

ORIGINAL ARTICLE

Dermatological emergencies and determinants of hospitalization in Switzerland: A retrospective study

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Abstract

Background: Dermatologic conditions are estimated to account worldwide for approximately 8% of all visits at emergency departments (EDs). Although rarely life-threatening, several dermatologic emergencies may have a high morbidity. Little is known about ED consultations of patients with dermatological emergencies and their subsequent hospital disposal.

Objective: We explore determinants and clinical variables affecting patients' disposal and hospitalization of people attending the ED at a Swiss University Hospital, over a 56-month observational period, for a dermatological problem.

Methods: De-identified patients' information was extracted from the hospital electronic medical record system. Generalized estimating equations were used to explore determinants of patient's disposition.

Results: Out of 5096 consecutive patients with a dermatological main problem evaluated at the ED, 79% of patients were hospitalized after initial assessment. In multivariable analyses, factors which were significantly associated with an increased admission rate included length of ED stay, age ≥ 45 years, male sex, distinct vital signs, high body mass index, low oxygen saturation, admission time in the ED and number and type of dermatological diagnoses. Only 2.2% of the hospitalized patients were admitted to a dermatology ward, despite the fact that they had dermatological diagnoses critically determining the diagnostic related group (DRG) payment. The number of patients managed by dermatologists during in-patient treatment significantly decreased over the study period.

Conclusions: Our study identifies a number of independent predictors affecting the risk of hospital admission for patients with dermatological conditions, which may be useful to improve patients' disposal in EDs. The results indicate that the dermatological specialty is becoming increasingly marginalized in the management of patients in the Swiss hospital setting. This trend may have significant implications for the delivery of adequate medical care, outcomes and cost-effectiveness. Dermatologists should be more engaged to better position their specialty and to effectively collaborate with nondermatologists to enhance patient care.

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INTRODUCTION

Dermatologic conditions are estimated to account worldwide for approximately 8% of all visits at emergency departments (EDs).¹ Although rarely life-threatening, dermatologic emergencies (DEs) may have a high morbidity and need to be treated promptly. Furthermore, misdiagnosis of dermatological conditions may result in inappropriate care and unnecessary hospitalizations.^{2,3} The broad spectrum of DEs assessed at EDs commonly include infectious processes, inflammatory skin diseases, urticaria, angioedema and drug adverse reactions.^{2,4} Since the number of patients attending the EDs is increasing, the ability to identify factors which allow to improve ED patients' flow and disposition are of utmost importance. Delays in ED patient flow represent a serious threat with negative impact on patient outcomes, staff and health costs. Several factors contribute to so called 'stopgaps' in the ED admission process, such as insufficient ED staff and beds, time to wait for a consultation by a specialist, and the search for an inpatient bed.⁵⁻⁷ The significant changes occurring in healthcare environment and compensation in many countries may have significant impact on the pattern of in-hospital disposition and on the dermatology specialty.⁸⁻¹⁰

Since care to patients with skin disease should be ensured by specialists with adequate training in the best interest of patients,⁸⁻¹⁰ identifying predictive factors for the clinical pathways of patients admitted with DEs at EDs may be useful to improve the patient disposition after ED triage. Therefore, our study had two objectives: first, to explore in patients with a DE the predictive factors and determinants leading to hospital admission with an analysis of the hospitalization rate; second, to gain insight into the trajectories of these hospitalized patients within the various departments after their initial evaluation in the ED.

MATERIALS AND METHODS

Study population

This single-centre retrospective study included all consecutive patients evaluated at the ED of the University Hospital of Bern between February 2016 and September 2020. DEs were defined as skin conditions, which were considered serious by either the affected patients or the referring physicians, and thus justifying a visit to the ED. All patients which were hospitalized ultimately got a discharge diagnosis with a DRG code for a skin disease. The latter determines the payment based on nationally service-related flat rate tariffs, the Swiss Diagnosis Related Group (SwissDRG).

The International Classification of Diseases tenth revision (ICD-10) code was used as the main criterion to select dermatological patients for this study evaluated in the ED. In case of multiple ICD-10 codes, only patients with a primary code related to a dermatological diagnosis were considered. When there was no code reported, patients were selected

according to a list of keywords matching the corresponding ICD-10 definitions for dermatological conditions in the physician's diagnosis and all the records were reviewed by a dermatologist before inclusion.

Patients were after initial evaluation the ED either hospitalized and transferred to a specific medical department for further management or dismissed from the ED with an outpatient management plan. Patients' disposal relies on decision of the ED after involvement whenever necessary of other specialists. On-call dermatologists are reachable as consultants at any time in 30 min when required.

