already known. Inferences drawn from these data to establish unknown relations are therefore reasonably acceptable.

Among the unscheduled returns, 89% returned once, 8% twice, and 3% more than twice. The post-ED destinations for the 250 cases were home (54%), ED observation ward (18%), other hospital wards (21%), surgical theatre (5%), intensive care unit (2%), and death (1%).

Patient dissatisfaction after the last ED visit reached a mean 3.8 points (95% CI 3.6 to 4.0).

There was a wide range of diagnoses for both cases and controls. Table 1 shows the diagnoses with a frequency of ⩾1% for the whole sample at the first visit and for unscheduled returned patients at the second visit. The correlation coefficient between first and second diagnoses for the unscheduled returns, estimated by contingency coefficient for nominal variables, was 0.80 ($p<0.0001$).

Comparisons between cases and controls for each of the variables considered are shown in table 2. For diagnosis on the first visit, chief complaints, and past medical history, only those components whose differences between groups were statistically significant are shown. For the diagnosis on the first visit, comparisons were performed with the most frequent diagnoses shown in table 1; chief complaints at the first visit and past medical history are considered in 12 categories.

Kendall's tau-b linear rank correlation coefficients between errors reached statistical significance for diagnostic and treatment errors (0.71, $p<0.001$), diagnostic and prognostic errors (0.38, $p<0.001$), diagnostic and follow up care errors (0.10, $p = 0.031$), treatment and prognostic errors (0.46, $p<0.001$), treatment and information errors (0.11, $p = 0.080$), prognostic and follow up care errors (0.18, $p<0.001$), prognostic and information errors (0.11, $p<0.001$), and follow up care and information errors (0.09, $p = 0.030$).The results of the logistic regression analysis of medical errors (diagnostic, prognostic, treatment) and other associated factors as predictors of unscheduled return are shown in table 3. None of the interaction terms between errors included in the multiple logistic analysis was retained by any model. The probability of an unscheduled return for an ED patient as predicted by a combination of errors and other associated factors is estimated by the logistic regression equation shown in table 4.

We found significant Kendall tau-b correlations between post-ED destination and the following control variables: age (0.30, $p<0.0001$), chief complaint of dyspnea (0.22, $p<0.0001$) or neurological disorders (0.16, $p = 0.011$), a past medical history of a neurological disorder (0.19, $p = 0.006$) or cardiomyopathy (0.15, $p = 0.035$). The results of the linear regression analysis of medical errors and other associated factors as predictors of post-ED destination are shown in table 5. None of interaction terms between errors included in the analysis was retained by any multivariate linear model.

We also found significant Kendall tau-b correlations between patients' dissatisfaction with ED attention and the following control factors: physician training level (0.38, $p<0.0001$), ED time band work shift (0.22, $p<0.0001$), educational level (-0.21, $p<0.0001$), ancillary studies (0.13, $p = 0.048$), and vital signs measurement (0.12, $p = 0.050$). Spearman's rank linear correlation coefficients did not reached statistical significance between dissatisfaction and reason for first visit, diagnoses at first visit or diagnoses at

Table 2 Comparison of errors and other factors

Error or factor	Unscheduled returns (n = 250)	Non-returns (n = 250)	p value
Prognostic error*	48	14	0.000
Treatment error*	30	6	0.000
Follow up care error*	26	8	0.000
Diagnostic error*	20	4	0.000
Information error (points)†	5 (4.8–5.2)	6 (5.8–6.2)	0.000
Diagnosis (erroneous or not) on 1st visit‡			
Hand wound*	0.0	2.0	0.025
Conjunctivitis*	0.4	5.2	0.001
Reason for 1st visit‡			
Increasing degree of seriousness†	7 (1–12)	6 (0–11)	0.043
Dermatological*	0.8	5.2	0.004
Abdominal pain*	12.4	0.0	0.000
Dyspnea*	12.0	5.6	0.012
Previous medical history‡			
Toxic habits*	5.9	2.0	0.044
Cardiopathy*	8.1	4.4	0.029
Care zone*			
Resuscitation ward	0.8	0.4	–
Boxes	63.2	61.2	–
Triage	36.0	38.4	0.738
Age (years)†	48 (18–86)	41 (18–82)	0.008
Physician category*			
Emergency specialists	11.6	11.6	–
Emergency staff	57.6	63.2	–
Residents	30.8	25.2	0.359
Observation ward admission*	8.8	21.6	0.000
Treatment applied*	66.4	56.0	0.017
Complementary studies*			
CT scanning	1.6	2.4	0.523
Ultrasound	1.2	1.2	1.000
Radiography	42.4	38.8	0.412
ECG	20.0	14.0	0.074
Blood test	51.2	34.8	0.000
Urine test	22.0	12.4	0.004
Accessibility (min)			
Ordinal scale†	4 (1–5)	3 (1–5)	0.001
>80*	22.6	29.2	–
61–80*	6.9	10.8	–
41–60*	4.4	10.4	–
21–40*	35.5	28.8	–
<20*	30.6	20.8	0.003; 0.002¶
Time band (work shift)*			
Night	21.6	23.2	–
Morning	37.6	41.2	–
Afternoon	40.8	35.6	0.487
Day of the week*			
Sunday	10.4	9.6	–
Monday	12.8	13.2	–
Tuesday	16.4	16.4	–
Wednesday	16.8	16.8	–
Thursday	10.4	10.8	–
Friday	13.2	16.4	–
Saturday	20.0	16.8	0.947
Clinical history*	89.8	91.1	0.840
Nurse report*	78.4	72.0	0.098
Sex (M/F)*	70.0/82.5	30.0/17.5	0.189
Educational level*			
University	2.6	7.8	–
Secondary	24.6	38.1	–
Primary	47.4	39.4	–
Unschooled	25.4	14.7	0.000; 0.000¶
Socioeconomic level*			
High	2.2	7.1	–
Medium	26.8	44.7	–
Low	71.0	48.2	0.000; 0.000¶

