

Original communication

# Climatic effects on incidence of sexual assault

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## Abstract

This study analysed the daily incidence of sexual assault in Greater Manchester with respect to the local weather conditions throughout the year 2002. Cases seen at the St. Mary's Sexual Assault Referral Centre (including police and self-referred clients) for which the date of the assault was known were included in the study. The daily maximum, minimum, and mean temperature, rainfall, wind speed, and hours of sunshine recorded at Manchester Airport were used in correlation and regression analyses. Maximum temperature and hours of sunshine both had a statistically significant ( $p < 0.05$  and  $0.01$ , respectively) positive relationship with the number of sexual assaults committed in a day.

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## 1. Introduction

A relationship between the weather and crime is well established: as early as 1835, Lambert Adolphe Quetelet provided statistical evidence that

“...during winter misery and want are more especially felt, and cause an increase of the number of crimes against property, whilst the violence of the passions predominating in summer, excites to more frequent personal collisions”<sup>1</sup>.

More recently, an analysis of crimes in England and Wales<sup>2</sup> found strong evidence that temperature was positively related to most types of property and violent crime, and others<sup>3</sup> found an overall rise in murders across the US in the summer months. However, adaptation to the local climate is likely to affect any specific local ‘crime temperatures’, e.g., temperatures of 27, 29, and 34 °C have all been identified as ‘riot temperatures’<sup>4</sup>. If the increases in anger and discomfort that accompany increases in temper-

ature can translate into increases in murder and disorderly behaviour, then it might be that there is an aspect of physiology involved along with the social changes that conspire to generate incidents of sexual assault.

An increase in incidence of rape in England and Wales with daily temperature (but not hours of sunshine) has been noted<sup>2</sup>, and that fewer sex crimes were committed on cold than warm days<sup>5</sup>. Cohn<sup>6</sup> found that whilst other crimes were affected by the weather incidence of rape was not. However, that study did find that sexual assaults and domestic violence increased at night, and a replication<sup>7</sup> found that temporal factors explained as much as 75% of the variance in calls to police for domestic violence. Since rape is a vastly under-reported crime, analyses are difficult, and many unreported assaults are committed at home by partners, rather than in public by strangers<sup>8</sup>. However, since domestic violence is also related to high temperatures (e.g., Farrell and Pease's analysis of Merseyside Police data<sup>9</sup>) one can speculate that rape, regardless of relationship to offender, might increase with the temperature.

Baumer and Wright<sup>10</sup> provided an extensive list of published research on this issue, summarising (whilst acknowledging some exceptions) that these studies generally found violent crime to rise in the summer and prop-

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erty crime in winter. They also suggest that future research should go beyond simply reiterating these trends. This author was aware of anecdotal evidence from staff at St. Mary's Sexual Assault Referral Centre in Manchester that hot and/or sunny weekends were often accompanied by a slight but noticeable increase in the number of referrals to the Centre. Rather than sexual assault being a direct consequence of warmer weather, as if the heat prompted a physiological impetus in the potential sexual offender, it was speculated that this was due to the greater number of people out in public for longer and later in good weather.

This reasoning is consistent with the Routine Activity theory of crime<sup>11</sup>. In this theory, there are three minimal elements of a crime: a likely offender; a suitable target (person or property); and the absence of a capable guardian to prevent the crime. The suitability of a target is governed by its value, visibility and accessibility to the possible offender, and its inertia or resistance to the crime. Therefore, if better weather increases the number of people in public/social areas, then amongst them will be more 'targets' of high 'value' to potential offenders. Likewise, being out in public and for longer increases visibility and accessibility.

## 2. Method

### 2.1. Aim and hypothesis

The purpose of this study was to ascertain whether or not seasonal variations affect the number of sexual assaults committed, such as temperature. The hypothesis is that the number of sexual assaults committed in the course of a day increases as the weather improves. Relevance of the day of the week was also explored.

### 2.2. Design

Retrospective descriptive single-sample survey.

### 2.3. Cases of sexual assault

St. Mary's Sexual Assault Referral Centre in Manchester is a NHS organisation that performs the forensic medical examinations of people alleging a sexual assault. The service covers the Greater Manchester area and conducts examinations for the Greater Manchester Police, which funds the Centre along with the Central Manchester and Manchester Children's University Hospitals NHS Trust. Examinations are conducted for primarily evidential purposes, rather than treatment. Self (as opposed to police) referrals can also be seen at the Centre, and so this data includes some assaults unreported to the police. Other services include counselling, sexual transmitted infection screening, and support during involvement with the criminal justice system.