Reasons for exclusion from the study included death of patients in the ED immediately after arrival, leaving ED without being seen or against medical advice, and in all cases in which information was either missing or inconsistent. The study was approved by the Ethical Committee of the Canton of Bern.

Collected data

For the purpose of this study, we extracted de-identified patients' information from the hospital electronic medical record system, including demographics (age, gender, ethnicity, language, marital status, employment, insurance status), referral by family physician, triage score, time of arrival and length of ED stay, number of ED visits in the last year, physician's diagnosis, triage anamnesis notes, patient's disposition (admission or discharged), hospitalization department, length of hospitalization, body mass index (BMI), vital signs (including body temperature, oxygen saturation and pain score), dermatological diagnoses and recorded comorbidities among hospitalized patients.

Dermatological diagnoses and comorbidities were recorded using ICD-10 codes. If the code was not available, a surrogate ICD-10 code was derived by searching the physician's diagnosis for a list of matching keywords. Patient's pain was assessed by using 0-10 visual analogue scale (VAS).

Endpoints

The main endpoint was the dermatological patient's disposition, either discharged or hospitalized. The secondary endpoint was the admission to the dermatology department versus other departments among patients hospitalized with a leading dermatological condition for consultation as inferred from the ICD-10 diagnoses made at the ED and from the DRG code assigned for each hospitalization.

Statistical analysis

For descriptive purposes, continuous data were presented as medians with interquartile ranges (IQR) while categorical data as absolute numbers with percentages. For analysis

purposes, continuous data were also categorized by using clinically relevant cut-off points.

Determinants of patient's disposition were explored by means of generalized estimating equations (GEE) assuming binomial distribution, including age and sex as adjustment factors.

A multivariable analysis based on GEE was conducted to understand independent factors associated with patient's disposition. Variables with a p -value < 0.25 and without zero frequency cells in the age- and sex-adjusted analysis were considered for inclusion.

Effect size measures were expressed in terms of odds ratios (OR) along with their 95% confidence intervals (CI) and p -values. All tests were considered statistically significant at $p < 0.05$. Analyses were performed with MATLAB v.9.1 software (MathWorks, Natick, USA). A detailed explanation of the statistical methods is provided in the [Supporting Information](#).

RESULTS

Demographic and characteristics of ED patients with disposition

In total, 4105 patients (median age 61 years, 56.2% males) with 5096 dermatological related ED visits were identified from the electronic hospital records during a consecutive period of 56 months. Demographics and characteristics of these patients, overall and by patient's disposition, are presented in [Table 1](#).

When compared to the patients discharged after the ED visit, the group of hospitalized patients were significantly older (64 vs. 47 years, $p < 0.001$) and showed a higher proportion of males (58.9% vs. 49.8%, $p < 0.001$).

The triage assessment in the ED resulted in the labelling of the evaluated patients in different administrative categories by the ED team (see [Table 1](#)). Overall, 1063 (20.9%) encounters ended with the patient discharged with an outpatient management plan, while 4033 patients (79.1%) were admitted.

The 1490 patients included in dermatological category had a low probability of being hospitalized with an OR of 0.08 (95% CI: 0.07–0.10). In contrast, patients labelled as neurological-psychiatric, infectious, gastrointestinal-gynaecological and traumatological category by the ED had a significantly higher probability of being hospitalized, when compared to the patients classified in the dermatological category ([Table 1](#)). ED patients referred by family doctor or with previous ED visits in the preceding year had also a higher chance of being hospitalized when compared to self-referred patients.

ED visit time and duration

We analysed the time of arrival and duration of the visits at the ED ([Table S1](#)). Patients admitted to the hospital

were more frequently seen during the days of the working week. The median length of duration of the stay in the ED was higher in the group of patients admitted compared to the group of discharged patients. Patients underweight (BMI < 18.5) or severely obese (BMI ≥ 35.0) had higher chance of being hospitalized. Other parameters affecting admission included high heart rate ($> 100 \text{ min}^{-1}$), fever ($> 37.5^\circ$), low SpO₂ levels ($< 95\%$) and pain severity ([Table S2](#)).

Dermatological diagnoses

The ICD-10 codes of dermatological diagnoses of patients which represented the primary cause of admission are shown in [Table 2](#). Hospitalized patients were more likely to have haemorrhagic skin conditions and purpura, cutaneous abscesses, furuncles and carbuncles, follicular disorders including hidradenitis suppurativa, radiodermatitis, localized swelling, mass and lump of skin, a systemic immunological-rheumatological condition such as dermatomyositis and other disorders of the skin and subcutaneous tissues. In contrast, the discharged patients had, among others, more frequently a diagnosis of acute skin changes due to ultraviolet radiation, urticaria, skin rashes, peripheral vascular diseases, erysipelas and dermatophytosis. The presence of multiple concomitant dermatological diagnoses was also associated with an increased hospitalization risk.

