Published in final edited form as:

Pediatr Dermatol. 2014 March ; 31(2): 163–168. doi:10.1111/pde.12158.

The epidemiology of ophthalmologic disease associated with erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis among hospitalized children in the United States

Jacqueline F. Moreau, BA¹, R. Scott Watson, MD, MPH², Mary E. Hartman, MD, MPH³, Walter T. Linde-Zwirble⁴, and Laura K. Ferris, MD, PhD

¹University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

²CRISMA Center, Department of Critical Care Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

³Department of Pediatrics, St. Louis Children's Hospital, St. Louis, MO, USA

⁴ZD Associates LLC, Perkasio, Pennsylvania, USA

⁵Department of Dermatology, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Abstract

Objective—To characterize the epidemiology and resource use of US children hospitalized with ophthalmologic disease secondary to erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis (EM/SJS/TEN)

Methods—We studied children ages 5–19 hospitalized in 2005 in 11 states, encompassing 38% of the US pediatric population. Using ICD-9-CM codes, we identified admissions with EM/SJS/TEN as well as presence of concurrent ophthalmologic disease, analyzed patient and hospitalization characteristics, and generated age- and sex-adjusted national estimates.

Results—We identified 460 admissions with EM/SJS/TEN, corresponding to 1,229 US hospitalizations in 2005. Among children with EM/SJS/TEN, 60 (13.0%) had ophthalmologic disease, primarily (90.0%) disorders of the conjunctiva. Children with the highest proportions of ophthalmologic disease included those with mycoplasma pneumonia (26.7%), herpes simplex virus (15.6%), upper respiratory infection (13.9%), and lower respiratory infection (13.7%). Compared to EM/SJS/TEN patients without ophthalmologic disease, those with ophthalmologic disease were more likely to receive ICU care (28.3% vs. 17.0%, $p=.035$) and to be admitted to a children's hospital (63.3% vs. 48.8%, $p=.035$). Ophthalmologic disease was also associated with

Address for correspondence. Laura K. Ferris, MD, PhD, Department of Dermatology, University of Pittsburgh School of Medicine, 3601 Fifth Ave, Fifth Floor, Pittsburgh, PA 15213, ferrlk@upmc.edu, 412-864-3677.

The other authors have no financial relationships relevant to this article to disclose. No authors have potential conflicts of interest.

Contributor's Statements:

Jacqueline F. Moreau designed the study, helped code the data, conducted the analyses, and drafted and revised the manuscript. She approves of the final manuscript as submitted.

Dr. R. Scott Watson helped clean, code, analyze, and interpret the data. He critically reviewed, revised, and approved the final manuscript as submitted.

Dr. Mary E. Hartman helped clean and code the data, as well as review and approve the final manuscript as submitted.

Mr. Walter Linde-Zwirble helped clean and code the data. He approves of the final manuscript as submitted.

Dr. Laura K. Ferris helped design the study and critically reviewed, revised, and approved the final manuscript as submitted.

significantly higher median length of stay (6.0 [3, 9] days vs. 3.0 [2, 6] days, $p<.001$) and median hospital cost (\$7,868 [\$3,539, \$17,440] vs. \$2,969 [\$1,603, \$8,656], $p<.001$).

Conclusions—Among children with EM/SJS/TEN, ophthalmologic disease was most common in those with concurrent *Mycoplasma pneumoniae* and herpes simplex virus infections.

Ophthalmologic disease was associated with considerably higher inpatient resource use in this population. Children with EM/SJS/TEN should be screened and treated early for ophthalmologic disease to prevent morbidity and minimize long-term costs.

