



Percentage of Deliveries Each Hour in Montana, 2012-2016

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AT A GLANCE

- Deliveries did not occur evenly throughout the 24-hour day in Montana or in the broader United States.
- A greater percentage of deliveries outside of a hospital occurred during nighttime hours than deliveries in a hospital.
- The nonrandom hospital delivery times were most pronounced among induced vaginal deliveries and cesarean deliveries without a trial of labor, types of deliveries that are typically scheduled in advance.

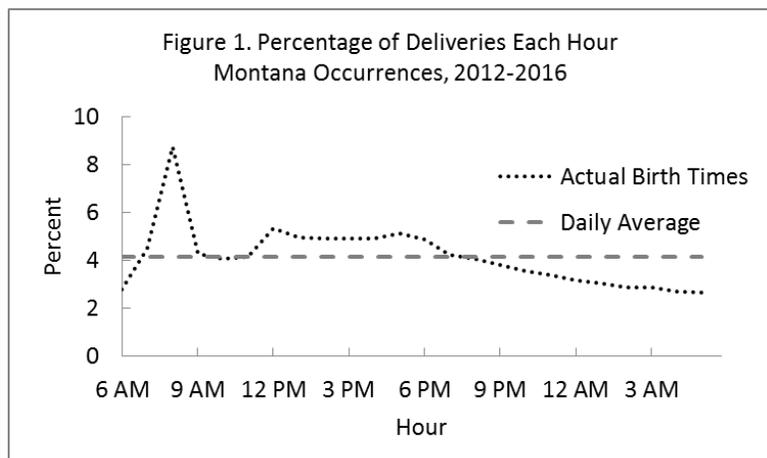
Introduction

Current obstetric practices cause a nonrandom distribution of deliveries throughout the 24-hour day in the United States and Canada.¹ Specifically, the proportion of deliveries is lower during weekends, holidays, and nighttime hours than during daytime hours on weekdays.¹ Moreover, the distribution of deliveries throughout the day in the United States varies depending on certain characteristics of delivery including day of week, location of delivery, and method of delivery.² This paper describes the distribution of deliveries throughout the day in Montana over the past 5-years, between 2012 and 2016, in order to determine if the nonrandom pattern emerges in this state specifically.

Methods

Data used in this report from the Montana Office of Vital Records were restricted to deliveries in Montana. The collected data included date of birth, hour of birth, location of birth (In Hospital or Out of Hospital), method of delivery (vaginal or cesarean), induction of labor (Yes or No among Vaginal Deliveries), and trial of labor (Yes or No among Cesarean Deliveries). The number of deliveries each hour was then used to calculate the percentage of all the deliveries that occurred each hour. This same calculation was performed on weekday deliveries and weekend deliveries separately, on deliveries within and outside of a hospital separately, and on vaginal and cesarean deliveries separately. Among vaginal deliveries, the calculation was performed on induced and non-induced deliveries separately; and among cesarean deliveries, the calculation was performed on deliveries with and without a trial of labor separately. Weekends included Saturdays and Sundays, but holidays were not considered for this analysis.

