

Trends in Burn Injuries in Northern Israel During the COVID-19 Lockdown

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Coronavirus disease 2019 obliged many countries to apply lockdown policies to contain the spread of infection. The restrictions in Israel included limitations on movement, reduction of working capacity, and closure of the educational system. The present study focused on patients treated at a referral center for burns in northern Israel. Their goal was to investigate temporal variations in burn injuries during this period. Data were retrospectively extracted from the medical records of burn patients treated at our hospital between March 14, 2020 and April 20, 2020 (ie, the period of aggravated lockdown). Data from this period were compared with that from paralleling periods between 2017 and 2019. During the lockdown and paralleling periods, 178 patients were treated for burn injuries, of whom 44% were under 18. Although no restrictions were enforced during the virus outbreak period with regard to seeking medical care, we noticed a decrease in the number of patients admitted to the emergency room for all reasons. Of particular interest was a 66% decrease in the number of adult burn patients ($P < .0001$). Meanwhile, among the pediatric population, no significant decrease was observed. Nonetheless, subgroups with higher susceptibility to burn injuries included children aged 2 to 5 years (56.3% vs 23.8%, $P = .016$) and female patients from all pediatric age groups (57.1% vs 25%, $P = .027$). These findings may be explained by the presumably busier kitchen and dining areas during the lockdown. Overall, the study results can assist with building a stronger understanding of varying burn injuries and with developing educational and preventive strategies.

In December 2019, an epidemic of viral pneumonia started in Wuhan, China, and rapidly spread to many countries until the World Health Organization (WHO) declared it a pandemic on January 30, 2020.^{1,2} The etiology of this pandemic was a newly discovered coronavirus, named 2019-nCoV by the WHO. The disease it causes was subsequently named coronavirus disease 2019 (COVID-19). Common symptoms of the disease include fever, fatigue, as well as dry cough, and the disease may be fatal.³ Home isolation and curfew policies were planned and implemented in many countries in order to decrease social contact and to contain the spread of infection.⁴ In Israel, February 27, 2020 marks the first date that a case of coronavirus was reported, namely, of a patient who traveled from Italy to Israel. On March 14, 2020, as the number of diagnosed patients had increased to 195, the Israeli government declared an aggravation of the existing coronavirus curfew, which included restrictions on movement, reduction of working capacity to 10% to 20%, and closure of the educational system for all ages. Meanwhile,

no restrictions were made with respect to seeking medical services.⁵

Burns constitute a significant public health issue and are among the leading causes of morbidity and mortality in the East Mediterranean region.⁶ Within the state of Israel, it is reported that burns comprise approximately 5% of all traumas admitted to the hospital.⁷ Burn epidemiology is a highly studied field, aimed at describing risks and temporal trends that may guide injury prevention strategies and staffing of burn services. Although there are many publications on the epidemiology and risk factors for burn injuries, some conclusions remain controversial. Namely, although some studies found correlations between burns and seasonality,^{8–12} holidays, day of the week,^{13,14} time of the day,^{15,16} gender,^{17,18} age groups,^{7,19,20} among other factors,^{21,22} and others did not.^{23,24}

In the present study, we examined temporal variation in cases of burn injuries at a referral center for burns in northern Israel. The covid-19 outbreak and the subsequent lockdown represent a unique time period during which the majority of the pediatric population, as well as parents, have stayed at home.

METHODS

Data were retrospectively extracted from the medical records of all patients treated for burn injuries at our level 1 trauma center between March 15, 2020 and April 20, 2020. These dates correspond to the period during which harsher lockdown policies were imposed in Israel. Data from this period were compared with the paralleling periods between the years 2017 and 2019.

For each patient, demographic information and injury-specific variables were extracted from the medical records, including age, sex, ethnicity, date of injury, burn etiology (flame,

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scald, contact, chemical, and electrical) and circumstances (home, outdoors, work), TBSA, depth of burn, and whether the patient was discharged or admitted to hospitalization.

Statistical analysis was performed using SAS software (version 9, SAS Institute, Inc., Cary, NC). Descriptive statistics in terms of mean, standard deviation (SD), and percentage were calculated to the whole parameters in the study.