Keywords

mucous membrane disorders; drug reaction; healthcare delivery; inflammatory disorders; quality of life

Erythema multiforme (EM), Stevens-Johnson syndrome (SJS), and toxic epidermal necrolysis (TEN) are dermatological conditions characterized by acute keratinocyte necrosis. These conditions can be associated with dramatic clinical presentations in children, thus resulting in inpatient hospitalization. SJS and TEN are most often caused by medication use.^{1,2} EM is classically associated with herpes simplex virus (HSV), but other infections have been implicated in its pathogenesis as well, particularly *Mycoplasma pneumoniae*. While EM is more common among children than are SJS and TEN,³ greater representation of SJS and TEN is expected among a hospitalized population given the high associated severity of these conditions. The overall incidence of hospitalization for EM, SJS, or TEN has been estimated to be between 0.5–7.4 cases per million per year in the general population.^{4–6} Among children, however, the reported incidence is much higher, at 35.5 cases per million per year.⁵

Unlike adults, children with EM/SJS/TEN have low mortality.^{3,7} Nevertheless, children with EM/SJS/TEN are at significant risk of morbidity, particularly related to ophthalmologic disease. Ophthalmologic disease has been estimated to affect over 80% adults with SJS and TEN.⁸ However, the nature and extent of ophthalmologic morbidity may differ between adults and children because ophthalmologic disease is more common among adults with SJS and TEN than adults with EM, and a relatively higher proportion of adults have SJS and TEN than EM. To our knowledge, there has been only one published study on the epidemiology of ophthalmologic disease associated with EM/SJS/TEN in children; 24% of patients had ocular disease while inpatient, including 9% of patients with EM, 69% with SJS, and 50% with TEN.⁹ As this study was limited to two tertiary care sites, one a burn hospital, and was conducted during 1960–1994, a time when patients stayed inpatient longer than they do today (giving time for ophthalmologic sequelae to surface), a more current assessment of the general population of children with EM/SJS/TEN is important. Recognition and treatment of ophthalmologic disease is crucial because dry eye syndrome and chronic ocular scarring negatively impacts quality of life,^{9–11} and vision loss may occur. Early intervention, including ophthalmologic consultation, may improve outcomes, as the severity and management of ophthalmologic disease in the acute phase is associated with risk of late complications.^{12–15} Thus, we sought to better understand the population at risk by using a large US data set to characterize the prevalence of ophthalmologic disease among children hospitalized with EM/SJS/TEN by demographic subgroups and concurrent disease status. We also aimed to determine whether ophthalmologic disease was associated with disease severity in this population, as indicated by resource use.

METHODS

Patients

We constructed a patient database using discharge data for calendar year 2005 from 11 states: Texas,¹⁶ Virginia,¹⁷ and 9 states from the State Inpatient Databases (SID) of the Healthcare Cost and Utilization Project (HCUP), Agency for Health Care Research and Quality (Arizona, Florida, Iowa, Maryland, Massachusetts, New Jersey, New York, North Carolina, and Washington).¹⁸ The databases include information about all admissions to non-federal hospitals. (i.e., excludes military, Indian Health Service, and Veterans Administration hospitals). These 11 states comprised 37.6% of the 2005 US pediatric population¹⁹ and were selected on the basis of geographic diversity, population sizes, and availability of needed data elements. We also obtained US Census population data to determine age and sex-adjusted incidences and generate weighted national estimates of the numbers of cases and deaths.¹⁹ This research was exempt from review by the University of Pittsburgh Institutional Review Board.

Case Selection and Definitions

We studied children and adolescents ages 5 to 19 years old at hospital admission to take advantage of age groupings used by the US Census and to significantly minimize inclusion of children who may have had scalded skin syndrome (SSS) as opposed to EM/SJS/TEN. For simplicity, we refer to this population as “children.” We identified patients who had EM/SJS/TEN using the 2005 ICD-9-CM code 695.1, which in addition to EM includes SJS, TEN, Lyell’s syndrome (synonymous with TEN), erythema iris, herpes iris, and SSS. As erythema and herpes iris are infrequently used diagnoses and unlikely to result in hospitalization, and scalded skin syndrome is extremely rare among children over 5 years of age, we refer to all cases coded 695.1 as EM/SJS/TEN.