Predictors and determinants of hospitalization

Significant independent predictors of patients' hospitalization found in multivariable analysis were as follows: male sex, older age, nondermatological, neurological/psychiatric, gastrointestinal/gynaecological, traumatological, ear–nose–throat (ENT) or various reasons for consultation, ED admission during the working week days from Tuesday to Friday, between noon and midnight, and mainly in springtime, ED stay ≥ 4 h, severe obesity, abnormal vital signs, including high heart rate, fever and low SpO₂ levels, moderate-to-severe pain (≥ 6), having ≥ 4 total diagnoses and various dermatological diagnosis, especially, infections of skin and subcutaneous tissue, congenital malformations of skin, or diseases classified with ICD code for 'other disorders of skin and subcutaneous tissue, not elsewhere classified' ([Table 3](#)). At variance, diagnoses such as unspecified bullous disorders, urticaria, non-complicated erysipelas, non-severe rashes and other nonspecific skin eruptions were all associated with a decreased probability of hospitalization.

Disposal of admitted patients and their trajectories in the hospital

We analysed the trajectory of the patients, which were admitted. These patients were most frequently transferred

TABLE 1 Demographics and general characteristics of patients included in the study considering all available visits, overall and by patient's disposition.

	Total visits (N=5096, 100%)	Hospitalized (N=4033, 79.1%)	Non-hospitalized (N=1063, 20.9%)	Adj. OR (95% CI)	<i>p</i> ^a
Age (years)					
Median (IQR)	61.0 (46.0–73.0)	64.0 (50.0–75.0)	47.0 (34.0–61.0)		
<45	23.1%	17.7%	43.7%	1	
45–59	24.3%	23.2%	28.5%	1.95 (1.64–2.33)	<0.001
60–74	30.8%	33.9%	18.8%	4.28 (3.54–5.18)	<0.001
75+	21.8%	25.1%	8.9%	6.90 (5.42–8.79)	<0.001
Sex					
Female	43.0%	41.1%	50.2%	1	
Male	57.0%	58.9%	49.8%	1.34 (1.16–1.54)	<0.001
Language					
German	87.5%	87.9%	86.0%	1	
French	6.3%	6.9%	4.0%	1.67 (1.19–2.34)	0.003
Other	6.2%	5.2%	10.0%	0.60 (0.47–0.78)	<0.001
Marital status					
Married	48.0%	48.5%	46.2%	1	
Single	27.7%	25.5%	36.3%	1.34 (1.12–1.60)	0.001
Divorced/Separated	22.5%	24.2%	16.2%	1.22 (1.00–1.49)	0.054
Widow/er	1.7%	1.8%	1.3%	1.94 (1.06–3.52)	0.031
Insurance class^b					
I	3.5%	3.8%	2.5%	1	
II	13.2%	14.2%	9.3%	0.84 (0.52–1.35)	0.474
III	83.3%	82.0%	88.2%	0.79 (0.51–1.21)	0.270
Referral by family physician					
No	82.8%	81.5%	88.6%	1	
Yes	17.2%	18.5%	11.4%	1.73 (1.36–2.20)	<0.001
Triage score^c					
4–5	4.3%	2.4%	11.5%	1	
3	55.7%	51.3%	72.6%	3.24 (2.42–4.34)	<0.001
2	31.7%	36.2%	14.5%	10.38 (7.49–14.38)	<0.001
1	8.3%	10.2%	1.4%	28.69 (15.97–51.54)	<0.001
ED visits in the last year					
0	59.2%	57.7%	65.2%	1	
1	20.5%	21.0%	18.6%	1.24 (1.03–1.48)	0.023
2	9.1%	9.6%	7.1%	1.53 (1.16–2.02)	0.002
3+	11.2%	11.7%	9.1%	1.72 (1.34–2.21)	<0.001
Administrative category of the visit according to ED^d					
Dermatological	30.7%	18.3%	76.2%	0.08 (0.07–0.10)	<0.001
Cardiovascular/ Respiratory	12.9%	15.1%	5.0%	2.53 (1.87–3.42)	<0.001
Neurological/Psychiatric	9.5%	11.8%	1.4%	8.94 (5.19–15.39)	<0.001
Gastrointestinal/ Gynaecological	9.0%	10.5%	3.1%	3.97 (2.72–5.79)	<0.001
Infectious symptoms	8.3%	10.1%	1.8%	5.97 (3.73–9.54)	<0.001
Traumatological	4.4%	5.1%	1.7%	2.90 (1.76–4.78)	<0.001
ENT	3.4%	3.5%	3.1%	1.34 (0.89–2.01)	0.158

