The Impact of Bonfire Restrictions on Lag BaOmer on Air Pollution in Israel, 2025

Abstract

This study examines the impact of restrictions on bonfire lighting during Lag BaOmer in Israel on ambient air pollution, focusing on fine particulate matter (PM2.5). Data were collected from 11 urban air quality monitoring stations during the holiday (18:00 on Lag BaOmer eve to 06:00 the following morning) for the years 2021–2025, corresponding to typical bonfire activity hours.

Given the small sample size and the non-normal distribution of the data, non-parametric statistical methods were applied, including the paired Wilcoxon signed-rank test, the Friedman test, and bootstrap resampling with 10,000 iterations to evaluate hypotheses.

Findings reveal a statistically significant reduction in PM2.5 levels in 2025 compared to previous years ($p < 0.05$), except for 2024, where the decrease was not statistically significant. These results suggest that stricter regulatory measures can substantially reduce long-term air pollution.

The study highlights the importance of continuous environmental monitoring and underscores the link between policy enforcement and measurable improvements in air quality.

Background

Lag BaOmer is a Jewish holiday characterized by the widespread tradition of lighting bonfires, typically beginning after nightfall. This practice has been consistently associated with dramatic spikes in air pollution, particularly in PM2.5 levels, resulting from the burning of wood, plastics, and other combustible materials. These fine particles can penetrate deeply into the lungs, enter the bloodstream, and pose serious risks to respiratory and cardiovascular health.

Over the past decade, growing public and regulatory concern has pushed for curbing the environmental and health damages caused by bonfires. In 2025, following a massive wildfire in Jerusalem on April 30 and extreme heat conditions, the Fire and Rescue Commissioner issued a nationwide ban on bonfire lighting from May 9 to May 18—including Lag BaOmer eve itself. Only sites with special permits from local authorities and the fire department were allowed to hold bonfires.

This was not the first year restrictions were imposed. Since 2021, rising environmental awareness, alongside safety and health concerns, has led to partial or regional restrictions on bonfires during

Lag BaOmer. These efforts aimed both to reduce immediate fire hazards and to mitigate the recurrent seasonal air pollution spikes.

Previous research has demonstrated that cultural and religious celebrations involving open burning—such as Diwali in India or New Year's fireworks in urban centers worldwide—are strongly associated with temporary surges in particulate matter (e.g., PM2.5 and PM10). In Israel, the Ministry of Environmental Protection has reported annual increases in PM2.5 during Lag BaOmer, particularly in densely populated regions with high bonfire activity.

This study seeks to investigate the issue by analyzing air pollution data from recent years (2021–2025), comparing annual trends, and assessing the specific effect of the 2025 nationwide ban.

Research Question and Hypotheses

Main Research Question:
Did the implementation of bonfire restrictions during Lag BaOmer 2025 lead to a significant reduction in PM2.5 air pollution levels in Israel?

Sub-questions:

1. **Is there a significant difference between the years 2021–2025?**
    - Null hypothesis (H0): There is no significant difference in PM2.5 levels between 2021–2025.
    - Alternative hypothesis (H1): There is a significant difference in PM2.5 levels between 2021–2025.
2. **How do PM2.5 concentrations during Lag BaOmer 2025 compare to 2021–2024?**
    - Null hypothesis (H0): There is no significant difference in PM2.5 levels between 2025 and previous years (2021–2024).
    - Alternative hypothesis (H1): PM2.5 levels in 2025 are significantly lower than in 2021–2024.

Data Description

Source and Collection

Air pollution data were obtained from the open database of the Israeli Ministry of Environmental Protection, which provides hourly measurements from official urban monitoring stations nationwide. This study focused on PM2.5 concentrations (particles smaller than 2.5 micrometers), a key pollutant linked to bonfires and biomass burning.

Data were collected from 11 urban monitoring stations, selected for their availability and geographical distribution. These sites represent diverse cities typically associated with bonfire activity. For each year between 2021–2025, PM2.5 samples were extracted for a 12-hour window (18:00–06:00), covering the traditional timeframe of bonfire events.

Preprocessing and Cleaning

The dataset was used to calculate the maximum PM2.5 value recorded in each 12-hour interval for every station and year. Missing or incomplete data points were excluded. The final dataset comprised 11 paired station-year observations. Pairwise comparisons were made within stations across different years to account for site-level variation.

Statistical Methods

Given the small sample size (n = 11) and the confirmed non-normal distribution (via Shapiro–Wilk test and QQ plots), non-parametric approaches were applied:

- **Friedman Test**: A non-parametric alternative to repeated-measures ANOVA, used to assess overall differences in PM2.5 across the five years (2021–2025). If significant, pairwise Wilcoxon tests were conducted post hoc.

- **Wilcoxon Signed-Rank Test**: Applied to compare PM2.5 levels in 2025 with each preceding year (2021–2024), directly addressing Sub-question 2.

- **Bootstrap Resampling**: A non-parametric bootstrapping procedure with 10,000 iterations was conducted to validate findings, providing robust inference without distributional assumptions.

Tools and Technologies

All analyses were performed in Python using pandas, scipy, seaborn, matplotlib, and numpy.

Results

Descriptive Statistics

PM2.5 concentrations during Lag BaOmer (18:00–06:00) were analyzed across 11 stations for 2021–2025. Median and interquartile ranges (IQR) of maximum PM2.5 values per station per year were calculated.

