ABSTRACT
The idea that the stars and planets may influence human health and behavior can be traced to at least Roman times, and research suggests a high proportion of health professionals continue to hold this belief. Nevertheless, evidence for the supposed influence of the moon on human behavior has proved particularly elusive, and research has tended to suffer from weaknesses in methodology and data analysis.
This article reports findings drawn from a re-analysis of data from a research study into the functioning of a sample of mentally ill people living in the community. The mental health and quality of life of a sample of 100 people were assessed on four occasions during a 30-month period. Data were aggregated to represent the span of one lunar month, with scores being allocated to the relevant week of the lunar cycle during which each assessment was made. Comparison of mean values across the weeks of the lunar cycle was performed using the ANOVA. Results showed significant change at the time of the full moon only in subjects with a diagnosis of schizophrenia (n = 56), where deterioration was observed in three areas of psychopathology and one area of quality of life. Some implications for nursing practice are discussed, and it is suggested that future research into the possibility of a lunar effect on human life should focus on the direct measurement of functioning in people with schizophrenia.
The belief that the stars and planets may influence human health and behavior can be traced to at least Roman times (Brewer, 1978). This belief persists even in modern times, and research has shown that a high proportion of health professionals continue to believe the moon affects the mental health of their patients (Danzl, 1987; Vance, 1995). Evidence for this influence is debatable, but many of the moon’s other properties are well documented. The moon’s orbit of the Earth is elliptical, and the amount of sunlight reflected by the moon varies throughout the month, with one full cycle having a mean span of 29.53 days. This period, the synodic month, is measured between two successive new moons and has been divided into four phases—new moon, first quarter, full moon, and third quarter.

There are several modern theories to explain the moon’s supposed influence on human life. An obvious characteristic of the lunar cycle is the increasing amount of sunlight reflected onto the Earth as the full moon phase approaches, and this presents one opportunity to account for behavioral change. Lieber (1978) has outlined a further theory concerning “biological tides,” the origins of which can be traced to the early eighteenth century (Hunter & Macalpine, 1964).
The search for evidence of a lunar effect continues and should not be considered an entirely theoretical endeavor with little practical application.

It is believed that because the human body is composed of 80% water, it is acted on at a cellular level by the moon's gravitational pull in the same way as the Earth's oceans. Both Lieber (1978) and Abel (1976) have described an alternative explanation focusing on the disturbance of human behavior by lunar gravitational changes on the Earth's electromagnetic field. However, despite the superficial appeal of these ideas, in many ways they seem unlikely to account for changes in human behavior. As Myers (1995) has observed, lunar gravitational effects on the Earth are of relatively small magnitude and are diurnal or semi-diurnal with a small fortnightly modulation. There are no uniquely monthly gravitational components corresponding to the period of the full moon, and the gravitational effects of the various lunar phases are effectively the same throughout the month.

However, the absence of a plausible scientific explanation for a lunar effect has not deterred researchers from pursuing their investigations. Indeed, the potential influence of the lunar cycle on human life has been explored in a range of areas as diverse as road traffic accidents (Alonso, 1993), the frequency of accidents in a hospital (Sutton, Standen, & Wallace, 1994), and employment absenteeism (Sands & Miller, 1991). It is the possibility of a relationship between the lunar phases and mental health that has attracted the most extensive research in recent decades. Despite this attention, findings remain distinctly inconclusive.

There is some evidence that there may be a greater amount of abnormal behavior at the times of full moon and third quarter (Templer & Veleber, 1980), and Osborn (1968) discovered an increased number of mental health admissions at full moon. Lieber and Sherin (1972) have reported a relationship between the full moon phase and homicide rate, and Rogers, Masterton, and McGuire (1991) found evidence to suggest there may be a small cyclical variation in parasucide with peaks at full and new moon. However, a number of studies have found no evidence to support the lunar hypothesis. Among these, Vance (1996) found no evidence that behavioral outbursts varied with the lunar cycle in a sample of people with a learning disability. When Wilkinson, Piccinelli, Roberts, Miccoli, and Fry (1997) examined the rate of general practice consultations for anxiety and depression, they found the rate did not vary significantly during the synodic month, and Mason (1997) similarly found no evidence of variation in the use of seclusion in a forensic psychiatric hospital.

The general pattern of research findings has been well summarized by Rotton and Kelly (1985) who performed a meta-analysis of 37 studies on the subject. This analysis revealed only a very weak relationship between the lunar cycle and mental health, where the lunar phases accounted for less than 1% of the variance in psychopathological behaviors. Rotton and Kelly (1985) also suggested methodological and statistical weaknesses sometimes had led to the acceptance of falsely significant results—a point subsequently reinforced by others (Culver, Rotton, & Kelly, 1988; Cyri & Kalpin, 1987).

