

The Full Moon and ED Patient Volumes: Unearthing a Myth

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To determine if there is any effect of the full moon on emergency department (ED) patient volume, ambulance runs, admissions, or admissions to a monitored unit, a retrospective analysis of the hospital electronic records of all patients seen in an ED during a 4-year period was conducted in an ED of a suburban community hospital. A full moon occurred 49 times during the 4-year study period. There were 150,999 patient visits to the ED during the study period, of which 34,649 patients arrived by ambulance. A total of 35,087 patients was admitted to the hospital and 11,278 patients were admitted to a monitored unit. No significant differences were found in total patient visits, ambulance runs, admissions to the hospital, or admissions to a monitored unit on days of the full moon. The occurrence of a full moon has no effect on ED patient volume, ambulance runs, admissions, or admissions to a monitored unit. (Am J Emerg Med 1996;14:161-164. Copyright © 1996 by W.B. Saunders Company)

On any particularly busy night in an emergency department (ED), it is not uncommon to hear the expression, "There must be a full moon out tonight." Although the expression is usually made in jest, it reflects the persistent notion of the effect of the full moon in the folklore of emergency medicine.^{1,2}

The expression, "There must be a full moon out tonight," appears to be used in two distinct contexts by ED staff. When an above-average number of disruptive patients, such as those with traumatic or psychiatric complaints, present to the ED, this "lunacy" is ascribed to the influence of the full moon. Coates et al³ have previously investigated this context in studying more than 1,400 trauma patients presenting to a Level I trauma center. No difference was found in the volume of trauma patients during a full moon as opposed to days without a full moon.³

The second context in which the expression, "There must be a full moon out tonight," is used occurs when the ED becomes unusually busy.² The increased noise, heightened activity level, and sense of chaos are often attributed to the effect of a full moon. We elected to explore this second context, that is, to determine if there is any relationship between ED patient volume and the full moon.

Total patient volume, number of ambulance runs, number of admissions, and number of admissions to monitored units contribute to the ED staff's sense of a busy shift. We

hypothesized that these four variables would be increased during days in which a full moon occurred. By examining a large sample of patients, even a small lunar effect on these four variables should be detectable.

METHODS

All patients who registered in the ED of MacNeal Hospital in the 4-year period from July 1st, 1989, to June 30th, 1993, were included in the study. MacNeal Hospital is a 400-bed community hospital located in a western suburb of Chicago. It is a Level II trauma center. The ED sees 35,000 to 40,000 patients each year.

A computerized data base is maintained of each ED patient visit. Data for each patient visit are entered at the time of registration and at the time of discharge. Multiple elements of descriptive data are entered for each patient visit, including the name, date of visit, age, sex, mode of arrival, final diagnosis, and disposition.

The data for this study were obtained from this computerized data base of patient visits. For each day of the study period, the following four variables were determined: total ED visits, number of patients arriving by ambulance, number of admissions, and number of admissions to a monitored unit.

The point in the full moon cycle was determined for each patient visit. The period of time from one full moon to the next is 29 days, 12 hours, and 44.05 minutes. This period is referred to as a lunar month or, astronomically, the moon's synodical period.⁴ The dates used for the presence of the full moon were obtained from the appropriate editions of *The World Almanac and Book of Facts*.⁴⁻⁸

Using the date of the full moon as the center of this cycle, the number of days before or after this date was calculated for each patient visit. For example, if a full moon occurred on June 12th and the patient visit occurred on June 14th, the visit would be considered to have occurred 2 days after the full moon. The range of patient arrival could be anywhere from 14 days before the full moon to 15 days afterwards.

The patient visit data from each day in the study period were then grouped according to which day in the lunar month (-14 to +15) the visit occurred. For example, all patient visits on days of the full moon were grouped together, all patient visits that occurred 1 day before the full moon were grouped together, etc. By grouping the data in this fashion, any obvious variation that occurred during other phases of the moon would also become apparent.

