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Chapter 24

The power of the full moon. Running on empty?

Eric H. Chudler

It is the very error of the moon;
She comes more near the earth than she was wont,
And makes men mad.
William Shakespeare, *Othello*, act 5, sc. 2, l

Look! Up in the sky! It's a bird. It's a plane. No. It's just the moon. However, not just any moon. It is a full moon (Fig. 24.1), capable of causing accidents, psychosis, suicide and animal rage. At least that is what the media would have us believe—that the full moon can somehow influence our behaviour; but what does the research show? Is there an association between the full moon and abnormal behaviour? If such an association exists, then should we alter our behaviour according to the lunar cycle to minimize risks to our physical and mental health? If there is no such association, then why is the belief that the full moon can control behaviour so prevalent in many areas of the world?

History

The moon has played a role in literature, superstition and medicine for centuries. Ancient Roman and Greek scholars, including Plutarch, Pliny the Elder and Hippocrates, all linked the moon to mental illness.[1] Indeed, mental illness has been referred to as 'lunacy', a word derived from the Latin 'luna' meaning moon. English authors, such as Charles Dickens, John Milton, Lord Byron, Percy Bysshe Shelley and William Shakespeare, have all written about the disturbing effects of the moon on behaviour.[1] The moon has even influenced English law.[2] For example, Sir William Hale, who went on to become chief justice of England in the 1600s, believed that the moon had the ability to influence brain disorders, especially dementia. In the mid 1700s, Sir William Blackstone in *Commentaries on the laws of England*, mentioned the influence of the moon on mental state when he wrote:

> A LUNATIC, or *non compos mentis*, is one who has had understanding, but by disease, grief, or other accident has lost the use of his reason. A lunatic is indeed properly one that has lucid intervals; sometimes enjoying his senses, and sometimes not, and that frequently depending upon the change of the moon.

Fig. 24.1 Full moon.

England's Lunacy Act of 1842 also distinguished between behaviour that was normal 2 weeks before the full moon, but abnormal 2 weeks after the full moon.

More violence, more suicides, more accidents, more aggression: does the full moon really bring out the worst in people? The belief that the moon influences behaviour has led people to label the phenomenon as 'The Lunar Effect'. These beliefs, that were so widespread throughout Europe hundreds of years ago, are still prevalent today, even within the medical and mental health professions.

The published data

Although anecdotal reports of abnormal behaviour during the full moon may make good newspaper copy, they do not carry much scientific support. Moreover, widespread acceptance of a belief does not make the belief true. Published research studies have investigated the relationship between the phase of the moon and abnormal behaviour by focusing on several general themes including (1) crime, aggression and violence; (2) mental illness, for example, anxiety, depression, psychosis and suicide; (3) emergency room (A&E) and hospital admissions; (4) drug overdoses; and (5) motor vehicle and other accidents. These retrospective studies have used quantitative methods to search for correlations between the phase of the moon and the frequency or severity of specific behaviours.

Aggression/criminal behaviour

The influence of the moon on aggressive and criminal behaviour has received a great deal of media attention. The frequencies of homicides in Dade County, Florida, have been reported to increase significantly around the full and new moons.[3] Further investigations by the same researchers, however, were unable to find a significant relationship between

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homicide rate and lunar phase in Cyahoga County, Ohio. Similarly, no significant relationships were found for homicide rates and lunar phase in Texas.[4,5] Differences in these results have been attributed to using the time of death rather than the time of injury to define when a homicide took place.[6] Although a few studies have found clustering of the number of assaults and other crimes around the time of the full moon,[7–9] these results have been difficult to replicate.[10] Police records indicate that there is no correlation between the number of arrests for violent crimes and the lunar cycle.[11] Furthermore, the frequency of violent behaviour in a captive prison population does not vary with moon phase.[12]

Although it is commonly assumed that emergency telephone operators are busier during the full moon, data do not support this belief.[13] For example, no association between the phase of the moon and 361 580 calls for police assistance has been found.[14] Victims of violence are also not admitted to the hospital more frequently during the full moon.[15] Nevertheless, police officers continue to believe more strongly in the power of the full moon and hold stronger opinions about the lunar effect than pedestrians and psychiatric workers.[16]