Nevertheless, the search for evidence of a lunar effect continues and should not be considered an entirely theoretical endeavor with little practical application. For example this investigation could inform clinical management of psychiatric illness if some patients are found to be more vulnerable at particular times of the month (Wilkinson et al., 1997). Similarly, if mental health service use is likely to vary during the month in a predictable way, there are implications for service planning in a broad range of areas (Wilkinson et al., 1997). This study is offered as an additional piece of evidence in this very complex phenomenon.

The study provides some distinct advantages over prior research because previously there was a tendency for researchers to use indirect approaches for assessment of any supposed lunar effect on mental state. For example, Wilkinson et al. (1997) examined the number of general practice consultations for anxiety and depression; Amaddeo, Bisoffi, Miccoli, Piccinelli, and Tansella (1997) analyzed the frequency of contact with community psychiatric services; Gorvin and Roberts (1994) studied the frequency of emergency psychiatric admissions; and Mason (1997) analyzed the use of seclusion in a forensic psychiatric hospital. This study used direct, face-to-face assessment of the functioning of mentally ill individuals, which limited the possibility of unknown extraneous factors influencing the evaluation process. In addition, the study sample suffered from a range of mental disorders, which allowed comparisons to be made between subjects with differing diagnoses. Finally, the study also examined quality of life in the patient sample. The author is unaware of the use of
quality of life as a dependent variable in any previous research into the lunar effect.

The specific research question addressed by the study was the null hypothesis: deterioration in psychopathology and quality of life is unrelated to the full moon phase of the lunar cycle in mentally ill individuals, regardless of psychiatric diagnosis.

METHOD

Data used in this secondary analysis were derived from research conducted between 1993 and 1995, entitled “Maintaining the functioning of mentally ill individuals in the community: A cohort study.” That study evaluated the impact of service reform on patients who were using community mental health services in a medium-sized British seaside town (Barr & Huxley, 1998, 1999). As a naturalistic observational study, 100 community mental health service users were selected randomly for inclusion in the sample.

This author conducted personal interviews with each of the individuals to monitor functioning levels during the period when a local community mental health team was being established. The interviews were repeated with each patient on four separate occasions, with approximately 9 months between each interview (to allow for any change in patient functioning to occur following the establishment of the community mental health team). In practice, all patients first were interviewed between January and March 1993. The second interviews were held between October and December 1993, the third, between July and September 1994, and the final interviews were conducted between April and June 1995. Although these assessment interviews were spread across the years 1993 to 1995, in effect the data generated can be viewed as covering each of the 12 calendar months, and so 12 periods of full moon. All assessments were made during daylight hours, and their timing was unrelated to patients’ diagnoses or current treatment program, or to subsequent input from other professionals.

Because the possibility of a lunar effect on mental health was not a factor investigated in the original study, no attempt was made to ensure that each patient was interviewed during each phase of the lunar cycle. However, because interview dates were chosen randomly, no particular patient was any more or less likely to be assessed at a specific point in the lunar cycle. Because of the number of assessments made, up to four with each of 100 individuals, one would expect the distribution to be spread fairly evenly across the weeks of the lunar month.

To make the assessments a number of instruments were employed to capture a range of facets of patient functioning. Two of these are particularly relevant to the lunar hypothesis, and both have valid and reliable psychometric properties. These instruments were:

- The Brief Psychiatric Rating Scale (BPRS) (Overall & Gorham, 1962), in which the assessment is made by the interviewer.
- The Lancashire Quality of Life Profile (LQOLP) (Oliver, 1992), in which the respondent makes the assessment.

Together these instruments generated data regarding each subject’s psychopathology and quality of life approximately at the time of the assessment interview.

Statistical Analysis

As described above, data collection interviews were held in a series of four 3-month blocks during a period of 30 months. Taken together, these blocks represented 12 lunar months. Data were aggregated into the week of the lunar cycle during which each specific interview was conducted, generating mean scores for all assessments made during the weeks of the first quarter, full moon, third quarter, and new moon. The interphase differences in mean values were tested using one-way analysis of variance (ANOVA) and limited unpaired t testing (not adjusted for multiple testing). The level of statistical significance was set at the customary (p = .05) level.

RESULTS

The sample of 100 mentally ill patients consisted of 56 men and 44 women. Eighty-six subjects had experienced psychiatric hospitalization at some time, with 55 being admitted at least once in the previous 5 years (mean = 3.05, SD = 2.29). Fifty-six subjects were diagnosed as schizophrenic (men: n = 39; women: n = 17); total patients taking psychotropic medication: n = 52); 33 individuals had a mood disorder (men: n = 10; women: n = 23; total patients taking medication: n = 28), and 11 patients had one of several mixed diagnoses (total patients taking medication: n = 7). Interviews were conducted with each of the 100 sample members on four separate occasions, resulting in a potential 400 assessment episodes.
The first change noted in patients with schizophrenia was in the subscale reflecting signs and symptoms of acute schizophrenia.