Data were then analyzed statistically to determine if there were any significant increases in any of the four variables on the day of the full moon. Data were analyzed using SYSTAT and PRODA statistical software. One- and two-factor analysis of variance ANOVA methods were used to assess the effect of the full moon alone or in combination with the month or day of the week on the following dependent variables: total ED visits, number of patients arriving by ambulance, number of patients admitted to the hospital, number of patients admitted to a monitored unit; and percentage of total ED patients arriving by ambulance, percentage of total ED patients admitted to the hospital, percentage of total ED patients admitted to a monitored unit. Data are presented as the mean \pm standard deviation. All statistical tests are two-tailed. A *P* value $< .05$ was regarded as significant.

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RESULTS

A full moon occurred 49 times during the 4-year study period. There were 150,999 patient visits to the ED during the 4-year study period. There were 34,649 patients who arrived by ambulance, 35,087 admissions to the hospital, and 11,278 admissions to a monitored unit (Table 1).

Table 2 lists the mean number of total patient visits for each day of the lunar month. The days are labeled from -14 to +15. The full moon falls on what would be day 0 of this table. The mean number of total patient visits on a full moon day was 104.1 ± 13.5 and varied from a minimum of 79 to a maximum of 148. On the day before the full moon (-1) there was a mean of 101.3 ± 14.6 total patient visits. On the day after the full moon there was a mean of 103.5 ± 13.3 total patient visits. The lowest number of mean total patient visits was 101.1 ± 13.2 and occurred on day -5 of the lunar month. The highest number of mean total patient visits was 106.0 ± 17.7 and occurred on day +15 of the lunar month.

There was no statistically significant change in the mean number of total patients seen on days of the full moon or on any other days of the lunar month. Figure 1 is a graph of mean total patient visits versus day of the lunar month. It visually depicts the lack of any increase for the day of the full moon or the period around the full moon.

Table 3 lists the mean percentage number of ED patients who arrived by ambulance during each day of the lunar month. The lowest mean was 21.6% and occurred on day -2 of the lunar month. The highest mean was 24.8% and occurred on day +15 of the lunar month. On full moon days, 22.9% of the ED patients arrived by ambulance. There was no statistically significant change in this variable for days of the full moon.

Table 3 also lists the mean percentage of ED patients who were admitted during each day of the lunar month. This mean ranged from 22.5% on day -5 of the lunar month to 24.4% on day +13 of the lunar month. On full moon days, 23.8% of the ED patients were admitted to the hospital. There was no statistically significant change in this variable for days of the full moon.

In addition, Table 3 lists the mean percentage of ED patients who were admitted to a monitored unit for each day of the lunar month. This mean ranged from 6.9% on day -13 of the lunar month to 8.2% on day -4 of the lunar month. On full moon days, 7.5% of the ED patients were admitted to a monitored unit in the hospital. There was no statistically significant difference in this variable for days of the full moon.

To summarize the results, there was no statistically significant difference found on days of the full moon for any of the following variables: total ED visits, number of

TABLE 2. Mean Number of Total Patients Per Day by Day of Lunar Month

Day of Lunar Month	Mean No. of Total Patients Per Day*	Standard Deviation of Total Patients Per Day	Min/Max of Total Patients Per Day
-14	101.5	11.6	83-139
-13	105.4	15.4	68-136
-12	104.0	13.4	79-132
-11	103.6	13.8	64-134
-10	103.8	14.3	73-152
-9	105.4	13.2	77-144
-8	104.4	14.9	66-136
-7	104.7	14.5	71-150
-6	103.6	11.5	85-141
-5	101.1	13.2	74-131
-4	103.5	14.0	75-140
-3	104.3	13.2	72-133
-2	102.9	14.4	76-142
-1	101.3	14.6	71-138
Full Moon	104.1	13.5	79-148
+1	103.5	13.3	83-136
+2	103.8	16.2	76-155
+3	103.3	12.6	79-138
+4	101.4	12.5	73-125
+5	105.5	12.5	82-134
+6	102.0	13.6	70-129
+7	102.0	13.7	75-133
+8	103.2	13.6	77-134
+9	103.8	14.1	77-144
+10	105.1	13.2	78-141
+11	101.3	12.6	81-128
+12	104.3	13.1	77-133
+13	101.4	11.5	77-131
+14	101.6	10.5	78-122
+15	106.0	17.7	78-144

*No statistically significant ($P < .05$) difference in comparisons.

patients arriving by ambulance, number of patients admitted to the hospital, number of patients admitted to a monitored unit; and percentage of total ED patients arriving by ambulance, percentage of total ED patients admitted to the hospital, percentage of total ED patients admitted to a monitored unit.