TABLE 1 (Continued)

	Total visits (N=5096, 100%)	Hospitalized (N=4033, 79.1%)	Non-hospitalized (N=1063, 20.9%)	Adj. OR (95% CI)	<i>p</i> ^a
Rheumatological	3.3%	3.5%	2.5%	1.32 (0.83–2.09)	0.243
Various reasons	19.1%	22.8%	5.5%	4.45 (3.37–5.89)	<0.001
Hospital department after ED					
INTM	–	33.1%	–	–	–
IBME		7.0%			
VMCK		6.1%			
ORTHO		4.6%			
ENT		4.4%			
NEBR		4.1%			
NCHK		3.6%			
HNOB		3.3%			
PLWB		3.2%			
RHEU		2.5%			
NSTB		2.3%			
DERK		2.2%			
NRLK		2.2%			
PMLK		2.1%			
Other		19.4%			

Abbreviations: Adj, adjusted; CI, confidence interval; DERK, dermatology; ENT, ear, nose and throat; IBME, intensive medicine; INTM, internal medicine; IQR, interquartile range; NCHK, neurosurgery; NEBR, nephrology; NRLK, neurology; NSTB, stroke unit; ONHB, oncology and haematology; OR, odds ratio; ORTHO, orthopaedic surgery and traumatology; PLWB, plastic, reconstructive and hand surgery; PMLK, pneumology; RHEU, rheumatology; VMCK, surgery and visceral medicine.

^aGeneralized estimating equations with binomial distribution including age and sex as adjustment factors and considering repeated patient's measurements.

^bSupplementary insurance to general health insurance: I private, II semi-private, III only general health insurance.

^cSTS: Swiss Triage Scale.¹⁷

^dMultiple categories are possible.

for further management into the general internal medicine department. The latter accepted the largest portion of patients (33.1%), while the transfer rate into other departments remained invariably below the rate of 7% (Table 1). The dermatology department was considered for further diagnosis and management of only 2.2% of the total admitted cases. The overall trend only marginally changed when patients evaluated at the ED, which were labelled as 'dermatological' were analysed. The ED providers involved the dermatology department for the further deliver care of only 8.0% of the total admitted patients in this category ($n = 701$). During the 4.5 years of the study time, the rate of transfer into the dermatology department of patients categorized as primarily dermatological cases by the ED progressively and steadily decreased from 12.5% to 5.6% (Figure 1).

DISCUSSION

Our results show that 79% of patients with a DE were admitted to a tertiary centre for management after ED assessment. Based on simple age- and sex-adjustment, determinants of hospitalization included age ≥ 45 years, male sex and referral by a primary care physician. In

multivariable analysis, determinants which remained significantly associated with an increased admission rate included, beside age and male sex, vital signs such as presence of temperature, pain intensity, abnormal body mass index of the patients and low oxygen saturation. Distinct times of ED admission during the working week, especially in springtime, longer patient's stay at the ED and presence of at least four dermatological diagnoses or specific diagnoses, such as haemorrhagic skin conditions, distinct bacterial cutaneous infections, hidradenitis suppurativa, unclear cutaneous swelling and masses, presence of cutaneous signs of connective tissue diseases were also positive predictors for admission. These patients' characteristics and variables reflect either the presence of serious diseases and comorbidities, which pose a diagnostic challenge, and/or require specific therapeutic interventions.^{1,11} Therefore, they should be considered as criteria useful to improve throughput and/or output of these patients from the EDs and thus might contribute to reduce ED overcrowding.

Noteworthy, only a small fraction (2.2%) of the 4033 patients hospitalized by the ED team with a dermatological condition, which constituted the major diagnosis and determined the DRG code critical for reimbursement, was taken in charge by dermatologists. Furthermore,

TABLE 2 ICD-10 codes of dermatological diagnoses of patients included in the study, overall and by patient's disposition.