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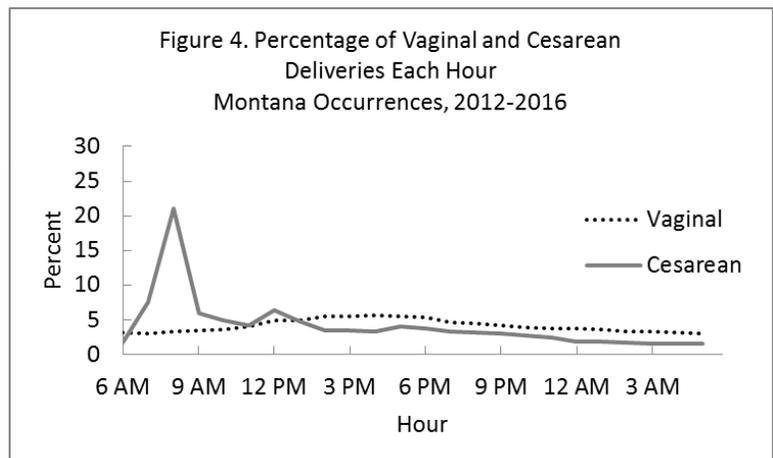
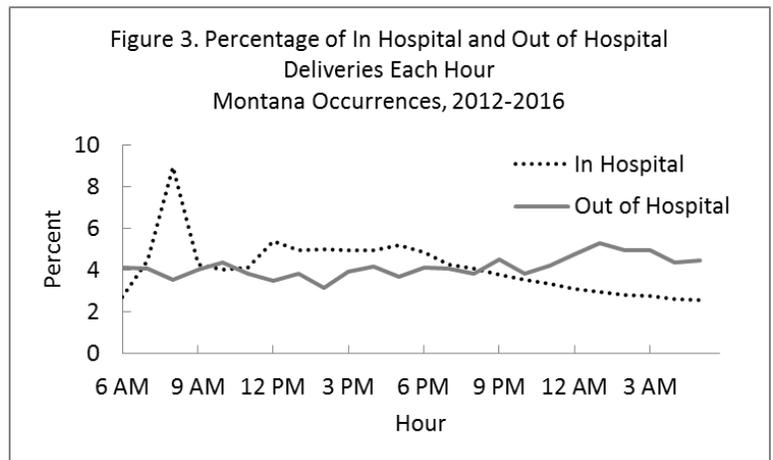
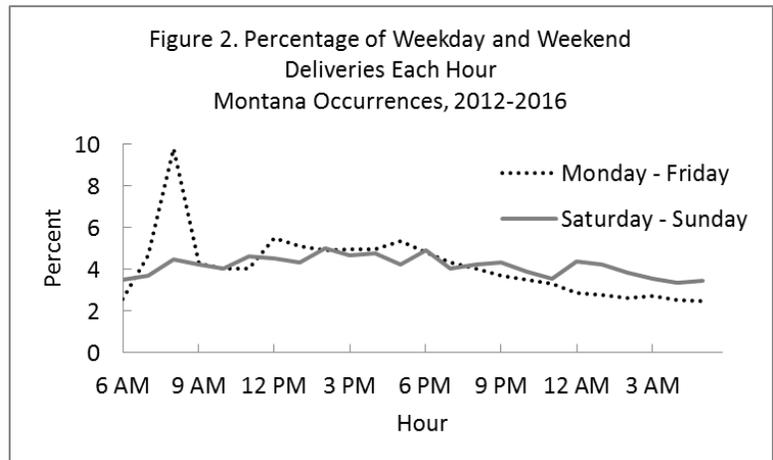
Figures 1 – 6 each show two different time of birth distributions. The difference between the mean hour of birth in each of the six pairs was tested using a t-test (one-sample for Figure 1 and two-sample for the remaining figures), and each of the differences were statistically significant ($p < 0.01$). A total of 61,596 deliveries between 2012 and 2016 were used in this analysis.

Results

The distribution of deliveries throughout the day in Montana was nonrandom. If deliveries were occurring evenly throughout the day, approximately 4.2% of deliveries would occur each hour. A high percentage of deliveries between 2012 and 2016 occurred between 8 AM and 9 AM. There was also an elevated percentage of deliveries occurring between 12 PM and 7 PM, as well as a reduced percentage of deliveries occurring between 10 PM and 7 AM (Figure 1).

The pattern was different between weekend deliveries and weekday deliveries. There was a peak between 8 AM and 9 AM on weekdays. There were also an elevated percentage of deliveries occurring between 12 PM and 7 PM on weekdays. Weekend deliveries, however, were more evenly distributed (Figure 2).

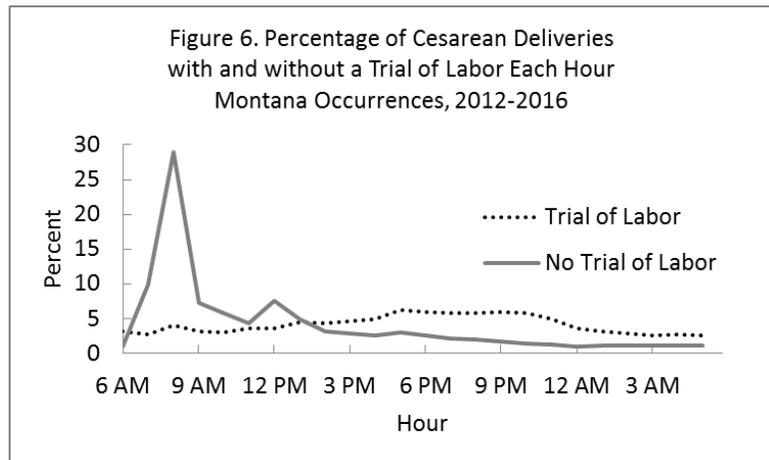
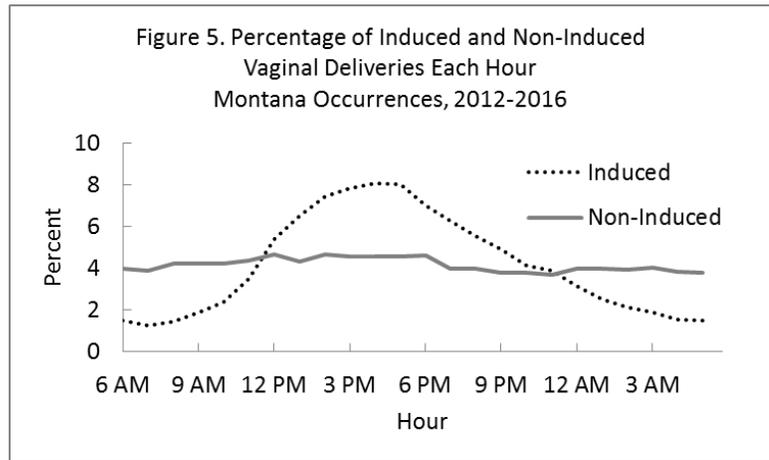
The pattern of deliveries was also different between deliveries that occurred within a hospital and deliveries that occurred outside of a hospital. A disproportionately high