Year	Median PM2.5 (μg/m³)	IQR (μg/m³)
2021	66.30	51.10–97.65
2022	48.80	31.25–84.50
2023	62.79	37.45–75.91
2024	31.50	24.70–57.23
2025	42.48	15.95–68.55

Results suggest a downward trend in PM2.5 levels between 2021–2025. The lowest median occurred in 2024, followed by a slight increase in 2025—though levels remained below those of earlier years.

The 2025 nationwide ban appeared effective, but not to the same extent as the reductions observed in 2024. The decline in 2024 may have been influenced by contextual factors such as the war that began on October 7, 2023, which potentially affected bonfire activity (e.g., rocket attacks, public sentiment).

Friedman Test

- Test statistic = 14.26
- p-value = 0.0065

This indicates a statistically significant difference in PM2.5 levels across the five years ($p < 0.05$).

Wilcoxon Pairwise Comparisons (2025 vs. previous years)

Comparison	p-value	Interpretation
2025 vs. 2021	0.007	Significant decrease
2025 vs. 2022	0.027	Significant decrease
2025 vs. 2023	0.021	Significant decrease
2025 vs. 2024	0.319	No significant difference

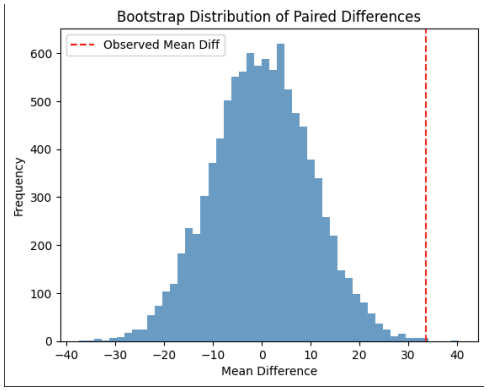
The Wilcoxon tests confirm statistically significant reductions in PM2.5 levels in 2025 compared with 2021–2023, but no significant difference relative to 2024.

Bootstrap Analysis

Bootstrap resampling supported these findings. For example:

- **2021–2025 yielded a mean PM2.5 reduction of 38.5 μg/m^3 with a one-sided p = 0.0072.**

Other year-to-year comparisons with 2025 were consistent with the Wilcoxon results: significant improvements compared to 2022 and 2023, but not compared to 2024.



Conclusions

This study assessed the impact of bonfire restrictions on air quality during Lag BaOmer in Israel by analyzing PM2.5 data from 2021–2025 across 11 urban monitoring stations. Using non-parametric methods (Wilcoxon signed-rank, bootstrap resampling), statistically significant reductions in PM2.5 were observed in 2025 compared to 2021–2023 ($p < 0.05$). However, no significant difference was found between 2025 and 2024, potentially reflecting external factors such as the war and prior regulatory efforts.

The results demonstrate that strong regulatory interventions—such as bans on bonfire lighting—can yield rapid and measurable improvements in urban air quality, even over short periods. The observed reductions (up to 38 $\mu g/m^3$ median PM2.5) have substantial public health implications, particularly for vulnerable populations.

The lack of difference between 2025 and 2024 may be attributed to:

- Earlier policy interventions and gradual behavioral changes beginning as early as 2020 (COVID-19 period).
- Meteorological variations (wind speed, humidity, temperature inversions).
- Differences in enforcement or compliance across municipalities.
- Reduced public enthusiasm for celebrations under wartime conditions.
- Growing public awareness of air pollution impacts during Lag BaOmer.

Limitations

- Analysis was limited to 11 urban stations, excluding rural and ultra-Orthodox communities where bonfire practices may differ.
- PM2.5 levels are also influenced by sources beyond bonfires, such as traffic, industry, and dust storms, which were not controlled for.
- Meteorological variables were not included in the statistical models; weather-adjusted comparisons could refine conclusions.

Summary

The evidence supports the effectiveness of policy restrictions in reducing air pollution linked to cultural practices. When clearly communicated and consistently enforced, such interventions can deliver measurable health and environmental benefits without requiring long-term infrastructural changes.

Sustainable alternatives to bonfires—such as community light shows or designated fire zones—may provide culturally acceptable, environmentally responsible long-term solutions.

Future Research Directions

- Incorporating meteorological factors into statistical models.
- Expanding the analysis to additional years, including pre-2021 baselines.
- Investigating public awareness and behavioral changes related to bonfire practices.

References

Data source:

- https://air.sviva.gov.il/

Fire ban announcement (2025):

- https://www.gov.il/BlobFolder/news/09_05_2025/he/%D7%A6%D7%95%20%D7%A0%D7%A6%D7%99%D7%91%20%D7%9C%D7%92%20%D7%91%D7%A2%D7%95%D7%9E%D7%A8%202025.jpg

Reports on Lag BaOmer pollution:

- https://infospot.co.il/n/Air_quality_monitoring2
- https://www.sviva.co.il/lag-baomer-pollution/

Environmental impacts of Lag BaOmer:

- https://magazine.isees.org.il/?p=16859

Diwali air pollution impacts:

- https://www.livemint.com/news/india/how-much-air-pollution-has-increased-post-diwali-celebration-check-data-from-kolkata-mumbai-delhi-chennai-etc-11730533192212.html

New Year fireworks reductions in China:

- https://www.mdpi.com/2073-4433/13/9/1388

Health effects of particulate matter:

- https://www.gov.il/BlobFolder/reports/environmental_pollutants/he/research_sviva_pollutants_info_Particulate-Matter.pdf