Investigations about a lunar influence on aggressive non-human animal behaviour have also failed to produce convincing results. In one study, for example, the frequency of animal bites peaked during the full moon.[17] However, this study examined only 10 lunar cycles and did not control for weekends or holidays. When adjustments for weekends were made, research has failed to find a relationship between the frequency of dog bites and the cycles of the moon.[18,19] It is important to note the day of the full moon because people do appear to be at a higher risk for being bitten by a dog on weekends and during non-winter months.[19]

Mental illness

Mental health professionals commonly believe that the moon can alter human behaviour. For example, 81 per cent (21 of 26 respondents) of the mental health professionals surveyed agreed with the statement 'I think the moon makes some people act weird or crazy'.[20] Crisis centre workers also believe more strongly in the lunar effect than non-crisis centre workers.[21] Anecdotal stories and news accounts of increased antisocial psychiatric patient behaviour, suicide attempts, telephone calls to mental health crisis centres and admissions to psychiatric hospitals during the full moon help to reinforce these beliefs in the general public. However, most studies do not provide evidence of increased psychiatric disturbances during the full moon. For example, telephone calls to crisis intervention centres[21–24] and college counselling centres[25] do not increase in frequency during the full moon. The number of psychiatric hospital admissions,[26,27] frequency of medical consultations for anxiety and depression[28] and the use of psychiatric services[29] are also not correlated with lunar phase. Although one study reported more frequent misbehaviour by developmentally delayed, institutionalized women on the day of the full moon,[30,31] violence and aggression by hospitalized psychiatric patients[32] and

agitated behaviour by nursing home residents[33] are not observed more often during the full moon.

Suicidal behaviour also does not occur more frequently during the full moon. In fact, a significant increase in recorded suicides around the new moon, but not around the full moon, has been reported.[34] A significant relationship between any phase of the moon and successful suicides or suicide attempts has not been found in several studies.[35–40]

Data about the relationship between self-poisoning and moon phase are conflicting. Intentional consumption of poison has been found to increase during the new moon and decrease during the full moon,[41] increase on days of the full moon[42] or show no relationship with the lunar cycle.[43] The cultural significance of the full moon (see below may contribute to the positive association between self-injurious behaviour and lunar phase.

Accidents

Emergency room nurses and physicians also hold strong beliefs about the lunar effect. Of 25 emergency department nurses surveyed, 20 (80 per cent) responded that they believed that the moon affected their patients and their mental health; 16 of 25 (64 per cent) of the emergency department physicians surveyed held similar beliefs.[44] These nurses also believed that lunar influences created a more stressful work environment and, therefore, that they should be compensated with higher wages during these periods.[44] Such workers, therefore, could be motivated by possible financial gain by believing in a lunar effect or by reporting such beliefs in the lunar effect when completing a survey. Hospitals, however, are not plagued by excessive accidents or errors during the full moon. Analyses of hospital records have failed to find a correlation between medication errors, treatment errors, falls and other 'untoward events' and lunar phase.[45] There is also no association between surgical complications (e.g. pain, mental health, patient complaints) and lunar phase.[46]

Despite the beliefs of medical personnel, data show that emergency departments are not unusually burdened with cases and there are no increases in emergency department admissions during the full moon. Examination of emergency department and hospital records of trauma, cardiac, respiratory and neurological cases has failed to find an increase in the number of cases during the full moon phase.[47–55] The number of patients who arrive to the hospital by ambulance also does not vary with the phase of the moon.[56] On the other hand, emergency departments do appear to be busier on Mondays than on other days of the week.[47]

Research that claimed an increase in vehicular accidents[56] during the new and full moon phases has been critiqued because of a variety of errors made by the investigators.[57] Moreover, when these data were reanalysed and controls for day of the week and holidays were included, the lunar effect disappeared.[14] Other data show no association between the number and severity of vehicular accidents with moon phase.[58] Still other studies have reported that traffic accidents occur least often on the day of the full moon[59] and that traffic accidents involving property damage and personal injury show no relationship with the phase of the moon.[60]

