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# Lunar Phases, Time Variations, and Birthrate in Western Michigan

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**LUNAR PHASES, TIME VARIATIONS,  
AND BIRTHRATE  
IN WESTERN MICHIGAN**

**By**

**Janet Mitchell**

**A THESIS**

**Submitted to  
Grand Valley State University  
In partial fulfillment for the requirements  
For the degree of**

**MASTER OF SCIENCE IN NURSING  
1999**

**Thesis Committee Members:  
Linda Bond, Ph.D., R.N.  
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## **ABSTRACT**

### **LUNAR PHASES, TIME VARIATIONS, AND BIRTHRATE IN WESTERN MICHIGAN**

**By**

**Janet Mitchell**

Staffing standards in the labor and delivery units of hospitals are based on estimates of the number of patients who will be admitted. Anecdotally, patients, visitors, and healthcare professionals frequently comment that the occurrence of the full moon brings about an increase in the number of laboring women. The purpose of this study was to examine the associations between birthrate and time of day, day of the week, month of the year and new and full moons. Martha Rogers' theory, the Science of Unitary Human Beings, was used as the theoretical framework.

A descriptive ex post facto design using retrospective data was used to determine statistical associations between the variables in this study. The population for the study consisted of all recorded live births occurring at a large Midwest teaching hospital during a one-year period from January 1, 1998 to December 31, 1998.

A statistically significant difference was demonstrated between time of day and spontaneous birthrate, and between day of the week and spontaneous birthrate. Influence of the new or full moon on the incidence of birth was not supported by the data.

### **Dedication**

**This thesis is dedicated to my husband Mike and daughters Katie, Emily, and Molly.**

**Thank you for your love, patience, and support. I couldn't have done it without you!**

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## CHAPTER ONE

### INTRODUCTION

Throughout history, lunar phases have been associated with influencing events in the lives of human beings. The moon has been the focus of stories of romance, the basis of musical composition, the background in tragic tales, and the visible celestial body in horror films. Even in today's scientifically advanced society, the moon is associated with such events as homicide, suicide, traffic accidents, aggression, and criminal behavior (Lieber, 1996, Lieber & Sherin, 1972). Among these events is the effect of the moon on the onset of labor. Patients and visitors frequently comment on the occurrence of the full moon and its relationship with an impending birth. Commonly, labor and delivery physicians and nurses believe that the full moon will bring about an increase in the number of women admitted to their units (Noller, Resseguie, & Voss, 1996).

Several existing hypotheses may explain the relationship between lunar phases and human behavior. The biologic tide theory suggests that the moon affects humans in much the same way that it influences the ocean's tides. Since the human body is composed mostly of water, an effect similar to the full moon's gravitational pull on the earth could theoretically occur (Lieber & Sherin, 1972). Although this idea was originally used when relating an increased number of homicides to the full moon, others have used this theory when speaking of the lunar effect on the amniotic fluid of pregnant women (Menaker & Menaker, 1959; Stern, Glazer, & Sanduleak, 1988).

Menaker and Menaker (1959) offered a second explanation for increased births around the full moon. They proposed that the full moon may have a positive correlation with ovulation and therefore, conception, because of an influence on both cultural behaviors and the menstrual cycle. Since the lunar cycle is 29.5 days and the average length of human gestation is 266 days, there are 9 synodic months from conception to birth. The full moon's hypothetical effect on conception would result in an increase in the number of births at the full moon nine months later. Jongbloet (1983) supported the idea of increased conception at the full moon. He suggested an association between mating behaviors and this phase of the moon.

A third explanation for this phenomenon is due to the effect of cognitive biases (Kelly, Rotton, & Culver, 1985). Individuals are more likely to notice events that support their beliefs than those that do not. Also, we tend to recall positive instances and forget negative ones. Hospital staff may recall all the full-moon nights when something unusual happened while forgetting uneventful full-moon nights. Staff members also may not remember the many nights without a full moon when birthing areas were incredibly busy.

One last explanation for this phenomenon is that the increased visibility of the moon at the peak enables many to observe its "effects". Closely related to this belief is the idea that a specific period of time, such as month of year, day of week, and time of day, may be associated with birth activity (Fraser, McLean, & Usher, 1989; Nalepka, Jones, & Jones, 1983). A relationship found between time periods, lunar phases and incidence of birth could enable maternity units to be adequately staffed, providing safer patient care and decreasing stress on staff (Kardong-Edgren, 1995). It may also help to validate popular folklore.

Previous studies regarding moon phase have been conflicting. Several studies have supported an association between full moon and birthrate (Menaker, 1967; Menaker & Menaker, 1959; Osley, Summerville, & Borst, 1973). Other research also considered the new moon (Kanhere, Gosavi, & Katti, 1983). Many studies found no association between lunar phase and birthrate (Abel & Greenspan, 1979; Chamberlain & Azam, 1983; Fallenstein, Haener, Huch, & Huch, 1984; Marks, Church, & Benrubi, 1983; Nalepka, Jones, & Jones, 1983; Schwab, 1975; Witter, 1983). Few researchers chose to examine the lunar phases along with time periods in relationship to births.