However, because of attrition in sample numbers and incomplete data in some individuals during the course of the study, results are based on a maximum of 363 assessments.

Psychopathology

The BPRS scores are rated on a scale from 1 to 7, in which 1 represents the complete absence of a specified psychiatric characteristic and 7 represents its presence in a very severe form. The questionnaire consists of a number of items which relate to specific psychiatric signs or symptoms. Each item is rated during the interview, and these ratings then are combined in various ways to generate scores in 11 subscales, including one total score which is the sum of all items. The mean values relating to each of these subscales during the four lunar phases were compared for the whole sample of subjects (N = 100) using the ANOVA. Of the 11 subscale areas, only one was found to have changed significantly during the course of the synodic month—that of hostility ($F = 2.61, p = .05$). The $t$ test confirmed a difference between the highest and lowest values for the weeks of the first and third quarters ($t = 2.83, p < .01$) but no significant differences for the week under study—that of the full moon.

Quality of Life

Data generated by the LQOLP questionnaire can be categorized into 13 subscales, or life domains. Each of these domains is scored on a scale from 1 to 7, with 1 representing total dissatisfaction and 7 representing total satisfaction. Comparison of mean values during the four lunar phases showed significant change only in the domain of subjective well-being for religion ($F = 3.42, p < .02$). The mean during the week of the first quarter was found to have risen in relation to the week of the new moon ($t = 3.11, p < .01$). Again, no significant change was related to the full moon phase of the lunar cycle.

The hypothesis under investigation held that any deterioration in patient functioning would be unrelated to the full moon phase of the lunar cycle, regardless of psychiatric diagnosis. Therefore, comparisons were made between subjects with differing diagnoses. Within the sample of 100 people, 56 subjects were diagnosed with schizophrenia, 33 with a mood disorder, and 11 with one of several other diagnoses. Mean values were examined only for subjects with schizophrenia and mood disorder because sample size rendered statistical analysis redundant for the third group.

Mood Disorder Subgroup

Comparison of subscale means for psychopathology and quality of life across the four lunar phases revealed significant change only in the subscale of anxiety-depression ($F = 2.71, p < .05$). However, this change was unrelated to the phase of the full moon because the $t$ test showed mean values to be significantly different between the weeks of the first quarter and the new moon, in which values fell from 3.00 to 2.31, respectively, reflecting an improvement in mental state ($t = 2.69, p < .01$).

Schizophrenia Subgroup

For this subgroup, significant changes occurred in three BPRS subscales. In each case, an increase in mean values was observed during the week of the full moon, indicating a deterioration in mental state at that time. This contrasted with findings for the mood disorder group, where no significant change was observed in these three aspects of mental health (i.e., symptoms of acute schizophrenia, hostility level, total BPRS score), as shown in the Figure.

The first change noted in patients with schizophrenia was in the subscale reflecting signs and symptoms of acute schizophrenia, where means for each of the lunar weeks were 1.50 at first quarter, 1.82 at full moon, 1.75 at third quarter, and 1.71 at new moon ($F = 2.62, p = .05$). The $t$ test confirmed a significant difference between the weeks of the first quarter and full moon ($t = 2.83, p < .01$). In the subscale for hostility, the corresponding means were 1.26 (first quarter), 1.68 (full moon), 1.58 (third quarter), and 1.46 (new moon) ($F = 2.81, p < .05$), and again the $t$ test showed a significant difference between the weeks of the first quarter and full moon ($t = 2.60, p < .02$). The third subscale to change represented the sum of all BPRS items (i.e., the total score). Means were 1.62 (first quarter), 1.89 (full moon), 1.70 (third quarter), and 1.76 (new moon) ($F = 3.41, p < .02$). Again the $t$ test confirmed the significant deterioration to lie between the weeks of the first quarter and full moon ($t = 3.01, p < .01$). The only quality of life domain to have changed significantly for the schizophrenia subgroup was that of subjective well-being for religion ($F = 2.69, p < .05$). The difference was between the week of the new moon (mean = 4.89) and the weeks of both the first quarter (mean = 4.54, $t = -2.49, p < .02$) and the full moon (mean = 4.59, $t = -2.09, p < .04$).
The overall interpretation of results for these two diagnostic subgroups is that the only deterioration to occur at the time of the full moon was in the mental state and subjective satisfaction with religion of subjects with schizophrenia.