*Percentage: comparisons using Pearson or Fisher's χ^2 exact test.
†Median (P_5–P_{95}): comparisons using Mann-Whitney U rank exact test.
‡Only items reaching statistical significance are shown.
¶Linear trend.

second visit. The results of the linear regression analysis of medical errors and other associated factors as predictors of patients' dissatisfaction with the ED are shown in table 6. None of interaction terms between errors included in the multivariate linear analysis was retained by any model. Kruskal-Wallis non-parametric multiple comparisons showed that the lower the educational level, the higher median information error level in the 0–10 point scale (2 for university educated, 3 for secondary educated, 4 for primary educated, and 5 for uneducated patients; $p<0.001$).

Table 3 Multivariate logistic regression analysis with unscheduled return as outcome*

Error or factor	b	SE(b)	Wald	p value	OR	95% CI (OR)
Prognostic error	2.92	0.31	75.01	0.000	18.62	9.60 to 36.09
Treatment error	1.55	0.31	24.89	0.000	4.75	2.57 to 8.77
Extra-hospital error	1.37	0.39	12.27	0.000	3.95	1.83 to 8.53
Information error (for each point)	0.44	0.09	22.22	0.000	1.55	1.29 to 1.86
Diagnostic error	0.02	0.40	0.04	0.951	1.02	0.41 to 2.53
No observation	1.38	0.41	11.09	0.001	3.99	1.76 to 9.01
No ED treatment	0.75	0.30	6.02	0.014	2.11	1.16 to 3.85
Accessibility (for each 20 min)	0.22	0.09	5.80	0.016	1.24	1.04 to 1.49
Reason for visit (degree of seriousness)	0.07	0.03	4.96	0.026	1.08	1.01 to 1.16
Constant	−7.33	0.82	79.69	0.045	0.001	–

*Not forced backward stepwise binary logistic regression method with Wald's criterion, $p>0.10$ step out and $p \leqslant 0.05$ step in, adjusted in two iterations, Hosmer-Lemeshow goodness of fit test = 8.7 ($p = 0.37$).
b, factor exponent in logistic equation; SE(b), b estimation standard error; Wald, model adjusting criterion; OR, odds ratio (e^b); 95% CI (OR), confidence interval at 95% for OR.

DISCUSSION

The medical errors most closely associated with unscheduled returns to the ED were prognostic errors, the medical errors associated with the worst post-ED destination were diagnostic errors, and the medical errors most closely associated with patient dissatisfaction were information errors.

Unscheduled returns

Our study identified prognostic errors as the main factors associated with unscheduled returns, which is consistent with the findings of other authors who found unfavourable developments as the principal cause of unscheduled returns.[10 18 19] In the present study the frequency of treatment error was higher than that reported in other similar studies.[20 21] This we attribute to the fact that we included patient non-compliance with medical prescriptions in this variable.

Follow up care errors were associated with 26% of unscheduled returns, considerably higher than the 1% reported by Kelly *et al*,[10] 4% by Pierce *et al*,[20] and 7% by Miró *et al*.[21] This difference may be due to different organizational models of primary care. In our setting, a public health center physician attends to an average of 12–16 patients per hour, thus limiting their availability for urgent primary care follow up of ED patients.