Because of the conflicting results of previous studies and the lack of research with time periods, this study will replicate work done by Nalepka, Jones and Jones in 1983. These authors examined 3499 births over three years in northeastern Ohio to determine any relationship between human birth and the variables of time of day, day of week, month of year, and the new or full phase of the moon. Chi square analysis revealed associations between the time of day, day of week, and month of year and births, but none between lunar phase and birthrate. The authors acknowledged that a limitation of their study was that it was performed in just a single locality and that replication of this research in another geographical area may validate its results. As in the work by Nalepka, Jones, and Jones, the purpose of this study is to examine the relationships between birthrate and day of week, time of day, month of year, and new and full moons.

## CHAPTER TWO

### THEORETICAL FRAMEWORK AND LITERATURE REVIEW

#### Theoretical Framework

**Martha Rogers, a nurse leader and nursing theorist, places the relationship between humans and environment as the central phenomenon in her theory, the science of unitary human beings. She describes the focus of nursing as the human being-environmental field or “people and their world” (Rogers, 1992, p. 29). She adds that neither unitary human being nor unitary environment can be discussed, considered, or understood in isolation from the other (Rogers, 1992).**

**When speaking of the human entity, Rogers refers to the dimension of wholeness of the being. Meleis (1997) states, “the unitary human being is an organization of the whole, which is more than the sum of the parts, and the individuality and uniqueness of human beings as reflected in this pattern and organization and in their wholeness” (p. 323). The environment is described by Rogers as, “an irreducible, pandimensional energy field, identified by pattern and integral with the human field” (Rogers, 1992, p.29). This look at the environment is unique to nursing and different from other theorist’s views.**

**Rogers conceived three principles to describe the patterns of human and environmental interaction and change (Rogers, 1992). To comprehend the direction, character, and strength of change in energy fields, three principles are described: resonancy, helicy, and integrality. Rogers defines the principle of resonancy as the change of energy field patterns from lower to higher wave patterns. The principle of helicy demonstrates the innovative, unpredictable, and increasing diversity of**

environmental field patterns characterized by non-repeating rhythmicities. The principle of integrality involves the continuous mutual field and environmental field process. This principle expresses Roger's belief that human and environmental fields evolve together and can only exist together (Fisher & Reichenbach, 1987). All of these principles are characterized by their continuity and represented by patterns (Meleis, 1997).

Rogers' theory intends to describe the continuous, evolving and unpredictable patterns of life processes that result from the interaction of person-environment (Meleis, 1997). "It provides a framework to describe the life process of unitary human beings and could provide knowledge of order. The concepts lead to description of pattern, rhythmicities, and symphonic harmony" (Meleis, 1997, p. 324). Fitzpatrick (1988) agrees stating, "Within this life process, multiple human and environmental rhythmic patterns can be identified" (p. 15). Fitzpatrick also believes that Rogers' conceptual model can be used to study human and environmental patterns and their relationships.

Associations have been made between birthrate and lunar and solar cycles (Martens, Kelly, & Saklofske, 1988). Childbirth results in energy field changes in both mothers and their infants and in the relationship with their environment (Polious, 1997). Natural periodicities of the sun and moon characterize rhythmic patterns in the environment.

As in previous research by Nalepka, Jones, & Jones (1983), this study will analyze the relationship between the incidence of human birth and month of year, day of week, time of day, and new and full phases of the moon. This study represents an attempt to examine the relationship between human and environmental energy fields and their patterns, which is a focus of Martha Rogers' theory.

## Literature Review

Varied research has been performed to analyze the relationship of solar and lunar cycles to birthrates. A review of this research will include studies that examined periods of time in relationship to births, such as time of day, day of week, and month of year. Also reviewed will be studies that looked for any correlation between lunar phases and delivery rates.

### Time of Day

There is much variability in studies that have examined the relationship between births and time of day. Nalepka, Jones, and Jones (1983) reviewed the records of 3499 births. Their study was conducted over a period of 3 years in northeastern Ohio. A significant relationship was discovered between time of day and number of deliveries ( $\chi^2=86.58$ ,  $p<.001$ ). Births occurred most frequently between 0600-1200, and almost as frequently between 1200-1800. A full 59% of births occurred during these two time frames. The authors divided the 24-hour time period of each day into four equal 6-hour blocks for convenience.

Kanere, Gosavi, and Katti (1983), also used 6-hour time blocks to examine the relationship between time of day and births. They found the greatest number of deliveries (26.94%) in the evening, from 1800-2400. This time frame was closely followed by the period of 2400-0600, when 26.69% of births occurred. Data were collected on 7500 births occurring over four years in Miraj, India. The authors stated that the births during this time period were "highly significant" (p. 39). The fact that no specific statistics were provided to readers is a limitation of this study. Another limitation of this and the previous study is the use of relatively large time frames (6-hours). A more accurate time

of day may have been obtained with the use of smaller time frames such as 2-hour blocks, or by the use of specific clock time.

Glattre and Bjerkedal (1983) studied 617,000 deliveries in Norway and found that for all births with spontaneous onset and delivery, a broad based bimodal pattern was evident. The highest peak of deliveries occurred between 0400-0600 and a second large peak was in the late morning, slightly before noon.