ICD-10 diagnoses ^a	Total (N= 5096)	Hospitalized (N= 4033)	Non-hospitalized (N= 1063)	Adj. OR (95% CI)	p ^b
A46: Erysipelas	18.0%	16.3%	24.3%	0.55 (0.47–0.66)	<0.001
B00: Herpes simplex infections	0.1%	0.0%	0.3%	0.27 (0.04–1.73)	0.166
B02: Herpes zoster	3.1%	3.2%	2.5%	1.00 (0.63–1.59)	0.997
B35: Dermatophytosis	2.1%	2.5%	0.8%	0.55 (0.47–0.66)	<0.001
B37: Candidiasis	9.2%	11.4%	0.6%	0.27 (0.04–1.73)	0.166
B86: Scabies	0.2%	0.2%	0.0%	4.49 (0.26–77.88)	0.218
C84: Mature T/NK-cell lymphomas	0.5%	0.6%	0.1%	3.48 (0.46–26.44)	0.227
C86: Other specified types of T/NK-cell lymphoma	0.7%	0.8%	0.5%	1.02 (0.38–2.77)	0.969
D69: Purpura and other haemorrhagic conditions	1.9%	2.4%	0.0%	53.24 (3.30–857.86)	<0.001
I73: Other peripheral vascular diseases	3.4%	3.0%	5.3%	0.51 (0.36–0.72)	<0.001
I83: Varicose veins of lower extremities	5.9%	7.2%	1.0%	5.71 (3.06–10.66)	<0.001
I87: Other disorders of veins	5.0%	5.7%	2.4%	1.55 (1.00–2.39)	0.049
I88: Nonspecific lymphadenitis	0.3%	0.3%	0.0%	7.14 (0.42–120.24)	0.084
I89: Other noninfective disorders of lymphatic vessels and lymph nodes	4.0%	4.6%	1.7%	2.73 (1.63–4.58)	<0.001
L01: Impetigo	0.8%	0.9%	0.8%	1.07 (0.47–2.40)	0.878
L02: Cutaneous abscess, furuncle and carbuncle	5.8%	7.2%	0.5%	22.37 (9.07–55.20)	<0.001
L03: Cellulitis and acute lymphangitis	6.8%	7.9%	2.6%	3.65 (2.44–5.46)	<0.001
L04: Acute lymphadenitis	0.5%	0.6%	0.3%	3.54 (1.01–12.37)	0.048
L05: Pilonidal cyst and sinus	0.3%	0.4%	0.0%	9.27 (0.56–154.24)	0.033
L08: Other local infections of skin and subcutaneous tissue	1.9%	2.4%	0.3%	8.31 (2.54–27.19)	<0.001
L10: Pemphigus	0.4%	0.4%	0.1%	2.15 (0.25–18.90)	0.489
L12: Pemphigoid	1.3%	1.5%	0.8%	0.82 (0.41–1.63)	0.563
L13: Other bullous disorders	0.5%	0.4%	0.7%	0.54 (0.23–1.26)	0.153
L20: Atopic dermatitis	2.5%	2.1%	4.0%	0.67 (0.45–0.99)	0.044
L21: Seborrheic dermatitis	0.8%	0.8%	0.8%	1.16 (0.51–2.65)	0.719
L23–L25: Contact dermatitis	6.6%	6.4%	7.4%	0.80 (0.60–1.05)	0.107
L27: Dermatitis due to substances taken internally	11.2%	12.0%	8.3%	1.62 (1.27–2.08)	<0.001
L28: Lichen simplex chronicus and prurigo	1.1%	1.2%	0.7%	1.41 (0.63–3.16)	0.408
L29: Pruritus	4.2%	4.2%	4.2%	0.89 (0.62–1.27)	0.510
L30: Other and unspecified dermatitis	11.0%	10.7%	12.1%	0.70 (0.56–0.87)	0.001
L40: Psoriasis	8.9%	9.3%	7.0%	1.19 (0.91–1.55)	0.209
L41: Parapsoriasis	0.2%	0.2%	0.1%	1.55 (0.17–14.27)	0.698
L43: Lichen planus	0.4%	0.4%	0.1%	3.05 (0.37–25.45)	0.303
L44: Other papulosquamous disorders	0.2%	0.2%	0.0%	5.55 (0.32–94.81)	0.135
L50: Urticaria	7.7%	4.9%	18.5%	0.32 (0.25–0.40)	<0.001
L51: Erythema multiforme	0.6%	0.6%	0.6%	1.50 (0.56–4.03)	0.419
L52: Erythema nodosum	0.4%	0.5%	0.3%	3.00 (0.80–11.25)	0.104

TABLE 2 (Continued)