Concurrent diagnoses were chosen on the basis of suspected or established association between the disease itself and EM/SJS/TEN (*Mycoplasma pneumoniae*; tuberculosis (TB); herpes simplex virus (HSV); Epstein Barr virus (EBV); coxsackie virus; cytomegalovirus (CMV); human immunodeficiency virus (HIV); hepatitis A, B, C, D, and E; varicella, and “other” viral infection) or association between medications used to treat the diagnosis and EM/SJS/TEN (lower respiratory infection (LRI), upper respiratory infection (URI), urinary tract infection (UTI), otitis media, gastroenteritis, osteomyelitis, endocarditis, seizures, malignancy, and bipolar disorder). Seizures and bipolar disorder were selected to identify cases caused by anticonvulsants, and malignancy was selected to identify cases caused by chemotherapy. We did not conduct further analyses for any concurrent diagnosis present among two or fewer children (coxsackie virus; CMV; HIV; hepatitis A, B, C, D, and E; varicella; TB; osteomyelitis; and endocarditis). *Mycoplasma pneumoniae* was omitted from LRIs to prevent double counting. Ophthalmologic diseases were categorized as disorders of the iris and ciliary body, blindness and low vision, keratitis, corneal opacity and other disorders of the cornea, disorders of the conjunctiva, and blepharitis. A full list of diagnoses and ICD-9-CM codes is provided in the Appendix.

Cases of severe sepsis were identified using previously described methods.^{20,21} Mechanical ventilation was identified using ICD-9-CM procedure codes for mechanical ventilation (96.70, 96.71 [duration < 96 hours] and 96.72 [duration > 96 hours]). Children receiving ICU care were identified by the presence of charges for ICU care. We classified hospitals as children’s hospitals or general hospitals based on the National Association of Children’s Hospitals and Related Institutions children’s hospital classification (<http://www.childrenshospitals.net>).

Statistical Analyses

We generated age and sex-adjusted national estimates of hospital admission by presence of EM/SJS/TEN. We estimated costs by multiplying charges by hospital-specific cost-to-charge ratios derived from the Centers for Medicare and Medicaid Services Provider Specific File. We used the Mann-Whitney U test to compare length of stay and costs. We compared categorical data by chi-square or Fisher's exact tests as appropriate. When values were missing (e.g., race was missing from 7.0% of admissions and payer from 10.6%), percentages were calculated based only on subjects with non-missing values. We conducted analyses in Stata 12.1 (Stata Corp., College Station, TX).

RESULTS

Of 483,024 hospitalizations in the 11 states, 460 (0.1%) were diagnosed with EM/SJS/TEN (Table 1). This represents 1,229 US admissions in 2005. The highest incidence was among 5–9 year-olds (23.9 per million, $n=467$), followed by 10–14 year-olds (19.6 per million, $n=410$), and 15–19 year-olds (16.8 per million, $n=353$). Males made up a similar proportion of children with and without EM/SJS/TEN (55.7% vs. 51.8%, $p=.096$). Children with EM/SJS/TEN were younger than children hospitalized for other reasons, with the highest proportion of EM/SJS/TEN cases seen among children ages 5–9 y (38.3%) and the highest proportion of cases of other disease seen among children ages 15–19 (45.7%). Compared to children without EM/SJS/TEN, children with EM/SJS/TEN were more often of white (49.6% vs. 44.1%) and non-Hispanic (13.9% vs. 17.4%).

Children with EM/SJS/TEN were more likely to receive ICU care (18.5% vs. 13.5%, $p=.002$), nearly 3 times more likely to be mechanically ventilated (4.5% vs. 1.9%, $p<.001$), and almost 6 times more likely to have severe sepsis (8.9% vs. 1.5%, $p<.001$) than children without EM/SJS/TEN. Children's hospital admission was also more common among children with EM/SJS/TEN than among other hospitalized children (50.7% vs. 40.8%, $p<.001$). However, mortality was the same among children with and without EM/SJS/TEN (0.4% for both, $p=.903$). While children with EM/SJS/TEN stayed in the hospital slightly longer than other hospitalized children (median 3 [2, 7] days vs. 3 [1, 5] days, $p<.001$), they had similar median costs (\$3,385 [\$1,703, \$9,523] vs. \$3,935 [\$2,246, \$7,276], $p=.1567$).