In the unscheduled returns group we found a higher frequency of information error than in the controls. Lerman and Kobernick[7] pointed out that 15% of unscheduled returns could have been avoided with better information.

In order of importance, the main factors other than medical errors associated with unscheduled returns were absence of an observation period in ED; absence of emergency pharmacological treatment; and the seriousness of the initial chief complaint. Table 4 shows the probability of unscheduled returns according to the medical errors taking place and the presence or absence of other factors. For example, the probability of an unscheduled return for a patient visiting the ED for a psychiatric disorder from a place 41–60 minutes away from the ED in whom prognostic and treatments errors take place is about 10%. In contrast, the rate of an unscheduled return for a trauma patient living the same distance from the ED who is not kept under observation and who experiences a moderate degree of prognostic and information errors is about 60%.

Post-ED destination

Diagnostic errors were the main errors associated with a worse post-ED destination. We found diagnostic errors in about 20% of unscheduled returns, which is consistent with the findings of Wilkins and Beckett[22] and O'Dwyer and Bodiwala.[23] Almost half the patients with an unscheduled return were admitted to other hospital departments (wards, surgical theatre or intensive care units). Three patients died, reflecting the magnitude of medical errors and their consequences.

Follow up care errors may be related to the frequency of non-specific ED discharge diagnosis. Out of hospital testing to identify a more precise diagnosis is often not available, thus contributing to errors in follow up care.[24 25]

Other than medical errors, we found that that a chief complaint of dyspnea was the most important predictor of a worse post-ED destination. Increased age, was the next most important factor associated with a worse post-ED destination.[26–28]

Table 4 Probability of unscheduled return depending on errors/factors

Errors or factors	Risk profile									
Prognostic error	−	+	+	+	+	+	+	+	+	+
Treatment error	−	−	+	+	+	+	−	+	+	+
Extra-hospital error	−	−	−	−	−	+	−	+	+	+
Information error*	0	0	0	2	4	2	5	4	4	10
Observation	+	+	+	+	+	+	−	+	−	−
ED treatment	+	+	+	+	+	+	+	+	+	−
Accessibility†	1	1	2	2	2	2	3	2	3	5
Reason for visit‡	1	2	3	3	5	4	8	5	6	12
Unscheduled return (p value)	0.0009	0.017	0.102	0.161	0.438	0.541	0.609	0.755	0.943	0.999
95% CI lower limit	0.0007	0.006	0.017	0.029	0.049	0.053	0.053	0.086	0.149	0.527
95% CI upper limit	0.0011	0.045	0.417	0.222	0.921	0.961	0.811	0.990	0.999	1.000

+, yes; −, no.
*On a scale of 11 points where 0 is the lowest and 10 is the highest dissatisfaction with information.
†Five ranges (1, >80; 2, 61–80; 3, 41–60; 4, 21–40; 5, <20 minutes).
‡On a scale of severity or importance (1, dermatology; 2, abdominal pain; 3, psychiatric disorder; 4, worsening of general state; 5, pain at other sites; 6, fever; 7, abdominal pain affecting general state; 8, trauma; 9, hemorrhage; 10, neurological changes; 11, chest pain; 12, dyspnea).

Table 5 Multivariate linear regression analysis with post-ED destination as outcome*

Error or factor	b	SE(b)	β	t	p value	95% CI (b)
Diagnostic error	0.616	0.140	0.171	4.256	0.000	0.331 to 0.902
Extra-hospital error	0.602	0.150	0.241	3.988	0.000	0.304 to 0.901
Information error (for each point)	0.125	0.036	0.273	3.448	0.001	0.054 to 0.197
Prognostic error	0.243	0.223	0.105	1.092	0.276	−0.197 to 0.683
Treatment error	0.192	0.172	0.066	1.116	0.265	−0.148 to 0.531
Dyspnea as reason for visit	0.717	0.195	0.120	3.679	0.000	0.335 to 1.102
Age (for each year)	0.010	0.003	0.242	3.004	0.003	0.003 to 0.016

*Without constant using not forced backward stepwise linear regression method, step in p = 0.05 and out p = 0.10, adjusted after 10 iterations, adjusted R^2 = 57%. Except errors, only factors reaching statistical significance at 0.10 level are shown.
b, non-standardized linear regression coefficient for the factor; SE(b), estimation standard error for b; β, standardized linear regression coefficient for the factor; t: *t* statistics value; 95% CI (b), confidence interval at 95% for b.