ICD-10 diagnoses ^a	Total (N= 5096)	Hospitalized (N= 4033)	Non-hospitalized (N= 1063)	Adj. OR (95% CI)	p ^b
L53: Other erythematous conditions	3.0%	3.1%	2.4%	1.17 (0.75–1.85)	0.487
L56: Other acute skin changes due to ultraviolet radiation	0.2%	0.1%	0.4%	0.16 (0.04–0.57)	0.005
L58: Radiodermatitis	0.7%	0.9%	0.0%	18.88 (1.16–308.11)	0.002
L60: Nail disorders	0.5%	0.5%	0.2%	2.58 (0.56–11.82)	0.222
L72: Follicular cysts of skin and subcutaneous tissue	0.3%	0.3%	0.0%	7.14 (0.42–120.24)	0.084
L73: Other follicular disorders	0.7%	0.9%	0.0%	20.50 (1.26–333.89)	0.001
L81: Other disorders of pigmentation	0.2%	0.2%	0.1%	1.90 (0.25–14.61)	0.538
L85: Other epidermal thickening	2.2%	2.3%	2.0%	0.75 (0.44–1.28)	0.299
L87: Transepidermal elimination disorders	0.1%	0.1%	0.1%	0.60 (0.10–3.70)	0.586
L88: Pyoderma gangrenosum	0.4%	0.4%	0.3%	1.50 (0.40–5.65)	0.553
L89: Pressure ulcer	4.1%	5.0%	0.4%	9.99 (3.64–27.42)	<0.001
L92: Granulomatous disorders of skin and subcutaneous tissue	1.1%	1.3%	0.4%	2.98 (1.02–8.69)	0.046
L93: Lupus erythematosus	1.2%	1.2%	1.0%	1.28 (0.63–2.61)	0.501
L94: Other localized connective tissue disorders	0.1%	0.1%	0.0%	1.85 (0.10–35.79)	>0.999
L95: Vasculitis limited to skin, not elsewhere classified	8.6%	9.4%	5.5%	1.77 (1.31–2.38)	<0.001
L97: Non-pressure chronic ulcer of lower limb, not elsewhere classified	2.8%	3.4%	0.4%	7.07 (2.52–19.88)	<0.001
L98: Other disorders of skin and subcutaneous tissue, not elsewhere classified	5.3%	6.6%	0.4%	15.71 (5.79–42.61)	<0.001
M33: Dermatopolymyositis	0.5%	0.6%	0.0%	14.07 (0.86–230.99)	0.009
Q82: Other congenital malformations of skin	0.5%	0.5%	0.3%	2.73 (0.72–10.29)	0.139
R21: Rash and other nonspecific skin eruption	14.8%	12.4%	23.8%	0.49 (0.41–0.58)	<0.001
R22: Localized swelling, mass and lump of skin and subcutaneous tissue	0.6%	0.7%	0.0%	15.67 (0.96–256.66)	0.006
No. diagnoses					
1	58.2%	55.5%	68.5%	1	
2	22.9%	23.3%	21.1%	1.25 (1.05–1.50)	0.011
3	10.5%	11.4%	7.2%	1.67 (1.27–2.20)	0.000
4+	8.4%	9.8%	3.2%	3.14 (2.16–4.56)	<0.001

Abbreviations: Adj, adjusted; CI, confidence interval; OR, odds ratio.

^aMultiple diagnoses are possible.

^bGeneralized estimating equations with binomial distribution including age and sex as adjustment factors and considering repeated patient's measurements. In case of zero cell frequency, a continuity correction was applied to the univariate model.

during the study period, the rate of admission into the dermatology department showed a progressive reduction. There are several explanations for the significant decrease of patients' in-hospital admission to dermatology. Dermatologists are on-call as consultants with an impossibility to provide an immediate bedside evaluation, a fact which negatively affects a rapid patient transfer solution

in an overcrowded ED.¹³ The possibility to hospitalize patients into our dermatology department has been limited by a reduction of its bed capacity. Furthermore, and importantly, it is likely that ED specialists and internists have little knowledge of the range of diseases that dermatologists are able to treat and their seriousness and may regard dermatologists unable to provide adequate medical care of

TABLE 3 Multivariable analysis of independent predictors of patient's hospitalization.