Among children with EM/SJS/TEN, 60 (13.0%) had ophthalmologic disease. 54 (90%) had disorders of the conjunctiva, 4 (6.7%) had disorders of the iris and ciliary body, 3 (5.0%) had keratitis, 1 (1.7%) had blepharitis, and 1 (1.7%) had blindness or low vision (Table 2); 4 patients had 2 concurrent ophthalmologic diagnoses. 13.2% of females and 12.9% of males with EM/SJS/TEN had ophthalmologic disease (Table 3). The highest prevalence of ophthalmologic disease was seen in 10–14 year-olds (17.7%) followed by 5–9 year-olds (13.1%), and 15–19 year-olds (7.6%). The most common concurrent diseases among children with EM/SJS/TEN were LRI (11.1%), seizure (10.9%), URI (7.8%), HSV (7.0%), "other" viral infection (4.3%), and mycoplasma pneumonia (3.3%). The highest proportion of ophthalmologic disease was seen among children with mycoplasma pneumonia (26.7%), HSV (15.6%), URI (13.9%), and LRI (13.7%). Only 4 (8.0%) of children with seizures had ophthalmologic disease.

Compared to EM/SJS/TEN patients without ophthalmologic disease, those with ophthalmologic disease were more likely to receive ICU care and be admitted to a children's hospital (28.3% vs. 17.0%, $p=.035$ and 63.3% vs. 48.8%, $p=.035$ respectively, Table 4). Having ophthalmologic disease was associated with longer median length of stay (6.0 [3, 9] days vs. 3.0 [2, 6] days, $p<.001$) and higher median hospital costs (\$7,868 [\$3,539, \$17,440] vs. \$2,969 [\$1,603, \$8,656], $p<.001$). However, mechanical ventilation and severe sepsis

were no more common among children with or without ophthalmologic disease (5.5% vs. 4.4%, $p=.723$ and 10.9% vs. 8.6%, $p=.571$ respectively).

DISCUSSION

This is the first population-based study of the epidemiology, ophthalmologic diseases and resource use of US children hospitalized with EM/TEN/SJS. Our research confirms that EM/TEN/SJS is relatively rare among children, but that it is more common among hospitalized children than adults, who have an estimated incidence of 0.5–7.4 cases per million per.^{4–6} The incidence rate is consistent with the only other reported pediatric incidence rate of 35.5 cases per million per year.⁵ Also consistent with past reports,^{3,7} children with EM/SJS/TEN had low mortality. Despite this, these children were considerably sicker than children hospitalized for other reasons, as reflected by complications (mechanical ventilation, sepsis) and hospital length of stay, making morbidity a greater concern. The dramatically higher resource use of children with concurrent ophthalmologic disease among those with EM/SJS/TEN suggests that ophthalmologic disease may preferentially impact those with more severe disease.

While all children with EM/SJS/TEN should be screened for ophthalmologic disease due to the often preventable nature of long-term sequelae with early intervention (i.e. prevention of ocular desiccation/scarring and bacterial superinfection via frequent eye lubrication),^{12,13} this study may help identify those at highest risk. Ophthalmologic conditions were more common among children with concurrent infectious diseases than non-infectious diseases, with the highest proportion seen among those with mycoplasma pneumonia. As this is consistent with past research that found that ophthalmologic disease was more common in *M. pneumoniae*-associated SJS than in drug-induced SJS,²² this knowledge may help inform the process of elucidating the underlying mechanism of ophthalmologic manifestations among patients with EM/SJS/TEN. In addition, although ophthalmologic disease did not demonstrate a sex-predilection, it was less common among older than younger children. This may be due to differences in the relative prevalence of medication vs. infection-induced EM/SJS/TEN between age groups. While long-term ophthalmologic complications are more common in those with severe initial ophthalmologic involvement, it is also important to remember that may also develop in patients without initial involvement.¹⁵ Thus, outpatient follow-up with ophthalmology should be recommended for all children hospitalized with EM/SJS/TEN. As pediatric EM/SJS/TEN are relatively uncommon, treating these conditions in a tertiary care environment is likely to be beneficial. Educating pediatricians as well as consultants, such as ophthalmologists, about the urgency and scope of assessment and treatment of these conditions is important for patient prognosis.