Cases seen at the Centre for which the date of the assault was recorded were included. In 2002 there were 529 such

cases, which were included in this study. 490 (92.6%) were female and 39 (7.4%) were male. The age range of all cases was 9–89 years (mean 24.64; median 21; mode 17). The nature of these sexual assaults were: vaginal and/or anal rape (339, 64.1%); attempted vaginal and/or anal rape (21, 4%); vaginal and/or anal penetration by fingers or an object (16, 3%); and indecent assault, i.e., other sexual assault (42, 7.9%). The type of assault was not recorded in 111 (21%) cases. This may be due to unconsciousness of the victim during the assault and/or the inability of the examiner to question the client due to her or his age (clients under 16 years must be video interviewed by police). Cases did not include cases of long-term child sexual abuse, which are not seen at the Centre, and whilst containing self-referred cases, this sample cannot represent those that do not report an assault on them to any service.

### 2.4. Meteorological data

Weather data for each day of 2002 were recorded at Manchester Airport (altitude 69m, latitude 53:36N, longitude 02:28W) by the Met Office (©2003). This was the best-placed weather station for the county of Greater Manchester with a full archive of data for 2002 available. The airport is situated at the southernmost point of the county, which covers approximately 600 square miles and is home to 2.6 million people<sup>12</sup>. Meteorological variables that were available from the Met Office related to temperature, rainfall, sunshine, and wind. (Humidity and barometric pressure data were not available.) Those chosen as key variables of Greater Manchester weather were: maximum, minimum and mean temperatures (degrees centigrade); total rainfall (mm); total hours of sunshine; and mean wind speed (knots). Minimum, maximum, and mean values for these variables in 2002 are presented in Table 1.

### 2.5. Procedure

The number of assaults on each day of the year was entered into Excel and SPSS, along with each day's meteorological data, supplied by George Hood at the Met Office. Correlations and regression analyses were conducted on numbers of assaults for different days of the week. Correlations and regression analyses were conducted on all weather features for all days and separately for weekends (Friday, Saturday, Sunday) and weekdays

Table 1  
Minimum, maximum, and mean values of weather features at Manchester Airport for 2002

Weather feature	Minimum	Maximum	Mean
Temperature (°C)	−6.2	27.1	10.5
Rain (mm)	0.0	37.6	3.3
Sunshine (h)	0.0	13.8	3.8
Wind (knots)	2.1	20.8	8.4

Source: Met Office ©2003.

(Monday, Tuesday, Wednesday, Thursday). Friday is counted as a weekend day here as Friday night is the start of the weekend.

### 3. Results

#### 3.1. Assaults on different days of the week

The day of the week is statistically significant at  $p < 0.01$  ( $p$  0.00, Spearman  $r$  0.274) in relation to the number of assaults committed, with more assaults occurring at weekends (Friday, Saturday, Sunday). The number of assaults that were committed on different days of the week as follows: Monday 63; Tuesday 62; Wednesday 51; Thursday 45; Friday 76; Saturday 112; Sunday 120.

#### 3.2. Assaults on all days ( $n = 529$ )

Maximum temperature ( $p < 0.05$ ) and hours of sunshine ( $p < 0.01$ ) showed statistically significant positive relationships, at and respectively, with the number of assaults committed. These results are supportive of the hypothesis that warmer, sunnier weather is accompanied with a greater incidence of sexual assaults. Correlations and regressions found no statistically significant relationships at  $p < 0.05$  between the incidence of sexual assault and mean or minimum temperatures, rainfall or wind speed. Statistical results for maximum temperature and hours of sunshine are presented in Tables 2 and 3.

#### 3.3. Assaults on weekdays ( $n = 221$ )

Analyses found that there were no significant relationships at  $p < 0.05$  between the number assaults committed and the weather features on weekdays and as such reject the hypothesis. The mean of maximum temperatures on these days was 13.9971 °C, and hours of sunshine 3.8971.

Table 2  
Results from Spearman correlations of maximum temperature and sunshine with daily incidence of sexual assault

All days, weekdays, weekends <sup>a</sup>	Weather feature	$p$ (two-tailed)	$r$
All days	Maximum temperature (°C)*	0.018	0.123
All days	Sunshine (h)**	0.002	0.148
Weekdays	Maximum temperature (°C)	0.221	0.085
Weekdays	Sunshine (h)	0.120	0.108
Weekends	Maximum temperature (°C)*	0.039	0.165
Weekends	Sunshine (h)**	0.002	0.250

<sup>a</sup> Weekdays – Monday, Tuesday, Wednesday, Thursday. Weekends – Friday, Saturday, Sunday.