	OR (95% CI)	<i>p</i> ^a
Sex		
Male vs. Female	1.46 (1.19–1.79)	0.001
Age (years)		
<45	1	
45–59	1.54 (1.18–2.01)	0.001
60–74	2.89 (2.19–3.81)	<0.001
75+	3.55 (2.52–5.01)	<0.001
Administrative category of the visit according to ED ^b (yes vs. no)		
Dermatological	0.16 (0.12–0.22)	<0.001
Neurological/Psychiatric	4.69 (2.65–8.30)	<0.001
Gastrointestinal/ Gynaecological	1.95 (1.25–3.04)	0.003
Traumatological	2.03 (1.25–3.30)	0.004
ENT	1.74 (1.13–2.68)	0.012
Various reasons	2.63 (1.77–3.89)	<0.001
ED admission hour		
6:00–11:59	1	
12:00–17:59	1.40 (1.09–1.80)	0.008
18:00–23:59	1.42 (1.09–1.85)	0.010
ED admission day of the week		
Tuesday	1.57 (1.08–2.27)	0.018
Wednesday	1.71 (1.17–2.51)	0.006
Thursday	1.89 (1.31–2.74)	0.001
Friday	1.45 (1.01–2.07)	0.043
Saturday	1	
ED admission month		
March–May vs. June–August	1.38 (1.05–1.81)	0.019
Length of ED stay (hours)		
<4	1	
4–5.9	2.22 (1.73–2.85)	<0.001
6+	3.38 (2.62–4.36)	<0.001
BMI (kg/m ²)		
35.0+ vs. 18.5–24.9	1.70 (1.12–2.59)	0.013
Heart rate (min ⁻¹)		
>100 vs. 60–100	2.18 (1.63–2.92)	<0.001
Systolic blood pressure (mmHg)		
<120	1	
120–139	0.70 (0.53–0.91)	0.008
140+	0.66 (0.51–0.86)	0.002
Body temperature (°C)		
>37.5 vs. 36.5–37.5	2.87 (1.96–4.20)	<0.001
SpO ₂ (%)		
90–94 vs. 95+	1.86 (1.20–2.89)	0.005
Pain (VAS)		
0	1	
1–5	0.44 (0.34–0.57)	<0.001
6–10	1.84 (1.18–2.86)	0.007

TABLE 3 (Continued)

	OR (95% CI)	<i>p</i> ^a
ICD-10: Dermatological diagnoses (yes vs. no) ^b		
A46: Erysipelas	0.43 (0.31–0.59)	<0.001
B35: Dermatophytosis	2.82 (1.05–7.61)	0.040
B37: Candidiasis	4.91 (2.02–11.94)	<0.001
I83: Varicose veins of lower extremities	3.55 (1.67–7.56)	0.001
L02: Cutaneous abscess, furuncle and carbuncle	31.05 (11.03–87.40)	<0.001
L03: Cellulitis and acute lymphangitis	4.82 (2.73–8.51)	<0.001
L08: Other local infections of skin and subcutaneous tissue	16.08 (3.83–67.57)	<0.001
L13: Other bullous disorders	0.15 (0.04–0.53)	0.004
L23–L25: Contact dermatitis	0.59 (0.39–0.90)	0.014
L27: Dermatitis due to substances taken internally	1.80 (1.31–2.47)	<0.001
L30: Other and unspecified dermatitis	0.53 (0.37–0.75)	<0.001
L50: Urticaria	0.40 (0.28–0.57)	<0.001
L89: Pressure ulcer	3.13 (1.01–9.69)	0.048
L97: Non-pressure chronic ulcer of lower limb, not elsewhere classified	3.67 (1.10–12.23)	0.034
L98: Other disorders of skin and subcutaneous tissue, not elsewhere classified	14.46 (5.03–41.62)	<0.001
Q82: Other congenital malformations of skin	7.00 (1.66–29.53)	0.008
R21: Rash and other nonspecific skin eruption	0.46 (0.34–0.62)	<0.001
No. diagnoses		
4+ vs. 1	2.46 (1.33–4.56)	0.004

Abbreviations: CI, confidence interval; ENT, ear, nose and throat; OR, odds ratio.

^aGeneralized estimating equations with binomial distribution using backward stepwise selection based on Akaike information criterion and considering repeated patient's measurements. Only significant factors in the analysis are reported.

^bMultiple categories/diagnoses are possible.

patients with comorbidities.^{8,9} The COVID-19 pandemic had an impact on hospital processes and bed numbers. Finally, the health economic strategy implemented by the hospital board in which all departments receive annual targets to achieve has increased competitiveness among the medical specialties for hospital admissions.¹² The idea that economic incentives affects patient's disposal and hospital admissions is supported by a large epidemiological study which has estimated that one third of all hospitalizations in Switzerland are unjustified.¹²

By multivariable analysis, the independent predictors for admission to the dermatology ward included presence of distinct dermatological diagnoses. Specifically, the highest OR for admission in dermatology were found for erythema multiforme, Stevens–Johnson syndrome and toxic epidermal necrolysis, congenital skin malformations, other

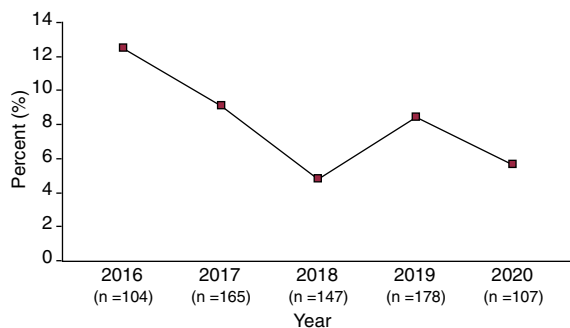


FIGURE 1 Trend of patients' admission in the department of dermatology over the study time, considering patients categorized as 'dermatological' by the emergency department ($n=701$).