Limitations of this study relate to the use of administrative data. While we were unable to differentiate EM, SJS, and TEN from one another, we are confident that we were able to distinguish cases of EM/SJS/TEN from SSS due to the rarity of the disease in children ages 5 and older combined with the rarity of the condition itself. Use of administrative data also rendered us unable to determine EM/SJS/TEN severity and body surface area involvement, which are likely related to resource use and potentially associated with risk of ophthalmologic disease. As the etiology of EM/SJS/TEN is not always known, the reported prevalence of each concurrent disease likely underestimates its actual prevalence. Similarly, there is likely a lower threshold for hospitalizing younger children than older children, resulting in a relative underestimation of EM/SJS/TEN prevalence in older children. Finally, the states that we studied may not be fully representative of the entire US, which would affect our national estimates. In effort to minimize this, we adjusted for sex and age differences between the 11-states and the entire country, consistent with previously used

methods.²⁰ We also selected states from geographically diverse locations, with populations that collectively amounted to over a third of the pediatric US population.

In conclusion, the data from this sample of hospitalized US children offers insight unavailable from single-institution series into important aspects of identifying and characterizing the distribution and cost of treating EM/SJS/TEN among children. Understanding the associations between EM/SJS/TEN and concurrent diseases is important because promptly treating these diseases may improve outcomes. Early recognition of ophthalmologic disease is important for managing short-term and long-term morbidity, as well as facilitating resource allocation and minimizing long-term costs.

Acknowledgments

Ms. Moreau received funding from the Doris Duke Research Foundation and the National Institutes of Health (grant number 5TL1RR024155). Statistics consultation was funded by the National Institutes of Health (grant numbers UL1RR024153 and UL1TR000005).

This research was exempt from approval at the University of Pittsburgh, IRB #PRO10030315

Abbreviations

EM	erythema multiforme
SJS	Stevens-Johnson syndrome
TEN	toxic epidermal necrolysis
HSV	herpes simplex virus
EBV	Epstein Barr virus
CMV	cytomegalovirus
UTI	urinary tract infection
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
ICU	intensive care unit
LOS	length of stay
SSS	scalded skin syndrome
HIV	Human Immunodeficiency virus
TB	tuberculosis
LRI	lower respiratory infection
URI	upper respiratory infection

REFERENCES

1. Leaute-Labreze C, Lamireau T, Chawki D, Maleville J, Taieb A. Diagnosis, classification, and management of erythema multiforme and Stevens-Johnson syndrome. *Arch Dis Child*. 2000 Oct; 83(4):347–352. [PubMed: 10999875]
2. Del Pozzo-Magana BR, Lazo-Langner A, Carleton B, Castro-Pastrana LI, Rieder MJ. A systematic review of treatment of drug-induced Stevens-Johnson syndrome and toxic epidermal necrolysis in children. *J Popul Ther Clin Pharmacol*. 2011; 18:e121–e133. [PubMed: 21467603]