Charles (cited in Kanhere et al., 1983) documented a greater incidence of births at night when examining 16,000 deliveries in England. The peak in births occurred at 0300. Osley, Summerville, and Borst (1973), when discussing diurnal effect on birthrate, state the maximum birthrate to be from 0600-0800, although this information was never supported with any data or citation.

Considering the large variability in times produced by these studies, there is a possibility that other factors may have affected birth times. Some institutions and cultures may be more likely than others to intervene in labors, therefore changing the length of labor and timing of delivery. Interventions may consist of artificially rupturing the membranes or using oxytocin to stimulate labor, among others. Limitations may exist in the studies that did not consider these factors.

#### Day of Week

A few studies examined the relationship between day of week and births. Borowsky (cited in Martens et al, 1988) examined births (n=811) over 13 lunar cycles in Saskatchewan from October 1986-September 1987. A significant relationship was found showing fewer births on Saturday and Sunday than on weekdays ( $\chi^2=25.14$ ,  $p<.001$ ). In



this study, Borowsky used total number of births, including cesarean sections, inductions, and spontaneous deliveries.

Other studies agreed with Borowsky. Criss and Markum (1981) looked at 140,000 births in New York City over a 12-month period. They found that more births occurred on weekdays when compared with weekends. The authors remarked that they were surprised at the fact that this pattern was consistent with total births as well as with spontaneous births. They theorize that because the 7-day week does not correspond to known natural cycles, the relationship is a cultural one. "Perhaps a disproportionate number of weekday births were induced precisely to avoid a likely weekend birth" (p.75).

Guillon, Guillon, Lansac, and Soutoul (1986), in a large French study of over 5,000,000 births, found the least number of births occurring on Sunday, with Tuesday having the largest number. Mac Farlane (cited in Martens et al, 1988) analyzed births during 1970-1976 in England and Wales. The author found that most births occurred during the weekdays, with lower birthrates on weekends. Birthrates were also decreased on holidays, such as Christmas. A limitation of several of these studies may be that the authors failed to examine spontaneous, naturally occurring births separately from the total number of births.

Nalepka, Jones, and Jones (1983), who studied 3499 births in Ravenna, Ohio from 1977-1979, found a significant increase in weekday births ( $\chi^2=25.15$ ,  $p<.01$ ). Friday was the busiest day of the week with an average of 2.82 births per day. The least number of births occurred on Sunday when the average was 2.01 births per day. The authors hypothesize that perhaps daily stress is related to birth day. They suggest that the associated physical and psychological stress of household duties and childcare in late

pregnancy may contribute to the increase in spontaneous labors as the week progresses. They also acknowledge that little is known about the relationship between physiologic or psychological stress and the onset of labor.

### Month of Year

Jongbloet (1983) states a seasonal pattern in births, which is thought to be evolutionary in nature. "It is not impossible that seasonal reproduction has had adaptive value, particularly for early man living in harsh nomadic conditions" (p. 528). The author also expresses the belief that this pattern has been influenced by cultural changes and may differ by geographical location. Unfortunately, the literature addressing possible variations in birthrate in relation to months or seasons was limited.

Rosenberg (cited in Martens, et al., 1988), whose study was performed in the United States in 1966, found a seasonal variation in birth rate with peaks in the autumn and troughs in the spring. Kanhere, Gosavi, and Katti (1983) studied 7500 births over a 4-year period in Miraj, India. They discovered a greater number of births (56%) in the latter half of the year, as opposed to the first half (44%). The greatest number of births (10.2%) occurred in August.

Nalepka, Jones, and Jones (1983), in their study in Ohio ( $N=3499$ ), also showed that birthrates varied significantly by month ( $\chi^2=24.12$ ,  $p<.05$ ). The peak of births was in August (9.35%) and September (9.2%). In opposition, the French study of more than 5,000,000 by Guillon, Guillon, Lansac, and Soutoul (1986) showed larger numbers of deliveries in May and the least in early fall.

### Lunar Phase and Birth

Several studies throughout the years have shown a significant relationship between lunar phase and birthrate. In New York, Menaker and Menaker (1959) conducted their study examining birthrate and lunar phase in two parts. The first part of their study involved over 253,000 births at New York municipal hospitals during 112 lunar cycles. The authors found that the 3-day period centered at the new moon (the phase of the moon when it is between the earth and the sun and is nearly invisible) had the lowest number of births for any 3-day period. The 3-day period centered on the full moon had the highest total of births. The single day with the highest frequency of births was the day before the full moon.

The second part of their study was based on over 257,000 births over the same 112 lunar cycles, but was conducted at private hospitals. The authors did not find the same 3-day low around the new moon. The peak of births in the private hospitals occurred as before in the day before the full moon, but a similar peak occurred on day 21 of the synodic month (where the new moon is day 0 and the full moon is day 15). Also, the 3-day intervals of days 19-21 and days 22-24 had totals as high as those at the full moon.

The Menakers then examined both the municipal and the private hospitals together. This eliminated many of the other high daily peaks and indicated a peak birthrate on the day before the full moon. Using chi-square, the authors claimed significance ( $p < .01$ ), but test statistics were not provided to the reader.