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Drug abuse

Just as emergency departments are not unusually busy with trauma and other cases, they are also not troubled by an abnormal number of drug abuse cases during the full moon.[61,62] This is also reflected in the absence of a relationship between the number of toxicology requests processed by hospital laboratories and lunar phase.[62]

Box 24.1 Moon facts

- The distance from the moon to the Earth varies from 356,410 km (221,438 miles) to 406,697 km (252,681 miles). The average distance between the Earth and moon is 384,400 km (238,855 miles).
- The equatorial radius of the moon is 1737 km (1080 miles).
- The circumference of the moon is 10,916 km (6783 miles)
- The surface area of the moon is 37.9 million km^2.
- The mass of the moon is 7.35×10^{22}.
- The first lunar landing occurred on July 20, 1969, at 4.18 p.m. (EDT) when the Apollo 11 Lunar Module touched down on the moon at Tranquility Base. At 10.56 p.m., astronaut Neil Armstrong touched one foot to the moon's surface.

Citation: National Aeronautics and Space Administration (Accessed July 14, 2006), http://solarsystem.jpl.nasa.gov/planets/

Possible mechanisms

It is readily apparent from the published data that studies indicating a positive relationship between abnormal behaviour and lunar phase are difficult to replicate. Although a few studies show increases in the frequency of unusual behaviour during the full moon, most studies show no relationship or a decrease in the frequency of abnormal behaviour at the time of the full moon. The inability to replicate these experimental data is a major problem faced by those who study the relationships between lunar phase and behaviour. A significant relationship should be replicable by different investigators using similar methodologies.

Rotton and Kelly[10] and Campbell[63] discuss the methodological problems inherent in many lunar effect studies and the methodological differences that make comparisons of the results from different data samples difficult. Some failures to replicate findings may be related to differences in experimental design. For example, some studies consider a few days before and after the full moon as a full moon period, while other studies restrict their investigations to only those behaviours on the day of the full moon. The number of moon cycles used to analyse lunar effects has also differed greatly among studies. Some investigators have collated data from moon phases extending 10 or more years, while others used data from only a few cycles of the moon. Limiting the observation period to only a few moon cycles may result in specific moon phases falling frequently on holidays

or weekends, thus influencing the results. Nevertheless, a meta-analysis of 37 lunar effect studies has revealed that only 1 per cent or less of the variance in abnormal behaviour could be attributed to the phase of the moon.[10]

Several excellent discussions and critiques of the mechanisms by which proponents of the lunar effect have suggested that the moon could alter behaviour have been published.[10,63,64] Such mechanisms include (1) a gravitational effect; (2) increased moonlight; (3) weather effects; (4) ozone effects; and (4) imperceptible stimuli such as geomagnetic forces, extremely low frequency electromagnetic waves and air ions. To date, none of these mechanisms have sufficient experimental data to account for a lunar effect. For example, the gravitational effect theory proposes that water in the human body, like water in the ocean, is influenced by the gravitational pull of the full moon. The problem with this hypothesis is that the moon has negligible effects on the human body, certainly much less than other earthly bound objects.[63,65] Moonlight provides a weak source of illumination and is nothing more than reflected sunlight.[64] Therefore, behaviours affected by moonlight should also be affected by other light sources, including that of the sun.

Although the majority of studies have failed to find evidence to support the belief that the full moon affects behaviour, the large body of negative data does not prove the absence of an effect. As the expression goes, *the absence of evidence is not the same as evidence of absence.* However, the burden of proof for the existence of a lunar effect lies with experimental evidence. Experiments must be designed to test the hypothesis that the full moon can influence behaviour. Perhaps the most common error made by lunar effect proponents is that of assigning cause to correlative data. In other words, even if the correlation between moon phase and the frequency of a behaviour is statistically significant, this does not mean that a particular moon phase *caused* the change in behaviour. As students of elementary statistics learn: *correlation does not mean causation.* Correlational studies are not sufficient to demonstrate causation. Experiments to test hypotheses regarding the mechanisms by which the lunar effect may work have not been conducted and may be difficult. As suggested by Rotton and Kelly,[10] 'Without observing individuals on a planet without a moon (say, Venus), there is no way investigators can conclude that phases of the moon affect behavior'. Alternatively, studies could be designed to investigate possible lunar effect mechanisms, for example by comparing how behaviour changes on full moon days when the moon can be seen (clear nights) with that when the moon cannot be seen (cloudy nights). Similarly, the influences of ozone, extremely low frequency electromagnetic waves and charged ions, on behaviour could be tested in humans and other animals.

