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When the Full Moon rises over the Sunshine State: A Quantitative Evaluation of Queensland Police Calls

Geoff Sheldon¹

Queensland Police Service, Australia

Henry Prunckun²

Charles Sturt University, Australia

Abstract

Police officers are amongst the strongest believers in the lunar hypothesis—the belief that the full moon affects human behaviour, yet most research fails to support this proposition. This paper examined eight years of calls for service data from a large metropolitan policing district in Brisbane, Australia. Between 2004 and 2011 data from more than 908,000 service calls were examined to determine if police received more requests for service during the full moon. The study found no support for the lunar hypothesis. It concluded that there was no statistically significant relationship between calls for service and the full moon.

Keywords: Full Moon, Police Administration, Criminal Justice Planning, Myths, Management, Queensland, Australia.

Introduction

Examining the lunar hypothesis that human behaviour is affected by the full phase of the moon takes one on an interesting journey through time. The earliest recorded account of this belief can be found during the Hippiocratic period, circa 400 BC (Cooke & Coles, 1978). The belief that people become *lunatics*, or that unusual behaviour or events manifest more frequently when the moon is full, hereinafter referred to as *the lunar hypothesis*, has been the subject of some research, but much discussion. References to the moon affecting human behaviour are common in the worlds of popular culture, academia, as well as the arts. In the late-1960s, the American rock band Creedence Clearwater Revival warned of a “bad moon rising” (Fogarty, 1969). And, in the 1970s the Jackson Five advised, *don’t blame it on the moonlight* (Jackson, 1978).

While some researchers have disputed the validity of the effects of a full moon (Crowe & Miura, 1995; Owens & McGowan, 2006; Russell & Dua, 1983), there are others who

¹ Doctorate in Policing and Security, Charles Sturt University, Australia; Detective Inspector, Queensland Police Service, Brisbane, Australia. E-mail: sheldon.geoffk@police.qld.gov.au

² Associate Professor, Australian Graduate School of Policing and Security, Charles Sturt University, Collins Beach Road, Manly, NSW 2095, Australia. Email: hprunckun@csu.edu.au

have identified a link (Cohen–Mansfield, Marx, & Werna, 1989; Purpura, 1979; Tasso & Miller, 1976; Templer, Veleber, & Brooner, 1982; Thakur & Sharma, 1984). It would seem that there are no definitive answers. There is an organisational-based discourse within the respected professions of psychiatric nursing, policing, and emergency medicine, all supporting the lunar hypothesis (Calver, Stokes, & Isbister, 2009; Rotton & Kelly, 1985b) and the topic has held academic and public interest for a considerable period.

In dismissing the beliefs of mental health professionals, police, and emergency workers, some researchers rationalise the anecdotal evidence as illusory correlation; the tendency to overestimate a relationship between two variables where, in fact, none exists (Gorvin & Roberts, 1994). Attributing beliefs of a lunar effect on human behaviour, is like grounding such a position in little more than the tapestry of folklore associated with the topic (Bickis, Kelly, & Byrnes, 1995, p. 701).

Theory

In respect of the lunar hypothesis, it is argued that there are two dominate theories; yet both are attenuated by a paucity of rigorous scientific investigation. The two theoretical positions this paper puts forward are termed gravity (i.e., human tide) and the other luminosity. Scholars appear to have been content to have examined the lunar hypothesis for close to a century (Cooke and Coles, 1978), more intent upon identifying or quantifying lunacy, than identifying causes associated with the phenomenon. By way of example, Barr (2000) lamented that a change to this situation was still some time away:

Researchers do not agree on exactly what effect they are looking for or whether it is only likely to occur in certain individuals. These problems stem from the absence of a widely accepted theoretical base which could account for any supposed lunar effect on [subjects]. Unfortunately, there is little sign this situation will change in the ... future (Barr, 2000).

With the two theories—gravity and luminosity—displaying varying degrees of scientific credibility sufficient enough to encourage an observer to reconsider or suspend immediate dismissal of the lunar hypothesis, there are other scientific facts that contradict these theories. Mathematical formulae are used to calculate and quantify the additional forces of gravity experienced by a person at the time of a full moon. Likewise, comparisons can be made between full moon luminosity and common events that make support for either theory problematic at best.

Rotton and Kelly (1985, p. 289) brought science to bear on the lunar hypothesis by noting that the gravitational effect of the full moon upon a person is the equivalent of that exerted by a drop of sweat or a flea upon the person's skin. Additionally, they point out that the earth's gravitational pull upon a person is 5,012 times that exerted by the full moon, yet no behavioural phenomena are attributed to such a force (Rotton & Kelly, 1985: 289).