In a follow-up study, Menaker (1967) looked at 501,000 births over 37 months in New York City from 1961-1963. He found that there were significantly more births in the

half of the lunar cycle that was centered around the full moon ( $\chi^2=13.64$ ,  $p<.01$ ). These findings were similar to those in the previous Menaker and Menaker (1959) studies, although the peak days of birthrate are not mentioned.

Osley, Summerville, and Borst (1973) examined over 500,000 births in New York City over a 3-year period. The authors compared the number of average daily births to those that occurred on the full moon, one day before, or one day after the full moon. The largest peak in births was 1 day after the first quarter. The birthrate on the full moon day was found to be "above the average" (p 414), although not statistically significant.

Criss and Markum (1981) also conducted their study on births in New York City in 1968. The authors examined the birth records of 140,000 infants. Six categories of births were examined over the 12-month period: total births, total spontaneous births, female, male, black, and white births. The authors correlated the data using sine waves comparing a 29.53-day period (the same as a synodic lunar month), a 28-day period, and a 31-day period. The sine wave of the 29.53-day period and spontaneous births was very similar in shape to the 29.53-day period alone, indicating that the "correlation in the data is similar to the ideal correlation" (p. 77). In contrast, sine waves of the periods of 28 and 31 days exhibited smaller magnitudes and much more irregular shapes. The authors concluded that there is a relationship between number of births and lunar phase. The peak of births in their study was close to the third quarter moon.

A limitation of this study is that no statistical data was presented to show that this correlation was significant. Also, the study was conducted over only 1 year, or 12 lunar cycles. In this type of study, the number of cycles is more important than the number of

cases. Conducting the study over a longer period of time may have increased its credibility.

This study, along with the previous three, were performed in metropolitan areas, where large numbers of records are easily obtained. Jongbloet (1983) suggests that the move from agricultural to industrial life has weakened the link between lunar cycles and birth. This is because daily light/dark cycles have become more important than lunar cycles in human ovulation. Osley, Summerville, and Borst (1973) state, "the society which provides the most reliable statistics is the society of large modern cities where the moon has the least cultural significance" (p. 527).

Other studies report a significant association with the full and/or new moon. Kanhere, Gosavi, and Katti (1983), whose study was conducted on 7500 births in India, compared the daily incidence of births with those on the full moon day and new moon day. The number of births per day averaged 1.8, while births on the new moon day were 2.3, and births on the full moon day averaged 2.5. The authors state that the results are statistically significant, however, a limitation is that no statistical evidence is provided to the reader.

Rajasingham, Marson, Mills, and Dooly (1989) also report a significant increase in births around the time of the full moon ( $p < .025$ ). This study of 416 spontaneous births was conducted at a hospital located in London, England during the months of July and August, 1987. Limitations exist in this study because of its short length and small number of participants.

Numerous studies have shown no correlation between lunar phase and birthrate. Schwab (1975) examined 4856 births in Vancouver during the years of 1972 and 1973.

His research discovered that the average daily number of births was 6.62, while the average number of births on a full moon day was 7.25. However, this difference was not significant. Also, there were seven other days where the number of births averaged at or above the number on the full moon.

Abell and Greenspan (1979) conducted their study at a University of California hospital over 4 years. It included 11,691 births. The authors analyzed the data to determine differences in birthrate for any specific day of the synodic month. There were no individual days of the synodic month that differed statistically when comparing live births ( $\chi^2=17.92$ ,  $p=.95$ ), spontaneous births ( $\chi^2=25.64$ ,  $p=.65$ ), multiple births ( $\chi^2=7.24$ ,  $p=.20$ ), and still births ( $\chi^2=2.48$ ,  $p=.78$ ).

Nalepka, Jones, and Jones (1983) examined spontaneous births (N=2756) over 3 years in northeastern Ohio to determine a relationship between new moon and birthrate and full moon and birthrate. Because the day before and the day after the new and full moon were included, a total of 111 "days at risk" were present for both the new moon and the full moon. The rate of births on the new moon was 2.66 per day; on the full moon it was 2.60 per day; and on other days it was 2.49 per day. These birthrates did not differ significantly by lunar phase when the chi-square test of association was applied ( $\chi^2=1.58$ ,  $p=.46$ ).

Marks, Church, and Benrubi (1983) examined a possible relationship between premature rupture of membranes (PROM) and lunar phase. The authors define PROM as "amniorrhea after rupture of the membranes, before labor starts" (p. 14). This study, conducted over six months at a hospital in Jacksonville, Florida, included 117 women at term gestation (>37 weeks) whose membranes had ruptured before the onset of labor. The

researchers analyzed the relationship between the number of women with PROM on each day with the full and new moons. No significance was found with the new moon ( $\chi^2=1.83$ ,  $p=.40$ ) or the full moon ( $\chi^2=3.66$ ,  $p=.16$ ).

Trap, Helm, Lidegaard, and Helm (1989) studied 1516 births over a two year period in Denmark to determine a relationship between PROM and phases of the moon and barometer readings. No association was observed between the phases of the moon and deliveries beginning with or without PROM.