Why the myth persists

Despite the absence of evidence for the lunar effect, many people continue to believe that the full moon can affect behaviour. With few exceptions, data that negate the lunar effect rarely pique the interest of the media. Therefore, the public is denied access to an abundant body of literature that has failed to support the lunar effect. This lack of

information may help propagate the belief in a relationship between the full moon and behaviour such that the belief becomes a self-fulfilling prophecy. In other words, if people believe that the moon affects behaviour, they may interact with others in ways to produce a relationship that then reinforces their belief. For example, if police officers believe that the full moon causes violent behaviour, they may stop more drivers for aggressive driving or make more arrests on days of the full moon. Nurses and physicians who believe in the lunar effect may treat patients differently on the day of the full moon.

Some people may go out of their way to mark the day of a full moon. They may highlight the day of the full moon on a calendar or alert co-workers to the next occurrence of a full moon. This heightened awareness of the full moon may also serve to direct attention toward events that occur during the full moon and may even motivate some people to act irresponsibly on days of the full moon. Heightened awareness of the full moon may also contribute to selective memory of strange events that occur. Although an accident or an unusual event may occur during a full moon, similar unusual events are likely to happen at other times during the lunar cycle. However, only those strange events that occur during the full moon will be remembered because of the significance that people have placed on this period of the lunar cycle.

Raison *et al.*[66] have advanced a novel hypothesis suggesting that moonlight may have affected sleep–wake patterns before the widespread use of artificial light. They point out that moonlight was important to many human social activities prior to the 19th century and suggest that people slept less on full moon days than on other days. Such an alteration in sleep patterns may have resulted in sleep deprivation that then led to cognitive and emotional changes including mania. Relationships between the full moon's light and these abnormal behaviours may have been recognized by people before the invention of gas and electrical lighting. Therefore, although moonlight has little value to most contemporary human activities, stories about the full moon and abnormal behaviour may have been carried over into modern times.

Cultural influences may also contribute to the persistence in the belief of the lunar effect. For example, the wonder and mystery of the full moon is instilled in children as they learn to read. Popular children's books such as *Goodnight Moon*,[67] *Where The Wild Things Are*,[68] *Goodnight, Goodnight*[69] and *Moongame*[70] all draw attention to the moon in their storylines. The moon has also been worshiped by cultures throughout the world, with moon goddesses and gods taking a prominent position in many religious beliefs. For example, the full moon holds a special place in the Hindu religion and is celebrated as 'purnima'. It is interesting to note that a significant increase in the incidence of poisoning on the day of the full moon was found in a study conducted in India[42] although the number of poisonings of people of the Hindu religion in this study is unknown. The full moon is linked to the time of festivals and celebrations in other cultures. For example, many Buddhist holidays, such as the Buddhist New Year, Vesak (Buddha Day), Magha Puja Day (Sangha Day) and Asalha Puja Day (Dhamma Day), take place on days of the full moon. In Korea, Taeborum is celebrated on the first full moon of the lunar year and in Thailand, the Loy Krathong festival is celebrated on the day of full moon in the

12th lunar month. The Jewish holiday of Passover also starts on the night of a full moon. Furthermore, calendars based on the lunar cycle are still used around the world. For example, the Hebrew, Islamic and Chinese calendars are all tied to the lunar cycle.

Summary

Newspaper editors who publish stories about the lunar effect, law enforcement officers who insist people act strangely on days of the full moon and healthcare workers who maintain that the moon influences their patients all provide fuel to perpetuate the belief that the phase of the moon affects behaviour. Examination of the many studies that have searched for a relationship between the full moon and abnormal behaviour, however, shows that the engine that drives these beliefs is running on fumes.

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