Using ANOVA testing, the data were reanalyzed to see if any statistical significance would appear after controlling for day of the week and month of the year. No significant variations appeared in total patients, percentage ambulance runs, percentage admissions, or percentage admissions to a monitored unit appeared.

DISCUSSION

Numerous articles have been published examining the relationship between the moon and human behavior.^{2,9-20} Attempts have been made to correlate the phases of the moon with suicidal behavior,^{11,12,18-21} homicides,¹² births,^{15,20,22} spontaneous rupture of membranes,²⁰ psychiatric emergency visits,^{2,12} agitation in nursing home patients,¹⁴ poison center calls,¹³ crime,^{12,19} hospital incident reports,²³ crisis intervention calls,⁹ and traffic accidents.^{12,16} The findings of these studies have been contradictory and confusing. Some authors found a significant relationship between phases of the moon and human behavior,^{12,13,16,18,19}

TABLE 1. ED Patient Visits July 1, 1989 to June 30, 1993

	No. of Patients	Percentage Total Patient Visits
Total patient visits	150,999	100.0%
Total ambulance runs	34,649	22.9%
Total admissions	35,087	23.2%
Total admissions to a monitored unit	11,278	7.5%

FIGURE 1. Number of patients versus day of the lunar month (◆, total ED patients; □, arrived by ambulance; △, admitted; ×, admitted to monitored unit).

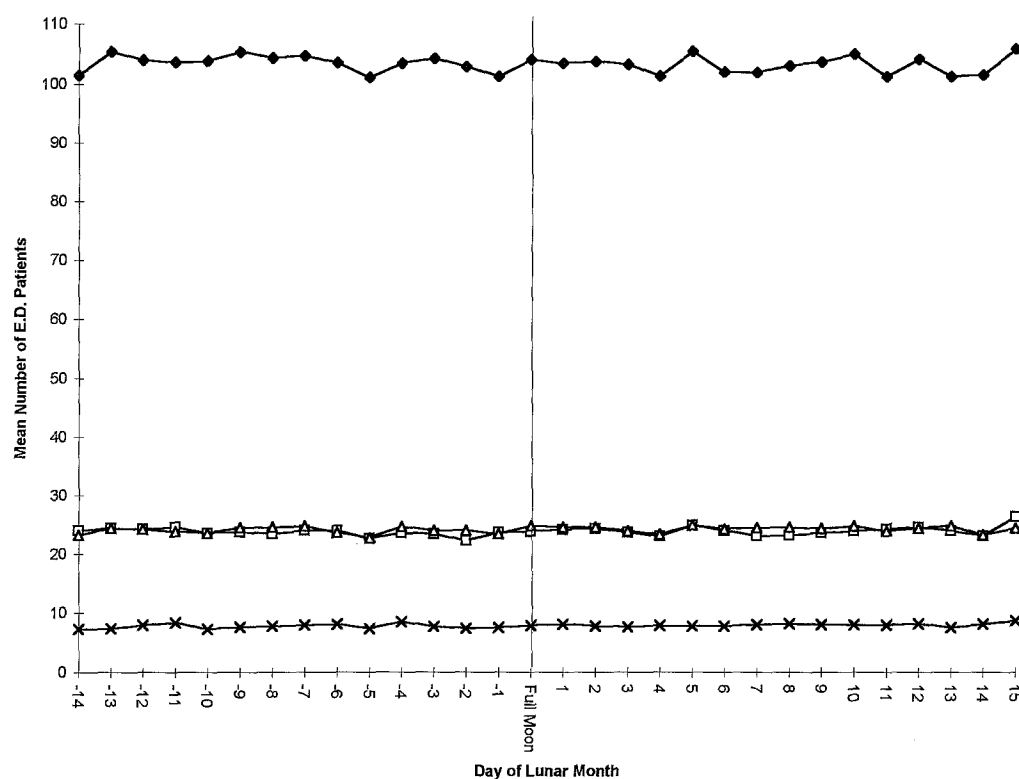


TABLE 3. Percentage of Total Patients Arriving by Ambulance, Admitted, and Admitted to Monitored Unit, by Day of Lunar Month

