

Seasonal and Weather Pattern Variation in Fracture Type, Severity, and Location in Pediatric Patients

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INTRODUCTION: Fractures in pediatric patients are a common occurrence, accounting for approximately 14% of emergency department (ED) visits for pediatric injuries and contributing roughly \$3.5 billion in healthcare costs in the United States annually. Understanding factors associated with variations in fracture patterns may help hospitals and EDs anticipate demand and allocate resources more efficiently. The goal of this study was therefore to determine if there are patterns in seasons or weather factors associated with fracture type, fracture location, and OR visits among pediatric patients presenting to the ED.

METHODS: A retrospective review of the electronic medical record was conducted at a single institutional, US academic tertiary care hospital. The study included patients aged 18 years or younger who received treatment for fractures in the ED between January 2017 and December 2021. Data on demographic, fracture type, ED admission, operating room (OR) visit, weather conditions, and seasons were collected for this cohort. Differences in categorical variables were assessed using the chi-square test or Fisher's exact test through bivariate analysis. For continuous variables, student's t-test was employed. To analyze the seasonal variation in the incidence of visits to the OR, student's t-test was performed by comparing the season with the highest number of visits to the other seasonal variables. Two threshold regressions with Bayesian Information Criteria (BIC) were utilized to determine the cut-off value of maximum temperatures associated with visits to the OR and with upper extremity fractures. The resulting cut-off values from the threshold linear regression were evaluated using multivariable regression while controlling for confounding variables.

RESULTS:

A total of 6,119 patients with fractures were included in our cohort. Among all fractures in our cohort, 174 (2.8%) fractures were open, and 1,057 (17.3%) fractures required a visit to the OR. The spring season demonstrated a significant higher proportion of upper extremity fractures compared to winter (66.6% vs. 56.6%; $p < .001$), and fall (66.6% vs. 62.5%; $p = .02$). A maximum temperature equal to or above 68 degrees Fahrenheit was associated with 1.35x increased odds of a fracture occurring in the upper extremities ([OR] 1.35; [CI] 1.19 - 1.52; $p < .001$). The spring season had a significantly higher proportion of open fracture cases compared to summer (36.2% vs. 25.9%; $p = .04$) and fall (36.2% vs. 19.5%; $p = .02$). On multivariable analysis, the spring season was associated with a 1.54x increased odds of an open fracture ([OR] 1.54; [CI] 1.11 - 2.13; $p = .01$). The summer season exhibited a significantly higher proportion of visits to the OR compared to winter (19.7% vs. 15.6%; $p = .01$), spring (19.7% vs. 16.9%; $p = .03$), and fall (19.7% vs. 16.0%; $p = .01$). A maximum temperature equal to or higher than 72 degrees Fahrenheit was associated with 1.2x increased odds of an OR visit ([OR] 1.2; [CI] 1.03 - 1.43; $p = .02$).

DISCUSSION AND CONCLUSION: The results of this study show that fractures are more frequently located in the upper extremity in the spring and at hotter temperatures, more likely to be open in the spring, and more likely to be managed operatively in hotter, summer months. Further research is needed to fully understand the reasons behind these variations, how this should impact resource allocation, and whether interventions can be implemented to reduce the incidence of fractures, especially during the identified peak seasons and weather conditions.