Pearson's chi-squared test and Fisher's Exact Test were used to investigate categorical values, while student's *t* test was used to investigate quantitative parameters, according to the year of burn injury.

Two-sided *P*-values were used for hypothesis testing and a value of $<.05$ was considered significant. This retrospective observational study was approved by the local Institutional Review board (IRB) according to the International Conference on Harmonization Good Clinical Practice (ICH-GCP) standards.

RESULTS

During the period investigated (March 15, 2020–April 20, 2020), out of 1134 pediatric patients who visited the pediatric emergency room (ER), 16 suffered from burn injuries (Table 1). Meanwhile, out of 5295 adult patients who arrived to the hospital's ER, 10 sustained burn injuries (Table 2).

Pediatric Burn Patients

Although the total number of patients and trauma patients arriving to the pediatric ER decreased significantly during the coronavirus lockdown (2386 vs 1134 and 703 vs 331, $P < .0001$, respectively), the number of pediatric burn injuries admitted to the ER did not change significantly in comparison to the paralleling periods between 2017 and 2019 (21 vs 16, $P = .17$; Figure 1).

In relation to the 2020 dates examined in this study, the mean age of the pediatric patient admitted to the ER was 3.77 years. Subgroup analysis of the pediatric population revealed a significant increase in the number of burns among children aged 2 to 5 years during the studied period in 2020 vs the paralleling periods between 2017 and 2019 (56.3% vs 23.8%, $P = .016$), 89% of whom were injured during cooking and dining activities. Interestingly, although the 2 to 5 age group appears to have had the highest susceptibility to burn injuries during the coronavirus lockdown, the 0 to 2 age group had a higher predisposition to burns in the corresponding dates between 2017 and 2019 (36.5%; Figure 2). An additional discordance was found upon analyzing trends in the pediatric population according to sex. Although most pediatric burn patients during the COVID-19 lockdown were females (75% vs 25%), in the paralleling periods between 2017 and 2019, they were males (57.1% vs 42.9%, $P = .027$; Figure 3).

The most dominant etiology of burn injuries throughout the coronavirus lockdown was scalds (93.7%) followed by a single case of electrical burn (6.3%). In the corresponding dates between 2017 and 2019, causes of burns were more diverse, including scald (71.4%), contact (11.1%), fire (9.5%), sun (4.8%), and chemical (3.2%) injuries (Table 1).

In terms of similar trends among the two studied periods, the mean TBSA calculated for injuries during the coronavirus lockdown was 3.67%, whereas in the paralleling periods

Table 1. Characteristics of pediatric patients

	2017–2019 Parallel period	2020 Lockdown period	<i>P</i>
ER admissions			
All patients, n	2385.7	1134	$<.0001$
Burn patients, n	21	16	.51
Ratio burn/All patients	0.9%	1.4%	.09
Trauma patients, n	703	331	$<.0001$
Ratio trauma/all patients	29.5%	29.2%	.83
Sex			
Male, n (%)	12 (57.1%)	4 (25.0%)	.027
Female, n (%)	9 (42.9%)	12 (75.0%)	
Ethnicity			
Jewish, n (%)	11 (52.4%)	9 (56.3%)	.86
Non-Jewish, n (%)	10 (47.6%)	7 (43.7%)	
Age groups			
<2 years, n (%)	7.67 (36.5%)	3 (18.8%)	.23
2–5 years, n (%)	5 (23.8%)	9 (56.3%)	.016
6–18 years, n (%)	8.33 (39.7%)	4 (25.0%)	.38
TBSA, %	3.56%	3.67%	.9
Injured area			
Face, n	4	2	.61
Torso, n	7.33	4	.22
Upper limbs, n	8.33	6	.56
Lower limbs, n	5.33	5	.54
Etiology			
Chemical, n (%)	0.67 (3.2%)	0 (0.0%)	1.00
Contact, n (%)	2.33 (11.1%)	0 (0%)	.33
Electricity, n (%)	0 (0%)	1 (6.3%)	.2
Fire, n (%)	2 (9.5%)	0 (0%)	.33
Phototherapy, n (%)	0 (0%)	0 (0%)	1.00
Scald, n (%)	15 (71.4%)	15 (93.7%)	.09
Sun, n (%)	1 (4.8%)	0 (0%)	1.00
Hospitalization, n (%)	6.33 (30.2%)	5 (31.3%)	1.00