**DISCUSSION**

It has been suggested that studies into the possibility of a lunar effect on mental health have been prone to methodological weakness and statistical error (Rotton & Kelly, 1985). One common approach to data analysis has been that which was adopted in this study—comparisons are performed across the phases of the synodic month as if each week were an independent and discrete category. This is clearly an artificial construct because, as Mason (1997) points out, the lunar cycle is continuous. However, there is a more fundamental difficulty—that the research question in this whole area is poorly focused. For example, there is no agreement whether research should concentrate on only the day of the full moon or whether it is reasonable to include the entire week within which the full moon occurs. Similarly, 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 mental health. Unfortunately, there is little sign this situation will change in the near future.

However, the present study does have some strengths to commend it. First, findings were based on randomly timed, direct, and repeated assessments of a randomly selected sample of mentally ill individuals. This allowed for comparison of a large number of assessments, which were made across the different weeks of the synodic month. Second, assessments were made “blind” to the particular lunar phase at the time of the interview because data were collected for a different study with no consideration of future analysis related to any possible lunar influence. This removed any bias which could have been introduced by an “interviewer effect.” Finally, the aggregation of data into one hypothetical synodic month effectively controlled for any seasonal variation, such as that seen in some affective disorders, and any influence from the local mental health service reforms which were underway during the period of study.

The findings led to rejection of the null hypothesis under investigation. A deterioration was found to have occurred during the week of the full moon in some aspects of the psychopathology and quality of life of sample members diagnosed with schizophrenia. However, the mechanism behind the findings requires explanation. While speculation is beyond the scope of this article, it is accepted that the small changes observed in this study may be due to weaknesses in the methodology or analysis adopted. It also is possible that an unknown number of confounding factors influenced the results. For example, the fact that the majority of subjects

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**Figure.** Comparison of mental health in three areas (total BPRS score, hostility level, symptoms of acute schizophrenia) between subjects with schizophrenia and mood disorder.

* $p < .05$ (one-way ANOVA).
In the field of community psychiatric nursing, during the week of the full moon, extra attention could be given to the reduction of environmental stresses, such as expressed emotion, in individuals judged to be particularly vulnerable to the lunar effect.

CONCLUSION

This study highlights at least two routes which may lead to a more productive line of investigation than seen previously. First, future research into the lunar effect should adopt direct, face-to-face measures to assess the functioning levels of subjects, rather than indirect indicators such as frequency of admission or service use. Second, studies should focus on individuals with a diagnosis of schizophrenia, rather than mood disorder, because this may prove to be a vulnerability factor in any lunar effect.

REFERENCES


(87%) were taking medication, which would decrease their symptoms, may or may not have been significant.

In this study, there are a number of reasons why the influence of potentially confounding variables was not addressed. First, the study was based on a re-analysis of data collected for a different study with a methodology designed to meet specific objectives unrelated to the present study. Therefore, data on factors that may have influenced patient functioning were not collected in such a way to allow for analysis in relation to the phases of the lunar month. Second, there is no a priori reason to believe any particular factor would be more or less relevant to any possible lunar effect on mental illness. For example, it has not been established that psychotropic medications have a specific effect on an individual’s mental health at the time of the full moon as opposed to any other time of the month. Put simply, because it is not known what factors may influence any possible lunar effect, it is not possible to identify which factors should be controlled during data analysis.

In any case, the findings reported in this article are based on a sample with more than 360 separate assessments of mental health and quality of life. In a sample of this size, when all assessments have been made on randomly selected dates, one would expect the distribution of potentially confounding variables to be more or less randomly spread across the lunar month. This in itself would tend to minimize the effect of these unknown variables. Only one explanation can be rejected with any degree of confidence: that moonlight itself was responsible for the observed findings because all assessments were made during daylight hours.

Findings from this study have an immediate relevance to the profession of nursing, especially in view of evidence suggesting a widespread belief among health workers that the moon has an influence on patients’ mental health (Danzel, 1987; Vance, 1995). Vance (1995) has observed that a belief in the lunar effect may lead health care workers to wrongly attribute behavioral difficulties in patients to the phases of the moon, and so fail to recognize more relevant factors (Vance, 1995). However, the present study suggests the opposite may be true—a deterioration in some aspects of patient functioning genuinely may be related to the full moon. If this association were to be confirmed by subsequent research, it would be reasonable to adjust nursing practice accordingly. For example, in the field of community psychiatric nursing, during the week of the full moon, extra attention could be given to the reduction of environmental stresses, such as expressed emotion (Vaughn & Leff, 1976), in individuals judged to be particularly vulnerable to the lunar effect. Similarly, increased counseling could be made available to vulnerable patients at critical times of the month, along with enhanced support to their care providers.


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