When examining luminosity, Rotton and Kelly (1985, pp. 288–289) further assert that the light from the sun is many thousands of times more powerful than that of the brightest full moon, and that the light from a standard light globe provides up to 70 times as much luminance as that of a full moon, yet no effect upon human behaviour is routinely attributed to either, in contrast to that attributed to the full moon. At a time when people

spend between 75% and 90% of their time in indoor settings (usually under lights), Rotton and Kelly (1985, p. 288) challenge the validity of any possible effect that moonlight may have upon human beings.

When considering the amount of light given off by the full moon, there are other interesting statistics to take into account. For example, a cloudless full moon night is 250 times brighter than a new moon night (Kruszelnicki, 2012, para 12), and 12 times brighter than the first quarter or last quarter phases of the moon (Rotton & Kelly, 1985, p. 288). Having said that, it must still be borne in mind that, even at full moon, the luminosity level is a quarter of that given off by a candle (1985, p. 289).

Further scientific facts contradict the basis of the human tides theory. When discussing the theory, Kruszelnicki stated:

This so-called 'theory' is wrong in a few ways. First, the moon-tides thing happens because the oceans are large, and made of a liquid. They would still happen if the liquid was freezing liquid hydrogen, room temperature mercury, or hot liquid iron. It doesn't have to be water. Second, tides happen only over large expanses, not within the small dimensions of a human body. Third, the ocean tides still happen if the Moon is full, new or half-full. The moon still has a gravitational effect even if the sun doesn't fully light it up for us (Kruszelnicki, 2012, paras 17–20).

Just as both under-pinning theories associated with the lunar hypothesis can be shown to have traces of scientific credibility, when the theory is subjected to scrutiny, there is more to disprove rather than affirm. With the earth, the sun and even the parasitic flea exerting more gravitational force upon a person than a full moon, and modern society living under artificial light for up to 90% of the time (Rotton & Kelly, 1985), it is not possible to either conclusively endorse or dismiss the validity of either theory for explaining the lunar hypothesis.

As can be seen, neither of these theories enjoy broad acceptance in the subject literature (Rotton & Kelly 1985). Additionally, on the occasion that either theory is posited as a causal factor in respect of the lunar hypothesis, there is little more than a cursory mention of it (Lieber & Sherin, 1972; Thakur, Sharma, et al., 1980; Thakur & Sharma, 1984; Simon, 1998; Raison, Klein, et al., 1999, Kung & Mrazek, 2005). As such, it is these two theories that form the base for the exploration of the research question of this study.

Review of Literature

While the lunar hypothesis had been the subject of scholarly investigation prior to the 1970s, it was the pronouncement by Lieber and Sherin (1972) of a link between the full moon and homicide that appears to have piqued academic curiosity. So, during the 1970s and 1980s research was conducted in an effort to determine whether the phases of the moon had any influence upon human behaviour (Tasso & Miller, 1976; DeVoge & Mikawa, 1977; Campbell & Beets, 1978; Purpura, 1979; Snoyman & Holdstock, 1980; Garzino, 1982; Thakur & Sharma, 1984; Rotton & Kelly, 1985). This research continued during the 1990s and 2000s (Mathew, Lindesay et al. 1991; Alonso, 1993; Vance, 1995; Gutierrez-Garcia & Tusell, 1997; Iosif & Ballon, 2005; Kuss & Kuehn, 2008; Sugama, Park, et al. 2008; Stolzenberg, et al. 2017).

By comparison, Australian-based research has been almost non-existent. While there was an historical lunar examination of attempted suicides in Australia in 1972 (Taylor & Diespecker, 1972), and there was an examination of violence and aggression across five psychiatric hospitals in Sydney in the late-1990s (Owen, Tarantello, et al. 1998), there has been a scarcity of Australian research until a study of hospital-based violence was conducted by Calver, et al. (2009).

As Calver, et al. (2009) shed some light on the lunar hypothesis in an emergency medicine context; Australian scholarly research on the lunar hypothesis in a policing context remained wanting. Moreover, the research that was conducted from other parts of the world predominantly used crime as the dependent variable (Lieber & Sherin, 1972; Forbes & Lebo, 1977; Thakur & Sharma, 1984; Cohn & Rotton 2000; Schafer, Varano, et al. 2010).

Police and Lunar Hypothesis

As a long-serving police officer arrived at work to commence another week of night duty, a feeling of foreboding overtook her when she caught a glimpse of the full moon. Similarly, after the sixth patient walked into a city hospital's emergency department seeking opiates, and the third "code blue" for the evening was announced over the hospital's public address system, a triage nurse was heard to mutter, "Damn! It must be a full moon tonight" (Iosif & Ballon, 2005, p. 1,498). "When I joined the police, the old blokes used to say, 'Full moons and brass bands bring out the crazies.' I don't know about the brass bands, but experience has shown the full moon aspect is true. It's just something every copper knows" (Hector, 2009, p. 56).