Day of Lunar Month	Mean No. of Total Patients Per Day*	Percentage of Total Patients Arriving by Ambulance*	Percentage of Total Patients Admitted*	Percentage of Total Patients Admitted to Monitored Unit*
-14	101.5	23.6	22.9	7.1
-13	105.4	23.1	23.1	6.9
-12	104.0	23.3	23.3	7.6
-11	103.6	23.7	23.0	8.0
-10	103.8	22.7	22.7	7.0
-9	105.4	22.5	23.2	7.2
-8	104.4	22.4	23.5	7.4
-7	104.7	22.9	23.6	7.5
-6	103.6	23.1	22.8	7.8
-5	101.1	22.3	22.5	7.2
-4	103.5	22.8	23.8	8.2
-3	104.3	22.4	23.0	7.3
-2	102.9	21.6	23.3	7.1
-1	101.3	23.3	23.1	7.4
Full Moon	104.1	22.9	23.8	7.5
+1	103.5	23.3	23.7	7.8
+2	103.8	23.4	23.6	7.4
+3	103.3	22.9	23.1	7.3
+4	101.4	22.7	23.0	7.7
+5	105.5	23.6	23.6	7.3
+6	102.0	23.5	23.7	7.6
+7	102.0	22.6	24.0	7.8
+8	103.2	22.4	23.8	7.9
+9	103.8	22.7	23.4	7.7
+10	105.1	22.7	23.5	7.6
+11	101.3	23.9	23.6	7.8
+12	104.3	23.5	23.4	7.8
+13	101.4	23.6	24.4	7.4
+14	101.6	22.7	22.9	7.9
+15	106.0	24.8	23.0	8.1

*No statistically significant ($P < .05$) difference in comparisons.

whereas other authors have found no variations in human behavior attributable to a lunar effect.^{2,11,14,15,17,21-23}

Review articles on the subject of "lunar effects" have also reached conflicting conclusions, but generally suggest no causal relationship.^{9,10,24,25} A meta-analysis of lunar effect research concluded that the phases of the moon could account for no more than 1% of the variances in the human behaviors studied.²⁴

There has been but one previous article published in the emergency medicine literature concerning health care workers and their beliefs regarding the full moon. Danzl¹ published a discussion of the factors pertaining to persistent beliefs of ED staff about the effects of a full moon. Using a modified belief in lunar effects (BILE) survey he reported that 80% of emergency nurses and 60% of emergency physicians believe that the moon has an effect on patients. Ninety-two percent of the nurses who believed in the effect of the full moon also believed that they should receive a lunar pay differential.

Some prior studies investigating the lunar effect did not control for confounding variables such as month or day of the week. Theoretically, such confounding variables could produce a spurious relationship or suppress an existing true relationship.^{2,9,17} Templer et al¹⁶ reported an increase in accidents during a 3-day period around the full moon. In a subsequent study, however, they reanalyzed their data controlling for day of the week, and found no increase in accidents during the full moon period.¹⁷ In our study, ANOVA testing of the data was performed controlling for day of the week and month. No statistically significant lunar effect was unearthed.

Another potential problem in the evaluation of the lunar effect is inadequate sample size.^{24,25} A large sample size is necessary to be able to detect weak trends. In our current study, however, a very large number of patients (150,999) were included and, still, no effect of the full moon was observed on the variables studied.

Some authors have found a significant relationship between non-full moon phases of the moon and human behavior. For example, Oderda et al¹³ reported an increase in suicides and drug abuse during the new moon. No such variation was seen in any of our study variables.

CONCLUSION

The presence of a full moon appears to have no effect on ED patient volume, ambulance runs, admissions to the hospital, or admissions to a monitored unit. The expression, "There must be a full moon out tonight," will likely remain in emergency medicine folklore. However, the belief that the ED is busier during the full moon cannot be substantiated.

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