Patient dissatisfaction

It is notable that information error rather than follow up care or diagnostic errors was the main factor associated with patient dissatisfaction. This highlights the fact that there is a gradual reduction in communication across different care zones (from observation to boxes to triage) resulting in increased patient dissatisfaction.

Patient educational level was also associated with patient dissatisfaction: the higher the level of education, the higher the level of patient dissatisfaction. This may be explained by increased expectation of quality care and efficient information by patients with a higher educational status, together with greater awareness of their rights, because the higher the level of education, the lower the frequency of information errors. The ED time band or work shift was also associated with patient dissatisfaction: the later the visit during a shift, the greater the level of patient dissatisfaction. This we attribute to an increase in tiredness by staff at the end of a shift which affects all aspects of the quality of care, and is especially compounded late at night by disturbances in the circadian rhythm.[29]

Possible bias and other considerations

The design of this study has a number of limitations. Firstly, the case-control study design assumes certain cause and effect relationships between the outcomes and the risk factors that we identified. It possible that these associations do not reflect causal relationships but, rather, reflect relations between time ordering of events. Secondly, the study was performed during the period of the year with the highest patient census; this implies a possible increase in errors and unscheduled returns secondary to inadequate staffing which we did not specifically examine in this study.[30] Other seasonal variables could affect the frequency of unscheduled returns, medical errors, and other associated factors.[31] Finally, accessibility to our department was estimated as time in minutes required to travel from the patient's home to the ED. This assumes that all patients are coming from home, which may have biased this factor.

This study was also subject to a number of constraints. Firstly, our definition of unscheduled return required that the reason for the first and subsequent visits was identical, which resulted in a considerable loss of possible cases. Other researchers have considered an unscheduled return as the return of the same patient within 72 hours for any reason at all.[7 32 33] Secondly, we classified as erroneous a prognosis that, although in agreement with the diagnosis, was followed by an unexpected or unfavourable development. Other authors have not considered this as a prognostic error, but we wished to minimize the possibility of subjective interpretation in this respect.[21] Thirdly, because of the wide range of diagnoses, the necessary grouping and arranging of them was performed using a subjective criterion of clinically similar degrees of seriousness. Although subjective, we believe this improved the usual absence of order in grouping.[7 16 21]

In spite of these limitations and constraints, our results show that medical errors are associated with unscheduled returns, worse post-ED destination, and patient dissatisfaction. Some of these factors are modifiable. Unscheduled returns may be reduced by limiting prognostic errors. Enhanced use of the ED observation ward, particularly for patients with dyspnea and the elderly, might reduce unscheduled returns. However, increased ED bed occupancy to provide greater observation times may interfere with patient flow. Future studies should test protocols for observation of patients based on the seriousness of their chief complaint.[34] In contrast to other types of errors, deficient staff-patient communication offers the greatest possibilities for improvement in quality of care. Improved information may help to reduce unscheduled return rates and reduce patient dissatisfaction. Patient satisfaction may be improved with more and better information, adapted to the age and educational status of the patient.[35] Strategies to improve post-ED destination should aim to reduce diagnostic errors, paying special attention to the elderly and to patients

Table 6 Multivariate linear regression analysis with patient dissatisfaction as outcome*

Error or factor	b	SE(b)	β	t	p value	95% CI (b)
Information error (for each point)	0.680	0.065	0.655	10.410	0.000	0.551 to 0.809
Extra-hospital error	0.632	0.234	0.110	2.701	0.007	0.171 to 1.093
Diagnostic error	0.521	0.216	0.062	2.410	0.017	0.095 to 0.945
Prognostic error	0.262	0.378	0.051	0.694	0.488	−0.482 to 1.006
Treatment error	0.084	0.254	0.013	0.329	0.742	−0.417 to 0.585
ED care zone	0.526	0.129	0.255	4.081	0.000	0.272 to 0.781
Educational level	−0.309	0.119	−0.190	−2.586	0.010	−0.544 to −0.073
ED work shift	0.304	0.123	0.120	2.465	0.014	0.061 to 0.547

*Without constant using not forced backward stepwise linear regression method, step in p = 0.05 and out p = 0.10, adjusted after 10 iterations, adjusted R^2 = 63%. Except errors, only factors reaching statistical significance at 0.10 level are shown.
b, non-standardized linear regression coefficient for the factor; SE(b), estimated standard error for b; β, standardized linear regression coefficient for the factor; t, *t* statistics value; 95% CI (b), confidence interval at 95% for b.

with dyspnea, and to improving strategies to provide follow up care.[36] The real impact of these and other possible interventions should be the subject of future studies.

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