\* Statistically significant at  $p < 0.05$ .

\*\* Statistically significant at  $p < 0.01$ .

Table 3

Results from linear regressions of maximum temperature and sunshine with daily incidence of sexual assault

All days, weekdays, weekends	Weather feature	Regression coefficient	Standard error	95% Confidence intervals	
				Lower	Upper
All days	Maximum temperature (°C)	0.03410	0.014	0.006	0.063
All days	Sunshine (h)	0.04501	0.019	0.007	0.083
Weekdays	Maximum temperature (°C)	0.02280	0.015	–0.007	0.052
Weekdays	Sunshine (h)	0.03969	0.021	–0.002	0.081
Weekends	Maximum temperature (°C)	0.04674	0.025	–0.003	0.096
Weekends	Sunshine (h)	0.05511	0.031	–0.007	0.117

#### 3.4. Assaults on weekends ( $n = 308$ )

Maximum temperature ( $p < 0.05$ ) and hours of sunshine ( $p < 0.01$ ) showed statistically significant positive relationships with the number of assaults committed on Friday, Saturday and Sunday. These results are supportive of the hypothesis that warmer, sunnier weather is accompanied with a greater incidence of sexual assaults. Further implications are explored in Section 4. Correlations and regressions found no statistically significant relationships at  $p < 0.05$  between the incidence of sexual assault and mean or minimum temperatures, rainfall or wind speed. Statistical results for maximum temperature and hours of sunshine are presented in Tables 2 and 3. The mean of maximum temperatures on these days was 14.159 °C, and hours of sunshine 3.766.

### 4. Discussion

The results supported the hypothesis that better weather, in terms of temperature and especially sunshine, was accompanied by greater incidence of sexual assaults. This is in line with the findings of Field<sup>2</sup> on temperature, but shows a relationship with hours of sunshine that Field did not. The overall finding that better weather in Greater Manchester is accompanied by a raised incidence of sexual assaults is also consistent with the findings of Quetelet<sup>1</sup> and Rotton<sup>5</sup>, and indicates that such a relationship is not restricted to one geographical region. Further, the lack of a significant relationship existing on weekdays, whereas there was a significant relationship on weekends, indicates that the effect is due to a combination of weather and social factors.

These findings do not imply a causal relationship, and the relationship that did exist, although statistically significant, was weak. However, the results relating to the day of the week show that these weather effects are non-significant on weekdays (Monday, Tuesday, Wednesday, Thursday). There are fewer cases on these days which may make a relationship harder to find, but the fact that there are fewer cases then suggests that activities that may lead to an increase in assaults are more common at weekends. These

same activities are also encouraged by better (warmer, sunnier) weather, as can be seen by the stronger effect size and Spearman correlation values ( $r$ ) in the weekend results for maximum temperature and sunshine compared to the all-days results.

However, the Spearman correlation values were very low (apart for sunshine at weekends which was low), according to Cohen and Holliday's classification<sup>13</sup>. Further, the effect sizes are very small, for example approximately 0.5 extra cases for a 10 °C rise in maximum temperature at weekends. Whilst the trend in the data was for fewer assaults on days of greater rainfall and wind speed, these features did not indicate a significant relationship.

Greater heat or exposure to the sun is not claimed to directly promote sexual offending, rather it is likely that the better the weather the more people will be outside or otherwise socialising, and for longer and later. In turn, the greater number of innocent people and (potential) offenders in public places may give rise to increased numbers of assaults. These findings support the Routine Activity theory<sup>11</sup> interpretation that as people spend more time outdoors socialising due to good weather (or time off work/school, e.g., weekends), so they increase their visibility and accessibility to potential offenders.

No specific temperature was identified at which the incidence jumps, such as Tennenbaum and Fink<sup>3</sup> claimed for murders, and Leishman<sup>4</sup> riots. Further, the absence of any significant results for weekdays reinforces this interpretation, suggesting that the physiological effect of the heat does not play a part. Other factors, such as the consumption of alcohol (or drugs) by all parties, may also be affected by the weather and in turn affect the incidence of assaults. There may also be interaction with other temporal or calendar affects, such as bank (public) holidays, which merit further investigation. These findings suggest that, at least, British police and sexual assault services (such as specialist centres, and hospital accident and emergency departments) should be aware of the potential for an increased incidence of sexual assaults on sunny and warm weekends. Further research to identify the other social aspects that may increase the chance of sexual assaults being committed

will enable us to understand the dynamic of sexual offending within our society.

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