ER, emergency room; TBSA, total body surface area.

between 2017 and 2019, it was 3.56% ($P = .9$). Similarly, there was no significant difference in the ratio of patients requiring hospitalization (30.2% vs 31.3%, $P = 1$). During the studied period in 2020, upper limbs were the most frequently injured body part (37.5%), a finding that did not differ significantly from that in the corresponding periods between 2017 and 2019. Likewise, the ratio of Jewish (53.3%) and non-Jewish (46.7%) patients did not change significantly between the studied periods ($P = .86$; Table 1).

Adult Burn Patients

During the coronavirus lockdown period, both the total number of patients who visited the adult ER and the number of adult patients presenting with trauma and burn injuries decreased significantly relative to the paralleling periods between 2017 and 2019 (8849 vs 5295, $P < .0001$, 1489 vs 493, $P < 0.001$, and 30 vs 10, $P = .003$, respectively; Figure 1).

Table 2. Characteristics of adult patients

	2017–2019 Parallel period	2020 Lockdown period	<i>P</i>
ER admissions			
All patients, n	8849	5295	<.0001
Burn patients, n	30	10	.003
Ratio burn/all patients	0.33%	0.18%	.107
Trauma patients, n	1489	493	<.0001
Ratio trauma/all patients	16.8%	9%	.0001
Sex			
Male, n (%)	59 (66.3%)	6 (60.0%)	.73
Female, n (%)	30 (33.7%)	4 (40.0%)	
Ethnicity			
Jewish, n (%)	58 (65.2%)	8 (80%)	.49
Non-Jewish, n (%)	31 (34.8%)	2 (20%)	
Age, years	41.2	43	.77
TBSA, %	3.44%	2.85%	.8
Injured area			
Face, n	8	2	.66
Torso, n	3.33	2	.71
Upper limbs, n	12.33	6	.35
Lower limbs, n	7	2	.87
Etiology			
Chemical, n (%)	7.33 (25.8%)	2 (20.0%)	1.00
Contact, n (%)	2 (6.7%)	0 (0%)	1.00
Electricity, n (%)	0.33 (1.1%)	0 (0%)	1.00
Fire, n (%)	4.67 (15.7%)	5 (50%)	.02
Phototherapy, n (%)	0.33 (1.1%)	0 (0%)	1.00
Scald, n (%)	11.67 (39.3%)	3 (30%)	1.00
Sun, n (%)	1 (3.4%)	0 (0%)	1.00
Hospitalization, n (%)	8.33 (28.1%)	3 (30%)	1.00

ER, Emergency room; TBSA, total body surface area.

The mean age of the adult patient admitted to the ER during the coronavirus lockdown was 41.2 years. Subgroup analysis of the adult patient population demonstrated that males had a higher incidence of burn injuries during both the studied period in 2020 and the paralleling periods between the years 2017 and 2019 (60% and 66.3%, $P = .77$). The distribution of patients according to ethnic groups, likewise, did not differ between the two time periods under comparison ($P = .49$; Table 2).

The results also showed that the mean TBSA burned during the coronavirus lockdown was not significantly different from the TBSA value calculated for the paralleling dates in the years 2017 to 2019 (3.44% vs 2.85%, $P = .8$). Additionally, the fraction of patients requiring hospitalization did not significantly differ between the two periods either (3.67% vs 3.56%, $P = .9$; Table 2).

The most dominant etiology of burns among adult patients during the curfew period in 2020 was fire (50%), and 20% of the injuries were occupation-related. In the periods studied between 2017 and 2019; however, scald (39.3%) and chemical (25.8%) injuries represented the most common causes of burns, and 34.8% of the injuries occurred at the workplace. In both time periods, upper limbs constituted the area most commonly injured by burns (50% vs 44.6%, $P = .35$; Table 2).

