Forecasting A&E Demand: Weather Correlations in Ophthalmology Patient Attendance

Matthew Stahl, Salaam Bosotross, John Vekinis, Emma Jones, Gordon Hay, Tjebo Heeren
Moorfields Eye Hospital NHS Foundation Trust

Introduction

- ***Do weather variables affect ophthalmic A&E attendance?***
- Anecdotally, there is a strong belief amongst healthcare professionals in ophthalmic A&E that weather influences patient attendance.
- It has long been established that heatwaves affect mortality [1]. A previous study has demonstrated a correlation between general A&E attendance in Greater London and increasing temperatures.[2]
- Understanding the factors that influence attendance can aid management in ophthalmology and the development of a predictive model would be invaluable for staff planning
- **This retrospective study aimed to investigate if there was any correlation between weather conditions and patient attendance** at the Ophthalmology Accident and Emergency (A&E) department at Moorfields Eye hospital, London.

Methods

- A&E attendances spanning from January 4, 2021, to August 31, 2023, were collected.
- London weather data, including temperature, rainfall, and sun hours were collected from a weather station in NW3 – data available at https://nw3weather.co.uk.[2] Dates of bank holidays and school holidays was also collected and incorporated.
- Multiple linear regression was used to assess the impact of various predictors on patient attendance and correlation coefficients were calculated between weather variables and attendance.
- Estimates for each predictor were calculated, with attendance as the dependent variable.
- The model's explanatory power was assessed using R^2 and adjusted R^2 values. Statistical analysis was performed using R statistical software.

Results

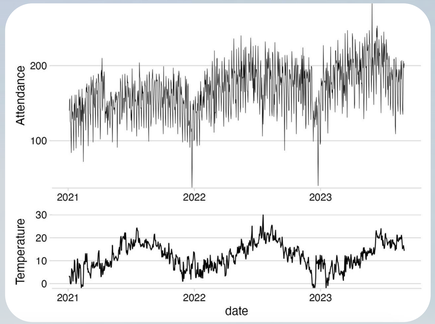


***Figure 1**: daily patient attendance with corresponding daily temperature data from showing the relationship between temperature and attendance*

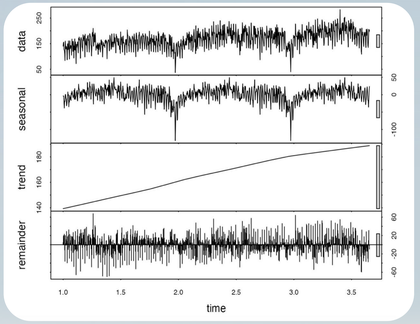


***Figure 2**: decomposed components of time series data The 'seasonal' component reveals consistent annual patterns. The 'trend' component indicates a steady increase in attendance over time the 'remainder' component captures irregular fluctuations.*

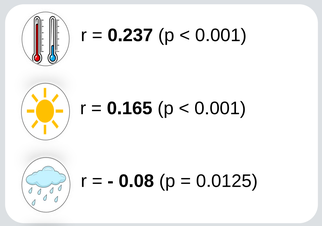


***Figure 3: Pearson correlation coefficients** comparing patient attendance and weather variables: (top to bottom) temperature, sun hours, and rainfall. Temperature shows a moderate correlation.*

Predictors	Estimates	CI	p
(Intercept)	-5.08	-7.76 – -2.39	<0.001
Bank holiday	-15.89	-18.30 – -13.48	<0.001
School holiday	-7.95	-10.59 – -5.30	<0.001
Temperature	0.83	0.63 – 1.04	<0.001
Sun hours	0.71	0.41 – 1.01	<0.001
Observations	**970**		
R^2 / R^2 adjusted	**0.254 / 0.251**		

***Figure 4: Regression Analysis of Factors Affecting Patient Attendance:** This table presents the results of a multiple linear regression analysis identifying factors influencing attendance. Includes estimates, confidence intervals (CIs), and p-values for predictors. The model accounts for 25.4% of the variance in attendance as indicated by the R^2 and adjusted R^2 values.*

- Our analysis highlights a significant relationship between weather variables and patient attendance at Moorfields Eye Hospital. The regression results indicate that temperature and sunlight hours are positively correlated with patient attendance. For every ‘1 degree’ increase in temperature there are ‘0.83’ more patient attendances.

Discussion

- Warmer, sunnier conditions are modestly correlated with increased attendance however bank and school holidays have a considerably larger effect.
- The reasons for the weather effect remain unknown and can only be postulated. Our findings are in keeping with a previous study by Hotz and Shahatz looking at general A&E attendances in Greater London between 2007 and 2012 and finding a similar correlation.[2]
- Possible explanations include:
  - the warmer conditions being associated with more outdoor activities – increasing the likelihood of corneal foreign bodies and trauma.
  - patient floaters may become more prominent in the sunnier conditions
- Whilst our model explains just over a quarter of the variance in attendance, other yet unknown factors may also play significant roles. Future studies should incorporate additional variables to improve on this model.

1. Haines A, Kovats RS, Campbell-Lendrum D, Corvalan C. Climate change and human health: impacts, vulnerability and public health. *Public Health*. 2006;120(7):585-596. doi:10.1016/j.puhe.2006.01.002
2. Corcuera Hotz I, Hajat S. The Effects of Temperature on Accident and Emergency Department Attendances in London: A Time-Series Regression Analysis. Int J Environ Res Public Health. 2020;17(6):1957. Published 2020 Mar 17. doi:10.3390/ijerph17061957
3. Weather data taken from https://nw3weather.co.uk – a freely available source of local weather data in NW3