3. Forman R, Koren G, Shear NH. Erythema multiforme, Stevens-Johnson syndrome and toxic epidermal necrolysis in children: a review of 10 years' experience. *Drug Saf.* 2002; 25(13):965–972. [PubMed: 12381216]
4. Roujeau JC, Guillaume JC, Fabre JP, Penso D, Flechet ML, Girre JP. Toxic epidermal necrolysis (Lyell syndrome). Incidence and drug etiology in France, 1981–1985. *Arch Dermatol.* 1990 Jan; 126(1):37–42. [PubMed: 2134982]
5. Chan HL, Stern RS, Arndt KA, et al. The incidence of erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis. A population-based study with particular reference to reactions caused by drugs among outpatients. *Arch Dermatol.* 1990 Jan; 126(1):43–47. [PubMed: 2404462]
6. Rzany B, Mockenhaupt M, Baur S, et al. Epidemiology of erythema exsudativum multiforme majus, Stevens-Johnson syndrome, and toxic epidermal necrolysis in Germany (1990–1992): structure and results of a population-based registry. *J Clin Epidemiol.* 1996 Jul; 49(7):769–773. [PubMed: 8691227]
7. Singalavanija S, Limpongsanurak W. Stevens-Johnson syndrome in Thai children: a 29-year study. *J Med Assoc Thai.* 2011 Aug; 94(Suppl 3):S85–S90. [PubMed: 22043758]
8. Morales ME, Purdue GF, Verity SM, Arnoldo BD, Blomquist PH. Ophthalmic Manifestations of Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis and Relation to SCORTEN. *Am J Ophthalmol.* 2010 Oct; 150(4):505–510. e501. [PubMed: 20619392]
9. Power WJ, Ghoraiishi M, Merayo-Llodes J, Neves RA, Foster CS. Analysis of the acute ophthalmic manifestations of the erythema multiforme/Stevens-Johnson syndrome/toxic epidermal necrolysis disease spectrum. *Ophthalmology.* 1995 Nov; 102(11):1669–1676. [PubMed: 9098260]
10. Haber J, Hopman W, Gomez M, Cartotto R. Late outcomes in adult survivors of toxic epidermal necrolysis after treatment in a burn center. *J Burn Care Rehabil.* 2005 Jan-Feb; 26(1):33–41. [PubMed: 15640731]
11. Sheridan RL, Schulz JT, Ryan CM, et al. Long-term consequences of toxic epidermal necrolysis in children. *Pediatrics.* 2002 Jan; 109(1):74–78. [PubMed: 11773544]
12. Tomlins PJ, Parulekar MV, Rauz S. "Triple-TEN" in the Treatment of Acute Ocular Complications From Toxic Epidermal Necrolysis. *Cornea.* 2012 Jun 6.
13. De Rojas MV, Dart JK, Saw VP. The natural history of Stevens Johnson syndrome: patterns of chronic ocular disease and the role of systemic immunosuppressive therapy. *Br J Ophthalmol.* 2007 Aug; 91(8):1048–1053. [PubMed: 17314145]
14. Goyal S, Gupta P, Ryan CM, Kazlas M, Noviski N, Sheridan RL. Toxic epidermal necrolysis in children: medical, surgical, and ophthalmologic considerations. *J Burn Care Res.* 2009 May-Jun; 30(3):437–449. [PubMed: 19349890]
15. Gueudry J, Roujeau JC, Binaghi M, Soubrane G, Muraine M. Risk factors for the development of ocular complications of Stevens-Johnson syndrome and toxic epidermal necrolysis. *Arch Dermatol.* 2009 Feb; 145(2):157–162. [PubMed: 19221260]
16. Texas Hospital Inpatient Discharge Public Use Data File TDoSHS. Austin, Texas:
17. Public use file-PUF1 patient level data. Richmond: State of Virginia; 2005.
18. Rockville, MD: Agency for Healthcare Research and Quality; Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases 2000–2006. Available at: <http://www.hcup-us.ahrq.gov/sidoverview.jsp>.
19. United States Census Bureau. [Accessed April 26, 2012] Methodology Summary for the Interim Population Projections for States by Age and Sex: 2004–2030. <http://www.census.gov/population/www/projections/methodology.html>.
20. Watson RS, Carcillo JA, Linde-Zwirble WT, Clermont G, Lidicker J, Angus DC. The epidemiology of severe sepsis in children in the United States. *Am J Respir Crit Care Med.* 2003 Mar 1; 167(5):695–701. [PubMed: 12433670]
21. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. *Crit Care Med.* 2001 Jul; 29(7):1303–1310. [PubMed: 11445675]