DISCUSSION

Burns are common, preventable injuries with significant impact on patients, their families, and healthcare services.^{6,7} Understanding the relationship between certain circumstances and their proneness to burn injuries is essential to guiding prevention strategies and planning burn units.

Starting in December 2019, COVID-19 outbreak obliged many countries to apply curfew policies in order to contain the spread of infection. On March 15, 2020, the Israeli

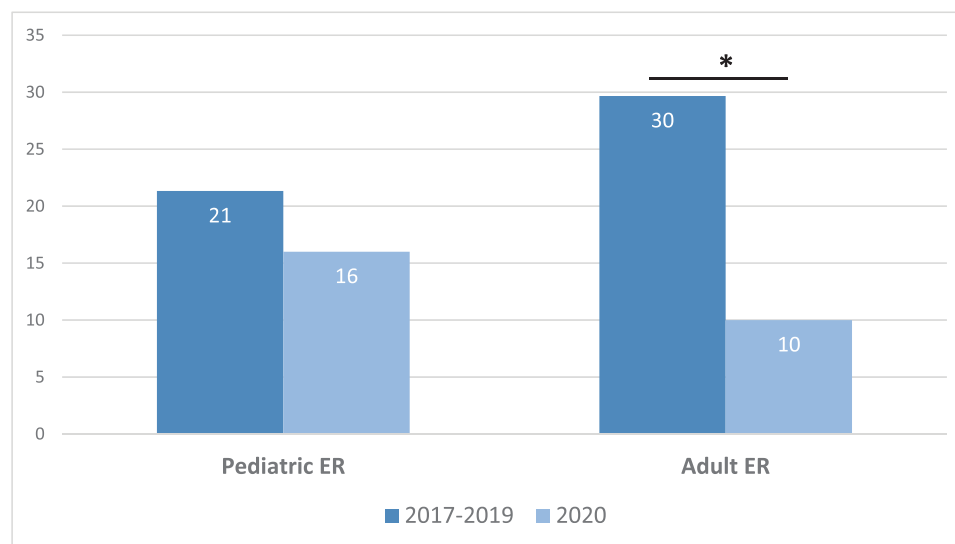


Figure 1. Patients admitted to the adult and pediatric emergency room with burn injuries. * $P \leq .0001$; ER, emergency room.

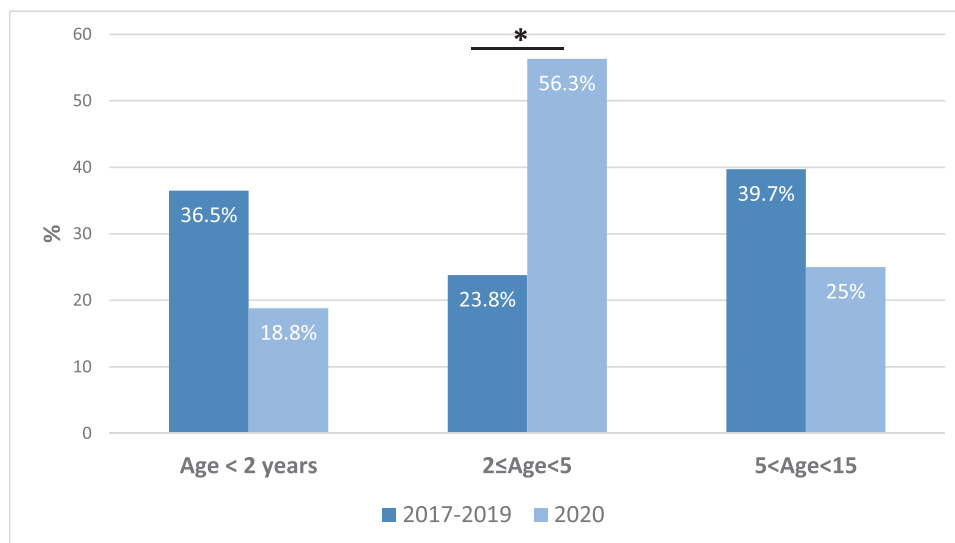


Figure 2. Distribution of pediatric patients with burn injuries by age. * $P = .016$.