Seasoned health care workers, police and other public officials who deal with the troubled public, certainly present an anecdotal case for the predictability of disturbed behaviour patterns at the time of a full moon. While such beliefs on the part of members of this fraternity are widely held and engrained in organisational culture, the academic and scientific community is ambiguous in its support (Calver, Stokes, & Isbister, 2009). Some researchers back the hypothesis that there is a celestial effect of the moon on human behaviour, whereas others are less than supportive (Rotton & Kelly, 1985). Trivial? Perhaps in some way it is, but it is common knowledge that police jurisdictions deploy more officers based on calls for service data. By way of example, weekends are busier, so departments roster extra crews and/or patrol cars accordingly; there is less need for administrative support on weekends, so non-sworn personnel are rostered off.

The anecdotal evidence by police officers acted as a catalyst for this study to explore the hypothesis that there is a greater demand for policing services during a full moon. The findings could have implications for the way police administrators allocate resources, plan police deployment, and funding for increases in police personnel and support services.

Research Question

This study examined the question: "Does the Queensland Police Service experience an increase in calls for service during a full moon?" In order to answer this question, the following hypothesis was put forward:

- The Queensland Police Service experienced increased service demand for calls for service associated with the full moon.
- The null hypothesis was that there was no noticeable difference.

This hypothesis was tested using a quantitative approach. The study will test this hypothesis in view of the theories of *gravity* (i.e. *human tide*) and the other *luminosity*.

Method

This study focused on two variables: calls for service (dependant variable) and the full moon (independent variable). Data relating to calls for service were collected from the Brisbane Police Communications Centre for what was referred to as the Metropolitan South Region of Queensland (now termed, the South Brisbane District of the Brisbane Region). Data relating to the phase of the full moon were collected from the Geosciences Australia (Commonwealth Government).³

The calls for service data were provided by the Queensland Police Service for the eight-year period under review; being, 1 January 2004 to 31 December 2011, inclusive, and comprised more than 908,000 separate calls for service. This study examined these calls for service using full moon periodicities of one- and three-days each month. That is to say, a one-day periodicity on the nominated day of the full moon, and a three-day periodicity comprises the day before, day of, and day after the full moon. The reason for the two periodicities is that previous studies assigned a variety of periodicities to the full moon that ranged from one to seven days. So, it was deemed that the full moon period is never seven days—one- and three-days were selected as the best representation of the phenomena.

The data were subjected to both descriptive and inferential statistical analysis. Descriptive analysis comprised examinations of dispersion and central tendency, whereas inferential analysis entailed the chi-square and the *t*-test.

Results

The study's findings are presented from two perspectives: 1) a descriptive analysis of the data relating to full moon days and non-full moon days; and 2), an inferential analysis of these two categories of data.

Table 1 shows the data for calls for service by non-full moon days as well as full moon days (one-day periodicity). Although both sets of data bear similarities, especially regarding the mean, upon closer inspection it became apparent that the full moon days presented as being less convincing in their quantum and hence less able to support the hypothesis. That is, this result is somewhat masked by the mean being 311 for both non-full moon days and full moon days, and supported by the close spread of the medium (301 and 289, respectively).

Nonetheless, the results regarding the minimum is higher than the non-full moon days ($n=201$ and $n=183$, respectively), and the maximum is noticeably higher ($n=450$ and $n=586$, respectively). So, when considering the minimum calls for service, one might be drawn to conclude that full moon days were in fact higher. However, when this result was considered in light of the maximum number of calls, a different picture emerged.

³ The study received approval from Charles Sturt University's Human Research Ethics Committee. With regard to the calls for service data, the authors thank the Queensland Police Service for making these data available; and in particular, to then-Assistant Commissioner Dr Peter Martin, Operations Support Command, for facilitating the data transfer.

Table 1. One-Day Periodicity

	Non-Full Moon Days	Full Moon Days
Minimum calls for service	183	201
Maximum calls for service	586	450
Mean	311	311
Median	301	298

To probe this result further, the study subjected the minimum and maximum call data to a chi square test. The result confirmed that: a) any apparent similarity to each other in relation to the mean/median; and b) the inclination to conclude that the full moon data supported the hypothesis, were doubtful. The chi square test showed that there was a statistically significant difference between the two results. The chi-square statistic was 8.9532 and the p -value was .00277. This result is significant at $p < .01$. The study interpreted the higher number of calls for service *on non-full moon days* were not a matter of random variation, thus rejecting the hypothesis of lunar influence.