Stern, Glazer, and Sanduleak (1988) looked at the influence of the new and full moon on the onset of labor and spontaneous rupture of membranes (SROM). Admissions to the labor and delivery unit of a large hospital in Cleveland, Ohio during 1984 comprised the sample (N=1999). Frequencies for onset of labor and SROM were compared with days controlled for barometric pressure. Results showed a positive significant correlation of the onset of labor to the full moon when barometric pressure is not controlled ( $\chi^2=5.018$ ,  $p=.025$ ). There was no relationship between new or full moon to onset of labor when barometric pressure was controlled ( $\chi^2=.968$ ,  $p=.325$ ).

Kardon-Edgren (1995) studied 483 births resulting from spontaneous labor to test the association between moon phase, barometric pressure, and human birth. The author compared three separate groups to the number of births that occurred on a day with no full moon and average barometric pressure. The first group, which included a full moon day with average barometric pressure, showed no association ( $\chi^2=.018$ ,  $p>.05$ ). The second comparison was with no full moon and rapidly falling barometric pressure. No association was evident ( $\chi^2=.075$ ,  $p>.05$ ). Lastly, no significant difference was found with the third group, a full moon day and rapidly falling barometric pressure ( $\chi^2=.075$ ,

$p > .05$ ). One limitation includes the fact that Kardon-Edgren randomly selected 72-hour periods that fit the definition of each particular group. Multiple time frames may have increased the strength of this study.

### Summary and Implications for Study

Upon reviewing the literature, it is clear that many inconsistencies remain regarding the relationship of the incidence of birth to celestial events such as lunar phases or units of time, including month of year, day of the week, and time of day. Reasons for this may include poorly designed studies as well as flawed methodology. In their review of the past 50 years of related studies, Martens, Kelly, and Sakolofske (1988) note that many of the studies were written by individuals who were not familiar with prior research in the area. This has resulted in a weak and unstable relationship between variables, even in those studies finding a positive correlation (Martens, Kelly, & Sakolofske, p. 933). With the conflicting findings of previous research, new and improved statistical methods, and accurate computerized birth records, further research is warranted (Kardong-Edgren, 1995).

The study by Nalepka, Jones, and Jones (1983) in northeastern Ohio examined many of the variables that have been researched in previously cited literature. The authors acknowledge that replication of their study in other geographical areas would strengthen its results. This study, therefore, has replicated the work of Nalepka, Jones, and Jones (1983) at a hospital in western Michigan.

### Research Questions

This study addressed the following questions:

1. Is there a difference in birthrate between months of the year?



2. **Is there a difference in spontaneous vaginal birthrate between days of the week?**
3. **Is there a difference in spontaneous vaginal birthrate during times of the day?**
4. **Is there a difference in spontaneous vaginal birthrate during the lunar phase of the new moon?**
5. **Is there a difference in spontaneous vaginal birthrate during the lunar phase of the full moon?**

## CHAPTER THREE

### METHODS

#### Research Design

A descriptive ex post facto design using retrospective data was used to determine statistical associations between the variables in this study. Because of the type of data, this design was appropriate for this study. All other studies examining birthrates in association with lunar and solar phases have used an ex post facto design. An advantage of this type of research design is that large amounts of data can be efficiently obtained and analyzed without invasiveness in regard to patients (Polit & Hungler, 1997).

The major limitation of non-experimental research is that it does not show causal relationships (Polit & Hungler, 1997). Polit and Hungler reiterate the phrase, "correlation does not prove causation" (p. 166). The authors add that the fact that a correlation exists is not enough to prove that one variable has caused the other.

#### Sample and Setting

The population for this study consists of all recorded live births occurring at a large Midwest teaching hospital during a one-year period from January 1, 1998 to December 31, 1998. This institution is located in a large metropolitan area of nearly 200,000 people. The source of the data was the birth log record books of the labor and delivery department.

Permission for access to and use of the data was obtained through approval of the hospital Research and Human Rights Committee. The Human Research Review Committee of Grand Valley State University also granted approval for this study.

### Data Collection Procedures

Data were collected by this investigator. Data was recorded for each birth according to the parameters described in Nalepka, Jones, and Jones (1983). Most of the information required for this study was extracted from the labor and delivery birth log. The birth log is a record book that is used to register birth statistics. The information that was taken from the birth log included: date of birth, time of birth, type of birth (vaginal or cesarean (c) section), and whether the labor was spontaneous or induced. This data was transferred to a data collection sheet by the researcher. Information used to determine day of week and lunar category for the data was obtained from the World Almanac and Book of Facts for 1998 (Famighetti, 1997).

In keeping with the method of the original study, births that were used in this study for analysis of association with the day of the week, time of day, and lunar phases were those with spontaneous labors resulting in vaginal births. Births that occurred as a result of induction or as a result of cesarean section were not used since they represent human intervention in the normal birth process and are confounding variables in the study. Data for the first-born child of multiple births were used in the study in order to count multiple births only once.

When analyzing data on lunar phases, the day preceding and the day following the full and new moons were used. The use of this 3-day window is desirable since a new or full moon might occur very close to the beginning or end of a day. Similar methods of using a specified number of days before or after a lunar event have been utilized in at least five other studies (Menaker & Menaker, 1959; Menaker, 1967; and Stern, Glazer, &

Sanduleak, 1988; and as cited in Martens, Kelly , and Saklofske, 1988: McDonald, 1976; and Borowsky, 1988).