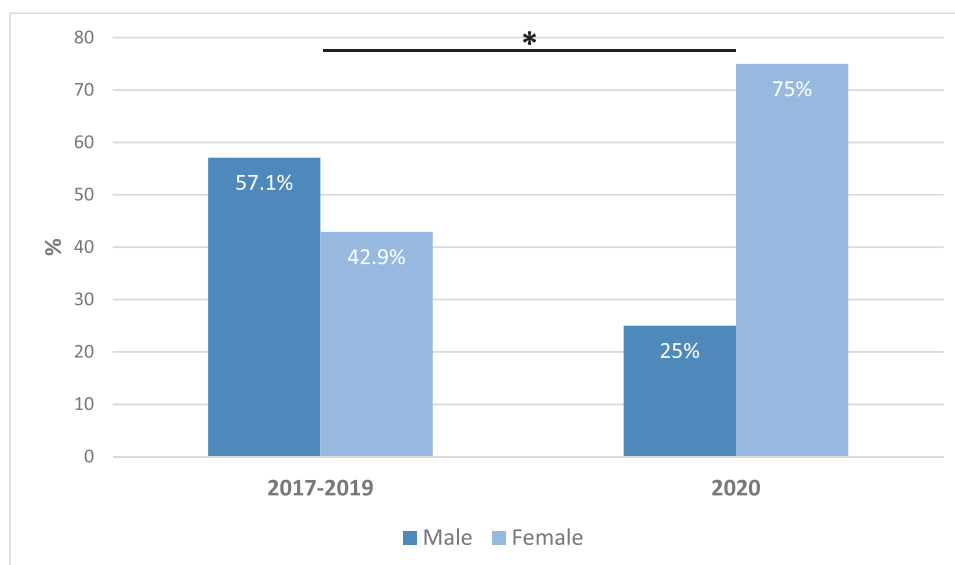


Figure 3. Sex distribution of pediatric patients with burn injuries. * $P = .027$.

government declared an aggravation of the lockdown, including restrictions on movement, workforce reduction to 10% to 20% capacity and closure of the educational system for all ages. The period between March 15, 2020 and April 20, 2020, which corresponds to the virus outbreak in Israel and the subsequent 35-day lockdown situation, provided us with the opportunity to study burn etiologies during a particularly unique period.

Although no restrictions were made with regard to seeking medical services during the coronavirus curfew in Israel, the study results suggest that there was a decrease in the number of patients admitted to the ER for all causes. Namely, there was a 41% decrease in adult ER admissions (8849–5295, $P < .0001$) and a 52% decrease in pediatric ER admissions (2386–1134, $P < .0001$). The observed reduction in admissions was mostly

due to fewer trauma cases and people's fear of contracting coronavirus had they presented to the ER for medical treatment. With respect to burn injuries, there was a significant decrease of 66% in the number of adult burn patients who visited the ER (30–10, $P = .003$). This can be partly attributed to the decrease in occupation-related burn injuries (10 vs 2, $P = .04$), following the mandated workforce reduction during the COVID-19 lockdown. This finding is consistent with previous studies, which demonstrated that adult burns were commonly the result of occupational activities.^{16,25}

Interestingly, no significant decrease in burn injuries was observed among the pediatric population (21–16, $P = .17$). This finding is supported by prior studies wherein most pediatric burns took place at the domestic environment.^{16,26,27} Upon conducting sex-based analysis of the adult and pediatric

patient populations, we found male dominance in both the adult (66.3%) and the pediatric (57.1%) patient groups during the periods paralleling the coronavirus lockdown between the years 2017 and 2019, a finding that is consistent with previous studies.^{17,28,29} This trend in burn injuries likely stems from a combination of environmental, psychosocial and socioeconomic factors.²⁰ Interestingly, this dominance pattern was reversed in pediatric patients presenting to our institution during the COVID-19 lockdown (male ratio: 25% vs 57.1%, $P = .027$). Since all burn injuries among female pediatric patients were caused by scalds, we can hypothesize that the stay-home mandate promoted more cooking and dining activities and has been the cause for 85% of injuries above 2 years of age. Previous studies have also alluded to the kitchen as the location where burn injuries in children commonly take place.^{29,30} Furthermore, since these activities are presumably more appealing to girls, their more frequent occurrence during the lockdown period may have led to a higher ratio of burns in female children.