erythematous and unclear dermatoses, congenital malformations, fungal infections, impetigo, whereas contact dermatitis and drug reactions-nonspecific rashes were associated with a decreased likelihood of being hospitalized. These observations are in line with the idea that only when the ED team is faced with distinct severe or unclear dermatological conditions requiring specialized skills or technical investigations will involve the on-call dermatology consultant.^{1,3,17-19}

Although in a tertiary centre there are multiple point of interventions to consider, including presence of comorbidities, dermatologists have a superior ability to diagnose skin diseases.^{3,10,15} A prospective study in an American University centre analysed the provisional dermatological diagnoses of 591 patients evaluated at the ED or hospitalized.¹³ The diagnostic accuracy of the departments of ED for adults, general internal medicine, intensive care and surgery varied between 22% and 39%. A retrospective study in the USA assessed 1430 hospitalized patients for which a dermatological consultation was conducted.³ In the latter, 74% of all patients admitted for an infectious cellulitis were misdiagnosed. Hence, dermatologists should play an important role to improve the treatments of dermatological problems. The American National Ambulatory Medical Care Survey reported that non dermatologists are more likely than dermatologists to prescribe more expensive and less effective therapies with significant impact on cost-effectiveness.^{9,10,14} It is essential to provide a correct diagnosis and management and to ensure counselling and preventive care to patients with skin diseases.

Finally, the reported rates of admission of patients with DEs are highly variable among studies. The latter likely depends on local healthcare systems, the type of referral centre analysed and regional factors. In an Australian tertiary hospital, 32.5% of dermatological patients presenting at ED needed to be hospitalized, while only 13.6% of patients visiting a German university dermatological department outside the normal office hours required a hospital admission.¹⁵ In contrast, an US tertiary hospital reported an admission rate as high as 40% for the dermatological cases which received an in-person visit at the ED.¹⁶ Retrospective and prospective studies performed in tertiary centres in Spain, in Italy, in France and in Switzerland found a rate of hospital

admission between 2.1% and 3.1%.¹⁸⁻²¹ These percentages are significantly lower than that of 79% found in the present study. This apparent discrepancy is because our study only assessed patients, which directly visited the ED by considering having a serious condition or were referred to the ED by a physician. In our dermatological outpatient sector, which is open weekdays for all patients seeking emergency care, the vast majority of DEs do not result in hospital admission in analogy to what reported in another Swiss university outpatient clinic.²¹ Our findings indicate that this pre-hospital triage process in our outpatient clinic works well, can save valuable ED resources and suggest that the contacts with the ED of patients with DEs are in almost 80% of cases justified.

Our study has several limitations. First, it describes disposal of patients with DEs in a single University hospital. These findings and their potential implications cannot therefore be generalized to other tertiary hospitals and countries. The study was mainly explorative without adjustment for multiple comparisons. In addition, since the data were extracted up to September 2020, it is possible that seasonality and COVID-19 pandemic had reduced the number of patients seen for any dermatological condition. It would be important to compare the trends observed in our institution with those in other tertiary centres. The study design does not allow to assess whether the outcomes of patients with dermatological diseases with regard to both medical care and financial costs is affected by the patients' disposal by the ED and the subsequent in-hospital trajectories. Whether the novel economically driven incentives and pressure exerted on medical specialties have an impact on the quality of delivered care and cost-effectiveness is a key question, which needs to be addressed because of its broad implications for the health system. Furthermore, because of the main study objectives, no correction for multiple comparison was taken into account.

Our study identifies determinants and risk factors for hospital admission in patients with DEs useful to make patients' disposal more efficient at EDs. It also provides basic information for our specialty and for the general health system important to improve medical training, management protocols and for the designation of dermatology beds in tertiary centres. Dermatology is increasingly marginalized in the management of inpatients in Switzerland. The impact of this trend on patients' outcome is however unclear and needs further investigations. The best interest of patients, state-of-the-art medical management and cost-effectiveness should be taken into account for an adequate patients' disposal at an ED and organization of healthcare structures.

Dermatology should better position itself as the specialized discipline for management of skin diseases and improve the collaboration with other specialists to enhance patient care at the bedside.⁹

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None.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to disclose related to the presented study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The study was conducted according to the ethical standards required and necessary.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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