Human rights of the individuals whose records were examined were protected in the study. Each birth record was assigned a 4-digit number that was used to identify corresponding data on information sheets. This has avoided any association of client names with the data. All data were analyzed and reported in grouped form to prevent individuals from being identified during the analysis process or when reporting results.

## CHAPTER FOUR

### DATA ANALYSIS

The number of deliveries which met the criteria for the study totaled 5588. All data were assigned a numerical value for the purpose of computer analysis. Analysis of the data collected was computed using the Statistical Package of the Social Sciences (SPSS) software.

#### Characteristics of the sample

Table one shows the frequencies and percentages of births. The deliveries are categorized into two groups, those without any human intervention (spontaneous) and those births that were assisted by induction or cesarean section. Research questions 2-5 involved only spontaneous births in order to prevent the bias of scheduled deliveries.

Table 1

#### Characteristics of Births

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Type of Birth	<u>Deliveries</u>	
	Number	%
Spontaneous	3512	62.8
Induction and C/S	2076	37.2
Total	5588	100

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### Research Question One

The first research question addressed whether there is a statistically significant difference between the incidence of birth and the month of the year. Table 2 shows the distribution of total births by month, along with percentages. The total number of births do not vary significantly by month ( $\chi^2=15.38$ ;  $df=11$ ;  $p=.17$ ).

Table 2

#### Total Births Classified by Month

Month	Number of Births	%
January	445	8.0
February	432	7.7
March	472	8.4
April	462	8.3
May	536	9.6
June	506	9.1
July	488	8.7
August	463	8.3
September	459	8.2
October	466	8.3
November	409	7.3
December	450	8.1
Totals	5588	100

Because the literature commonly referred to a seasonal variation in births, the data were also analyzed by collapsing the months into four seasons. Table 3 demonstrates the variation between the seasons of winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), and autumn (September, October, and November), along with the percentages of births occurring during each season. There was no statistically significant difference between seasons ( $\chi^2=3.68$ ;  $df=3$ ;  $p=.30$ ).

Table 3

Births Classified by Season

Season	Births	
	Number	%
Winter	1327	23.7
Spring	1470	26.3
Summer	1457	26.1
Autumn	1334	23.9
Total	5588	100

Research Question Two

The second research question investigated whether any statistically significant difference existed between spontaneous vaginal birthrate and day of the week. Table 4 lists the number of spontaneous vaginal births for each day and the percentage of

deliveries. A significant difference between births and days of the week was discovered ( $X^2=105.25$ ;  $df=6$ ;  $p=.00$ ). The greatest number of spontaneous births occurred on Friday, the least on Tuesday.

Table 4

Spontaneous Births Classified by Day of Week

Day of Week	Births	
	Number	%
Sunday	524	14.9
Monday	493	14.0
Tuesday	475	13.5
Wednesday	485	13.8
Thursday	523	14.9
Friday	532	15.1
Saturday	480	13.7
Total	3512	100

Although not specified by the research question, it would also be helpful to identify any daily pattern in total births (including inductions and cesarean sections) to assist in scheduling staff. Table 5 illustrates the numbers and percentages of total births



by days of the week. When examining total births, the weekdays have more deliveries and the weekends have fewer births.

Table 5

Total Births Classified by the Day of the Week

Day of Week	Births	
	Number	%
Sunday	675	12.1
Monday	798	14.3
Tuesday	865	15.5
Wednesday	783	14.0
Thursday	886	15.9
Friday	882	15.8
Saturday	699	12.5
	5588	100

Research Question Three

Research question three sought to determine any statistically significant difference between spontaneous vaginal birthrate and time of day. The 24-hour time period of each day was divided into four equal 6-hour periods: 00:01-06:00 (night); 06:01-12:00 (morning); 12:01-18:00 (afternoon); and 18:01-midnight (evening). Table 6 shows the number of spontaneous deliveries and the percentages for each quartile of time. Birthrate was shown to vary significantly by time of day ( $X^2=21.43$ ;  $df=3$ ;  $p=.00$ ).

Table 6

Spontaneous Births Classified by Time of Day

Time	Births	
	Number	%
00:01-06:00 (night)	823	23.4
06:01-12:00 (morning)	932	26.5
12:01-18:00 (afternoon)	947	27.0
18:01-midnight (evening)	810	23.1
Total	3512	100

Research Questions Four and Five

The fourth research question examined whether the spontaneous birthrate varied significantly according to the lunar phase of the new moon. No significant findings were discovered ( $X^2=.94$ ;  $df=1$ ;  $p=.33$ ). Research question 5 asked if any difference was evident in spontaneous vaginal birthrate during the full moon. Births did not vary significantly during the full moon ( $X^2=.173$ ;  $df=1$ ;  $p=.68$ ). Table 7 reports the number of spontaneous births and percentages during the new moon and full moon phases of 1998.

Table 7

Spontaneous Births Classified by Lunar Phase

Phase of Moon	Births	
	Number	%
New	321	9.1
Full	359	10.2
Other	2832	80.7
Total	3512	100

## CHAPTER FIVE

### DISCUSSION AND IMPLICATIONS

#### Discussion

The purpose of this research study was to examine the relationship between the incidence of human birth and the variables of month of year, day of week, time of day and the lunar phases of the new and full moon. Data analysis revealed significant results with the variables of day of week and time of day, but not with month of year, new moon, or full moon. The discussion will address each research question, relationship of findings to the theoretical framework, limitations and recommendations, and implications for nursing.