When evaluating susceptibility to burn injuries by age group during the studied periods between 2017 and 2019, we found that the incidence of burn injuries was disproportionately high in young children, particularly between the ages of 0 and 2 years (36.5%), as previously noted by other studies.^{7,19,20,31} Meanwhile, during the 2020 lockdown period, burn incidence in children aged 2 to 5 years increased significantly compared with the corresponding periods in 2017 to 2019 (56.3% vs 23.8%, $P = .016$). This increase may be attributed to the children's growing curiosity, along with more frequent cooking and dining activities that took place in an environment that, in most cases, is less well-suited for burn prevention relative to supervised kindergartens (ie, kindergartens that have a separate kitchen area with restricted access and restriction on maximal water temperature at washbasin), altogether producing burn-susceptible conditions. Moreover, this curiosity is often not matched by an appropriate level of mental preparedness for preventing and handling kitchen-related accidents.²⁵ As evident in the literature, children most frequently endanger themselves from hot liquids when reaching up to kitchen countertops, or from hot tap water in the kitchen or bathroom.^{26,27,29,32} As such, impulsivity and motor development are important factors that may place children at higher risk in their environment. In contrast, the trend toward lower incidence of burns in children under the age of 2 (36.5% vs 18.5%, $P = .23$) may be attributed to the closer supervision of parents throughout the curfew period, when compared with regular times during which these children are under the supervision of an untrained family member, a nanny or attend in-home daycare, an unsupervised environment that is usually lacking burn prevention practices.

With regard to the different etiologies of burn injuries during the COVID-19 lockdown, we observed that the vast majority of pediatric patients were injured by scalds (93.8%). Meanwhile, causes of burn injuries in the paralleling periods between 2017 and 2019 were more diverse. Namely, they included contact (11.1%), fire (9.5%), sunburn (4.8%), and chemical (3.2%) injuries, as consistent with previous studies.¹⁷

To our surprise, the mean TBSA burned did not significantly differ between the COVID-19 lockdown period and the corresponding dates in 2017 to 2019. This finding was true for both the adult (3.44% vs 2.85%, $P = .8$) and pediatric

(3.67% vs 3.56%, $P = .9$) burn patients. Similarly, the rate of hospitalization in the two periods under comparison was neither statistically significant among adult patients (28.1% vs 30%, $P = 1$), nor among pediatric patients (30.2% vs 31.3%, $P = 1$). This finding may suggest that even during the virus outbreak, a sensitive time that presumably deterred many from going to the hospital out of fear of virus exposure, most patients, including those with minor burns, continued to seek medical care at the ER. Furthermore, they did not refuse hospitalization when deemed necessary. The number of patients presenting to the ER during the virus outbreak can therefore be used to describe trends in burn injuries in this geographical area.

Although the present study does point to certain interesting trends in the incidence and epidemiology of burn injuries during the unique COVID-19 lockdown, it also has several limitations. A major limitation of the study is that it is based on a single institutional database, and therefore, it only reflects trends in northern Israel. Another limiting factor is that our data are based only on patients who visited our institution's ER.

In conclusion, the COVID-19 outbreak and the subsequent lockdown provided us with the opportunity to study the etiologies and circumstances of burn injuries during such unique circumstances. With respect to the adult population, our results demonstrate that the mandated workforce reduction during the COVID-19 lockdown was followed by a decrease in occupational injuries. This is in line with the observation that adult burns tend to occur at the workplace.

On the contrary, most pediatric burns generally occur at a domestic environment. Given the stay-at-home orders during the coronavirus curfew, burn injuries among pediatric patients did not decrease. In fact, within the pediatric population, children aged 2 to 5 years and females from all age groups were more susceptible to burn injuries. The main cause of burns in this subset of the population was scald injuries, which occurred during cooking and dining activities. These findings can assist both in understanding the different circumstances that render burn injuries more likely, and in developing educational and preventive strategies.

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