Table 2. Three-Day Periodicity

	Non-Full Moon Days	Full Moon Days
Minimum calls for service	183	201
Maximum calls for service	586	497
Mean	311	310
Median	302	297

When the study examined the data regarding a three-day periodicity, a similar result was noted. There was little variation in the mean/median data just like the one-day periodicity dataset. And, when a chi square analysis was conducted, it returned a result that was significant at $p < .05$. The chi-square statistic was 4.7325, and the p -value was .029598. Again, the study interpreted the higher number of calls for service *on non-full moon days* were not a matter of random variation; once more rejecting the hypothesis of lunar influence.

Table 3. Average Calls for Service

	Non-Full Moon	Full Moon
Week Days	310	311
Weekends	370	373

Table 3 examines the argument that calls for service on weekends may have been a factor that could confound the results. This table shows that the average number of calls were almost identical. A chi square analyse confirmed that there was no statistically significant difference, even at the less robust level of $p < .10$ (the chi-square statistic was 0.0055, and the p -value was .940776).

At this stage, the study formed the view that there was little likelihood that additional analysis would provide a different interpretation or reveal other scenarios in the data. Still,

in an attempted to exhaust other obvious possibilities, the study looked at the calls for service variables relating to: 1) mentally ill people; 2) domestic violence; 3) disturbance; 4) rape; 5) homicide; 6) suicide; 7) wilful exposure; and, 8) fatal traffic accidents. With each variable, a paired sample *t*-test was conducted using the average number of calls for service relating to these particular types of calls for service, and the number of observations contained in the eight-year period (i.e. whether it was a full moon or not). In each of these eight call for service types, the data failed to produce a statistically significant result at $p = < .05$. This result resolved any doubt the study had—any further analysis of the data was unlikely to yield a finding that would reject the null hypothesis.

Discussion and Conclusion

For decades the catch-cry in management circles has been *efficiency*. Arguably, efficiency is at the heart of all organisations' ability to achieve outcomes. Efficiency allows organisations to increase outputs, reduce costs, and minimise waste. In order to achieve any level of efficiency, organisations need to plan. Business administrators use numerous methods to assist their planning processes—methods that help clarify problems, or analyse political, economic, social, and/or technological data, or envisage how the future might impact on the organisation. This study examined an obscure issue that common wisdom has for centuries held with more than a bit of sway—the effect the full moon has on human behaviour. In the context of policing, this translates to calls for service.

If this study found that the anecdotal evidence of police officers that the full moon had such an effect, the finding could be used to assist police administrators streamline practice by helping them plan the deployment of resources to maximise efficiency. From a policy point of view, police administrators could use the finding to lobby for additional resources, or for a reorganisation of police commands to take in to account of the full moon the same way recurring events do—the annual Christmas pageants, national holiday festivals, and so on.

The lunar hypothesis posed an interesting research question because if there was evidence that was found to support it—based on either theory, it could have had practical as well and policy implications. Nonetheless, no evidence was forthcoming. The study looked at full moon days and non-full moon days using descriptive analysis, and this suggested that there may be some differences. Although there were variations in the minimum and maximum number of events, a chi square analysis determined that the higher number of calls for service on non-full moon days could not be due to random variation, thus rejecting the hypothesis ($p < .01$). But this was for a single full moon day; that is, the day of the full moon. The question was then asked of the data, “Could this be too narrow an interpretation of the full moon? Could a three-day full moon period yield a different result?” So, the study analysed data relating to a three-day periodicity. The result varied little. A chi square analysis returned a similar result, though it was significant at $p < .05$.

Based on these results, no support for the lunar hypothesis could be provided. Regardless, the study posited the question whether there might be confounding variables—such as weekends—that might be concealing the results. So, a series of additional statistical tests were run to see if there was any weight to this argument. The study also tested eight specific types of police responses—calls regarding: 1) mentally ill people; 2) domestic violence; 3) disturbance; 4) rape; 5) homicide; 6) suicide; 7) wilful

exposure; and, 8) fatal traffic accidents—to see if these events might result in a different finding. In the end, all tests failed to reject the null hypothesis.

Organisational improvements in operational and administrative aspects could be achieved through planning when, and only if, there is an increased service demand during a full moon. What this study demonstrated was that the concept of police being busier at the full moon due to a celestial influence upon human behaviour has not manifested when subjected to scientific inquiry. The failure of this study to identify any correlation between calls for service and the full moon makes the need for appropriate consideration in policy and practice unnecessary. With the exception of discounting a policy of rostering extra personnel or resources during a full moon—a practice that has long been used in some health facilities (e.g., Freilich, 1965)—the implications for police practice are minimal at best.

It is posited that the results of this study may not sway police officers' belief in the lunar hypothesis, but it makes clear that such beliefs are at odds with the overwhelming body of evidence to the contrary, including the evidence presented in this study.

Limitations

The study examined calls for service data in one state of Australia—Queensland. Although these data do not allow for the study to extrapolate to other states in Australia, or to overseas jurisdictions, the conclusions drawn were mindful to remain within this limit of the data.

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