The first research question addressed any difference in birthrate during the months of the year. Although May and June had a greater incidence of birth, the difference in birthrate between the months was not statistically significant. The findings of this question are inconsistent with those of the original research by Nalepka, Jones, and Jones (1983). Those investigators found significant monthly differences over the three years of the study, with the greatest number of births occurring during the months of August and September. One explanation for the observed differences in the studies is the possibility that the study length of one year is not long enough to adequately reflect actual patterns present. Increasing the length of the present study from one year to three years may have produced statistically significant results.

Nalepka, Jones, and Jones (1983) also associated their findings of an increased late summer birthrate and preceding increased conception rate of winter to severe winter weather. They hypothesize that extreme winter weather may result in more time spent

confined to home with a subsequent increase in sexual activity, and thus an increase in conception. The past few winters in Michigan have been relatively mild. According to the ideas of Nalepka, Jones, and Jones, this may result in fewer hours spent confined to home and a subsequent decrease in sexual activity and conception rate. If this were true, the birthrate may be more evenly spread throughout the months.

Jongbloet (1983) suggested a seasonal evolutionary birth pattern that was beneficial to early humans. The author admits this pattern has shown numerous alterations in different parts of the world, times during history, and in different cultures. Perhaps cultural and geographical variability today make it difficult to identify any significant monthly patterns in birthrate.

The second research question explored whether there was a difference in the spontaneous vaginal birthrate between days of the week. A statistically significant difference was evident. Examination of the individual days of the week showed Friday to have the most spontaneous births with Sunday and Thursday close behind. The fewest spontaneous births occurred on Tuesday and Saturday.

As reviewed in the literature, other researchers (Criss & Markum, 1981; Nalepka, Jones, & Jones, 1983) found significantly more babies born during the week as opposed to weekends. This was true for spontaneous deliveries as well as the total number of deliveries in their studies. In the present study, no such rhythm or pattern was revealed with spontaneous births. Not surprisingly, when inductions and cesarean sections were included in the birthrate, the weekdays had more births than the weekends. Awareness of these types of trends is important in relation to staffing issues on the birthing units of hospitals. Weekend staff is usually obtained at a premium wage since weekends are

considered a less desirable period to work. In areas with fewer births on the weekends, it may be cost effective to have fewer staff members scheduled to work, with reserves available on call.

The third research question was asked to determine whether a difference exists between spontaneous vaginal births and time of day. Data analysis concluded that a statistically significant difference was present. The largest number of births occurred between 12:01 and 18:00, closely followed by the period of 06:01-12:00. This finding is consistent with the original study by Nalepka, Jones, & Jones (1983). Nalepka et al. noted that even though a greater number of births may occur during the daytime hours, adequate numbers of nurses are still needed at night. This is because many women may have labored during the previous evening or night, requiring nursing care.

One explanation for the increased birthrate during the morning and afternoon may be that during the daytime hours the physician or midwife might be more willing to perform artificial rupture of membranes or augment labor, thus possibly decreasing the amount of time in labor. This may be seen as a welcome step to the patient in labor as well as to the patients scheduled in the office waiting for the health care provider to return. Although birth data used for the analysis of this research question did not include inductions or cesarean sections, augmented labors were not excluded.

The fourth research question explored whether there were differences in spontaneous vaginal birthrate during the new moon. The fifth question asked whether a difference was evident in the spontaneous vaginal birthrate during the full moon. The statistical analysis of data showed no significant change in births during the new or full moon. These findings support many of the more recent studies reviewed in the literature

(Chamberlain & Azam, 1983; Fallenstein, Haener, Huch, & Huch, 1984; Marks, Church, & Benrubi, 1983; Witter, 1983), including the original study by Nalepka, Jones, & Jones (1983).

A possible reason for the non-significant results may be the small sample size. It may be necessary to study a very large number of births before a statistically significant difference is evident in relation to lunar phases. It is also possible that a lunar effect is not strong enough to play a major role in the incidence of birth. Sanduleak (1985) supports this idea by stating, "...no conclusive statistical evidence exists for the reality of any kind of lunar effect on human behavior" (p. 241).

Theories that were proposed in the literature to explain a lunar effect on birthrate have not been supported by the present study. Stern, Glazer, & Sanduleak (1988) believe that the biologic tide theory, which proposes that the human body and the moon have a relationship similar to that of the oceans and the moon, is not thought to be plausible. "The concentration of water in the body is so miniscule in comparison to large bodies of water, that the compounded effect observed in ocean tides would be reduced to insignificance in the human body" (p.57).

#### Relationship of Findings to Conceptual Framework

Martha Rogers' science of unitary human beings is well suited to the study of the incidence of human birth with month of year, day of week, time of day, and new and full phases of the moon. Much of the research conducted in this study involved the environment's effect on human birth. Significant findings with time periods, such as the day of the week and the time of the day, and spontaneous births demonstrate the patterns

and rhythmicities that are described by the interaction of person and environment in Rogers' theory.

