Lunar Effects on UW-Eau Claire On-Campus Housing Incidents

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Introduction

The relationship between lunar phases and human behavior has been a topic of folklore for centuries. In the last century, it has been studied scientifically with varying results. In this study, we analyzed the effect of the full moon on incidents reported in UWEC housing. We used Non-parametric methods, as well as Time Series and Generalized Linear Models.

Non-parametric Analysis

We used Non-parametric tests since there is a relatively small count of “full moon days” (101 of 1016 days fell on a full moon), and the distributions of incident and student counts are heavily right-skewed. Non-parametric tests (with minimal assumptions) are appropriate for data such as this. We used the Kolmogorov-Smirnov test (KS), the χ² test of Independence (claimed by both Non-parametric and parametric statistics), and the Mantel-Haenszel test (MH).

• KS tests if there is evidence that two populations have different distribution functions.
• χ² Test of Independence: tests for an association between variables.
• MH test: assesses stratum of 2×2 tables to determine whether the tables behave similarly.

Distribution Comparisons

Hₖ: The distribution of incident/student counts on full moon days differs from non-full moon days using the KS test.

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Statistic</th>
<th>P-value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Count</td>
<td>0.027</td>
<td>1</td>
<td>Not significant</td>
</tr>
<tr>
<td>Student Count</td>
<td>0.0066</td>
<td>0.9594</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Hₖ: During the weekend, the distribution of incident/student counts on a full moon day differs from the distribution on a non-full moon day using the KS test.

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Statistic</th>
<th>P-value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Count</td>
<td>0.0282</td>
<td>1</td>
<td>Not significant</td>
</tr>
<tr>
<td>Student Count</td>
<td>0.0088</td>
<td>0.9393</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Hₖ: Among weekdays, the distribution of incident/student counts on a non-full moon day differs from the distribution on a non-full moon day using the KS test.

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Statistic</th>
<th>P-value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Count</td>
<td>0.1348</td>
<td>0.2822</td>
<td>Not significant</td>
</tr>
<tr>
<td>Student Count</td>
<td>0.1645</td>
<td>0.1083</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Alcohol Sanctions

Hₖ: For student counts, there is an association between the full moon and alcohol related incidents using the χ² Test.

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Statistic</th>
<th>P-value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekend</td>
<td>2.0625</td>
<td>0.1895</td>
<td>Not significant</td>
</tr>
<tr>
<td>Weekdays</td>
<td>0.1954</td>
<td>0.6600</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Hₖ: For incident/student counts, there is an association between the full moon and alcohol related incidents on either Weekends or Weekdays (using the MH Test).

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Statistic</th>
<th>P-value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Counts</td>
<td>0.0785</td>
<td>0.4974</td>
<td>Not significant</td>
</tr>
<tr>
<td>Student Counts</td>
<td>0.0281</td>
<td>0.8761</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Severity of Sanctions

Hₖ: For sanction counts, there is an association between the severity of a sanction and the full moon. Of particular interest, the proportion of sanctions occurring on full moon is much higher for Severity 2 on weekends, but much higher for Severity 3 on weekdays.

Discussion

Overall, the non-parametric analyses reveal no significant interaction between policy violations and the full moon. Additionally, there is not evidence of an interaction between the full moon and alcohol related incidents. However, there is evidence of an association between the severity of a sanction and the full moon. Of particular interest, the proportion of sanctions occurring on full moon is much higher for Severity 2 on weekends, but much higher for Severity 3 on weekdays.

Future Questions

• Is there a gender difference between incidents and Full Moon?
• Is there association between crime in the city of Eau Claire and full moon?
• Does longer lag or moving average produce a more useful time series model?

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References


Results: Overall GLM Analysis

Generalized Linear Models and Time Series Analysis

Generalized Linear models with Poisson response

We are estimating, using maximum likelihood techniques, the parameters β₀, β₁, ..., βₚ with the equation

\[ \mu = e^{\beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p} \]

For the mean of the Poisson-distributed count, when \( x_j \) is an indicator variable at \( x_j = 1 \), this multiplies the mean by \( e^{\beta_j} \).

Count Time Series Following Generalized Linear Models

We model the count time series of generalized linear models using the package “tscount” in R. This method allows us to estimate coefficients \( \beta_0, \beta_1, ..., \beta_p \) using quasi conditional maximum likelihood and to analyze models with logarithmic link function with Poisson conditional distribution, and including a first-order autoregressive term.

Fall 2015 Analysis

Spring 2016 Analysis

Figure 1: Number of students involved in housing incidents across all Fall and Spring semesters; model fit by Generalized Linear Model with Poisson mean

Spring 2016 Analysis

Figure 2: Number of students involved in housing incidents in Fall 2015

Spring 2016 Analysis

Figure 3: Number of students involved in housing incidents in Spring 2016