22. Kunimi Y, Hirata Y, Aihara M, Yamane Y, Ikezawa Z. Statistical analysis of Stevens-Johnson syndrome caused by Mycoplasma pneumonia infection in Japan. *Allergol Int.* 2011 Dec; 60(4): 525–532. [PubMed: 22113160]

Table 1

Characteristics of hospitalized children by presence of EM/SJS/TEN

	All Admissions		p
	With EM/SJS/TEN N=460	Without EM/SJS/TEN N=482,542	
Male, %	55.7	51.8	.096
Age group, %			<.001
5–9 y	38.3	26.0	
10–14 y	33.3	28.3	
15–19 y	28.5	45.7	
Race/ethnicity, %			.034
White	49.6	44.1	
Black	1.3	2.4	
Hispanic	13.9	17.4	
Other/Unknown	35.2	36.1	
ICU admission, %	18.5	13.5	.002
Children's Hospital Admission, %	50.7	40.8	<.001
Mechanical ventilation, %	4.5	1.9	<.001
Severe sepsis, %	8.9	1.5	<.001
Hospital mortality, %	0.4	0.4	.903
Ophthalmologic disease	13.0	0.6	<.001
Hospital length of stay, d			<.001
Mean + SD	6.1 + 8.6	4.5 + 9.5	
Median ([IQR])	3 [2, 7]	3 [1,5]	

y=year; SD=standard deviation; IQR=interquartile range; d= day

Table 2

Manifestations of ophthalmologic involvement in patients with EM/SJS/TEN

Ophthalmologic manifestation	N (%)
Disorders of Conjunctiva	54 (90.0)
Disorders of the iris and ciliary body	4 (6.7)
Keratitis	3 (5.0)
Corneal opacity and other disorders of cornea	1 (1.7)
Blepharitis	1 (1.7)
Blindness and low vision	1 (1.7)

Percentages do not sum to 100 because some patients had more than one ophthalmologic manifestation

Table 3

Prevalence of ophthalmologic disease by demographic traits and concurrent disease

	N (%) with ophthalmologic disease
Sex	
Female	27 (13.2)
Male	33 (12.9)
Age group	
5–9 y	23 (13.1)
10–14 y	27 (17.7)
15–19 y	10 (7.6)
Concurrent Disease	
Mycoplasma pneumonia (n=15)	4 (26.7)
HSV (n=32)	5 (15.6)
Upper Respiratory Infection (n=36)	5 (13.9)
Lower Respiratory Infection (n=51)	9 (13.7)
“Other” viral infection* (n=20)	2 (10.0)
Otitis Media (n=6)	0 (0)
Gastroenteritis (n=8)	0 (0)
EBV (n=8)	0 (0)
UTI (n=3)	0 (0)
Bipolar disorder (n=11)	1 (9.1)
Seizure [†] (n=50)	4 (8.0)
Malignancy [‡] (n=11)	0 (0)

y=year

* “Other” viral infection includes “other specified viral infection” and “unspecified viral infection”

[†] “Seizures” includes epilepsy, seizures, and convulsions[‡] Malignancy includes malignant neoplasm, carcinoma in situ, and neoplasm of uncertain behavior

Table 4

Characteristics of admissions of children with EM/SJS/TEN by presence of ophthalmologic disease

	With ophthalmologic disease	Without ophthalmologic disease	p
ICU admission, %	28.3	17.0	.035
Children's Hospital Admission, %	63.3	48.8	.035
Mechanical ventilation, %	5.5	4.4	.723
Severe sepsis, %	10.9	8.6	.571
Hospital length of stay, d			<.001
Mean $\pm$ SD	8.5 $\pm$ 9.4	5.7 $\pm$ 8.4	
Median [IQR]	6.0 [3, 9]	3.0 [2, 6]	
Hospital Cost, US dollars			<.001
Mean $\pm$ SD	14,818 $\pm$ 21,268	10,852 $\pm$ 27,861	
Median [IQR]	7,868 [3,539, 17,440]	2,969 [1,603, 8,656]	

SD=standard deviation; IQR=interquartile range; d= day