The focus on the constant interaction between person and environment provides insight with regard to the principle of integrality, or Rogers' belief that human and environmental fields evolve together and can only exist together (1992). It is this belief that will continue to keep researchers investigating the relationship between humans and the environment. Further studies using this framework may help obtain greater understanding of human and environmental patterns and interactions.

#### Limitations and Recommendations

One limitation of this study is that data was gathered from only one institution. Collecting data from several hospitals or birth centers would have enhanced the variety of data and increased the number of the sample. Replication of this study in other geographical areas may substantiate or refute the findings.

A second limitation is the fact that the data from only a single year was obtained, therefore no control was possible for any year-to-year changes in the birthrate. It would be helpful in future studies to analyze data from several years to allow for yearly variation and to increase the number of subjects in the study.

Examining only certain parameters of time is another limitation. Although statistical significance was revealed in reference to time of the day, studying other periods of time may produce more accurate results. The use of exact hour instead of quartiles may be helpful to future researchers.

Lastly, there were no controls for other factors believed to have an influence on the rate of birth. The phenomenon of labor is complex, being affected by exogenous and



endogenous factors. The relationship of other influences such as hormonal changes, barometric pressure fluctuations, and psychosocial stressors may have an effect on labor and subsequent birthrate.

### Implications

The findings of this study support the fact that hourly and daily trends occur in the birthing area. Awareness of these patterns may assist with staffing decisions. Improved staff-to-patient ratios may decrease the stress of caregivers and increase the quality of patient care.

Better staffing ratios are also important to nursing administration. With the advent of healthcare reform, reimbursement issues, and cost cutting measures, staffing is monitored carefully. Research that identifies daily or hourly trends in the number of births may help increase staffing accuracy.

The findings of this study may also help to decrease belief in folklore, since no significant influence of the full or new moon on birthrate was documented. However, for those staff members in the labor and delivery area, long-held beliefs associated with the lunar phases may be difficult to change. Expression of those beliefs include verbalization, and even anxiety about concern over how busy the birthing area may become. Health care professionals may go as far as switching days of work to avoid working on a full moon day. Many have expressed relief at not being scheduled during certain lunar phases. Visitors and staff are even more likely to comment with special lunar events such as eclipses or harvest moons, perhaps because the media covers these events so thoroughly. Values and beliefs, even those associated with folklore, are difficult to

change. Perhaps discussion and sharing of scientific studies related to these topics may help to educate and enlighten healthcare professionals and the public.

### Summary

The purpose of this study was to examine possible differences between births and the variables of month of the year, day of the week, time of day, and the lunar phases of the new and full moon. Spontaneous birthrate differed significantly during times of the day and day of the week. These findings may help improve staffing accuracy in the birthing area. Influence by the new or full moon on the incidence of birth was not supported by the data. Because of the plethora of factors that may influence birthrate, further research is needed. Anecdotally, the public, as well as healthcare professionals, will probably continue to believe in an association between birthrate and the full moon.

Appendix A

DATA COLLECTION TOOL

ID	MNTH	DAY	TIME	NEW	FULL	IND	C/S
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Appendix B



1 CAMPUS DRIVE • ALLENDALE, MICHIGAN 49401-9403 • 616/895-6611

January 4, 2000

Janet Mitchell  
Kirkhof School of Nursing  
215 HRY

Dear Janet:

Your proposed project entitled **Lunar Phases, Time Variations, and Birthrate in Western Michigan** has been reviewed. It has been approved as a study which is exempt from the regulations by section 46.101 of the Federal Register 46(16):8336, January 26, 1981.

**Please note that a copy of the permission letter to access and use the data from the hospital needs to be faxed to me at 895-3446 ASAP. The reference number for the letter is 00-130-H and needs to be included with the fax.**

Sincerely,



Paul A. Huizenga, Chair  
Human Research Review Committee

## Appendix C



### Spectrum Health

*Downtown Campus*  
100 MICHIGAN STREET NE GRAND RAPIDS MI 49503-2560  
616 391 1774 FAX 391 2745 [www.spectrum-health.org](http://www.spectrum-health.org)

January 6, 2000

Janet Mitchell, BSN, RN  
900 Roger, NW  
Grand Rapids, MI 49544

Dear Ms. Mitchell:

By means of the expedited review process your project entitled, "Lunar Phases, Time Variations, and Birthrate in Western Michigan", was given approval by the Spectrum Health Research and Human Rights Committee. The Spectrum Health number assigned to your study is #2000-002.

This approval does not include the awardance of any monies for your study.

Please be advised that any unexpected serious, adverse reactions must be promptly reported to the Research and Human Rights Committee within five days; and all changes made to the study after initiation require prior approval of the Research and Human Rights Committee before changes are implemented.

The Research and Human Rights Committee and the F.D.A. requires you submit in writing, a progress report to the committee by November 1, 2000, and you will need reapproval should your study be ongoing at that time. Enclosed are some guidelines, entitled "Protocol Points", for your convenience in working with your study.

If you have any questions please phone me or Linda Pool at 391-1291\1299.

Sincerely,

Jeffrey S. Jones, M.D.  
Chairman, Spectrum Health Research and Human Rights Committee

JSJ/jfn

c: Jan Hodges, R.N.  
Cindy Reistroffer, Director of Women's and Infants Service  
File

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