percentage of deliveries outside of a hospital occurred between 12 AM and 4 AM; and since most of the births occurred within a hospital, the distribution of births within a hospital was very similar to the distribution of all births (Figure 3).

The distribution of deliveries throughout the day was also different between vaginal and cesarean deliveries. Over one-fifth of the cesarean deliveries occurred between 8 AM and 9 AM, and over half of the cesarean deliveries occurred between 7 AM and 2 PM. The vaginal deliveries were more evenly distributed, with a slight increase between 2 PM and 7 PM (Figure 4).

Among vaginal deliveries, the distribution differs depending on if they were induced. Induced vaginal deliveries gradually reached a peak at around 5 PM and reached a low point at around 8 AM. Non-induced vaginal deliveries, however, were more evenly distributed (Figure 5).



Among cesarean deliveries, the distribution differs depending on if there was a trial of labor. Over a quarter of the cesarean deliveries without a trial of labor occurred between 8 AM and 9 AM, and over two-thirds of the cesarean deliveries without a trial of labor occurred between 7 AM and 2 PM. The cesarean deliveries with a trial of labor were more evenly distributed, with a slight increase between 5 PM and 12 AM (Figure 6).

Discussion

Deliveries in Montana were not spread evenly throughout the day, and this finding is consistent with other studies that have observed this trend within the United States and Canada.^{1,2} This pattern is likely due to scheduling deliveries, and not due to natural human biology, because women who have little exposure to modern medicine or artificial light typically give birth during nighttime hours.³ Moreover, the deliveries in Montana outside of a hospital reached their peak during nighttime hours, which indicates that deliveries not made to conform to a medicalized pattern follow a distinctly different and possibly more natural pattern. It is also worth noting that the disproportionate percentage of births during daylight hours was mostly observed among induced vaginal deliveries and cesarean deliveries



without a trial of labor, procedures that are typically planned. Scheduling more deliveries than necessary has been associated with both maternal and neonatal morbidity, which may be due to preterm birth.^{4, 5,}

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This analysis was not able to determine which deliveries were scheduled in advance nor determine which were medically necessary; nor did it take into consideration if a medical doctor was present at the births outside of a hospital or if a birth occurred during a holiday. These are some of the factors that may have contributed to the patterns of birth timing found in this paper.

These results illustrate the need to further describe the frequency of medically necessary inductions and Cesareans compared to the frequency of elective inductions and Cesareans. Future research could also measure the association between elective inductions or Cesareans and preterm birth or low birth weight.

¹ Rindfuss RR, Ladinsky JL, Coppock E, Marshall VW, MacPherson AS. Convenience and the occurrence of births induction of labor in the United States and Canada. *International Journal of Health Services* 1979; 9(3): 439-460.

² Matthews TJ, Curtin SC. When are babies born: morning, noon, or night? Birth certificate Data for 2013. *National Center for Health Statistics*. Data Brief 200, May 2015.

³ Varea C, Fernandez-Cerezo S. Revisiting the daily human birth pattern: time of delivery at Casa de Maternidad in Madrid (1887-1892). *American Journal of Human Biology* 2014; 26(5): 707-709.

⁴ Clark SL, Miller DD, Belfort MA, Dildy GA, Frye DK, Meyers JA. Neonatal and maternal outcomes associated with elective term delivery. *American Journal of Obstetrics & Gynecology* 2009; 200(156): 1-4.

⁵ Silver RM et al. Maternal morbidity associated with multiple repeat cesarean deliveries. *Obstetrics & Gynecology* 2006; 107(6): 1226-1232.

⁶ MacDorman MF, Declercq E, Zhang J. Obstetrical intervention and the singleton preterm birth rate in the United States from 1991-2006. *American Journal of Public Health* 2010; 100(11): 2241-2247.