

# Delivery rate in Benin City, Nigeria: Are there seasonal variations?

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## Abstract

**Objective:** To determine if there are monthly variations in the rate of deliveries in Benin City, Nigeria.

**Materials and Methods:** A retrospective descriptive study carried out in the three major obstetric centers in Benin City, Nigeria. We extracted the total number of deliveries from the hospitals' records for over a five-year period and analyzed the figures for monthly variation in delivery rates. This was repeated for a standardized 30-day month and the findings noted.

**Results:** There were 28,686 deliveries during the study period with an average monthly delivery of 2,390. The monthly distribution showed a sinusoidal pattern with peak delivery rates in April–May and October and lowest rates in July–August and December. The months of April, May, and October had delivery rates that were significantly higher than the monthly average delivery rate, while the converse was true for July, August, and December at the 99% confidence interval.

**Conclusions:** There exists a significant monthly variation in delivery rates in Benin City. This finding will prove valuable in health system planning and in the interpretation of seasonal variations in other reproductive parameters.

**Key words:** Delivery rate, delivery variation, monthly variation

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## Introduction

Humans have the potential of year round reproduction in a cyclical pattern. A fertile woman has the potential of conception following unprotected sexual intercourse at the time of ovulation. Ovulation in humans occurs cyclically. Studies abound on the seasonal variation of various obstetric events.<sup>[1,2]</sup> It has been shown in some studies that the incidence of eclampsia and pre-eclampsia is season-dependent.<sup>[3-7]</sup> The seasonal effect on the rate of ectopic pregnancy,<sup>[8,9]</sup> spontaneous abortion,<sup>[10]</sup> and even the seasonal effect on conception has been studied with conflicting results.<sup>[4]</sup> Etard *et al.* also reported a seasonal variation in direct obstetric mortality in rural Senegal, although the seasonal variation noticed was not statistically significant.<sup>[11]</sup> However, many of these studies had no reference to seasonal variation in the delivery rate, as a possible variable that may have resulted in an

apparent seasonal difference in the incidence of these conditions.

This study aims at reviewing the monthly distribution of deliveries. The monthly distribution of deliveries approximately reflects the monthly distribution of conception, as each term delivery reflects a conception that occurred about nine months earlier. The knowledge gained of the seasonal variation in conception and delivery will be important in various aspects of health system planning, especially those concerning reproductive health issues. In batching for assisted reproduction, the findings could assist in predicting periods of improved successful outcome. It will also assist in the better understanding of these reproductive issues and the factors that affect

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their occurrence. Knowledge of seasonal variation in the delivery rates may also be a necessary denominator in validating the apparent seasonal variations in various reproductive health statistics. Considering the dearth of information on the seasonal distribution of deliveries, it becomes necessary at this point in time, to document such a variation, if any, and thus provide some evidence on its existence or otherwise.

## Materials and Methods

This is a retrospective descriptive study carried out in three of the largest obstetric centers in Benin city, Edo state, Nigeria: (i) the University of Benin Teaching Hospital, Benin city — a tertiary health center serving as a referral center for about five million people from within and outside the state, with an annual delivery rate of 2,000 to 3,000; (ii) The Central Hospital, Benin city — a specialist hospital run as a government-owned secondary health center and also having an annual delivery rate of 2,000 to 3,000; (iii) St. Philomena Catholic Hospital, Benin city — the foremost missionary hospital in the state with an annual delivery rate of 1,000 to 2,000.

A five-year record of deliveries at these centers was extracted. The extracted data was then fed into a computer and an analysis was performed, based on the grouping of the delivery rates per month. The monthly delivery rates were standardized to a uniform 30-day month, to eliminate the disparity that may result from the differences in the number of days in the various months of the year, and the analysis was repeated. The SPSS version 16 statistical software was used to analyze the results. This study was approved by the ethical committee of the University of Benin Teaching Hospital.

## Results

The total number of deliveries recorded in the obstetric centers over the study period was 28,686, with an average monthly delivery of 2,390. The range of monthly deliveries was 2,102 to 2778. The monthly distribution of total deliveries showed a slightly sinusoidal pattern with two peaks: A major peak spanning two months, April and May, and another peak in October [Figure 1]. The Figure also depicted the nadir number of deliveries to occur majorly in July and August and another in December. This pattern persisted even after correction for the differential number of days in the months of the year [Figure 2].

The percentage distribution of monthly deliveries is shown in [Table 1]. It shows that almost 40% of the annual deliveries occur in the months of March, April, May, and October. In addition, it shows the significance level of the monthly average deliveries compared to the computed

overall average monthly delivery rate of 2,390. The months of April, May, and October are shown to have significantly higher monthly delivery rates and the months of July, August, and December have significantly lower average monthly delivery rates compared to the computed monthly average at the 99% confidence interval.

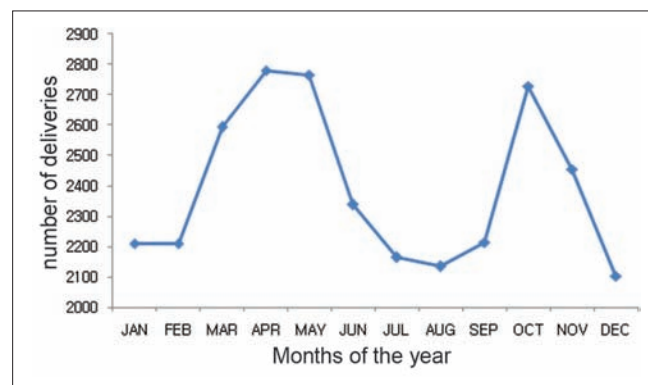


Figure 1: Monthly distribution of total deliveries in Benin city

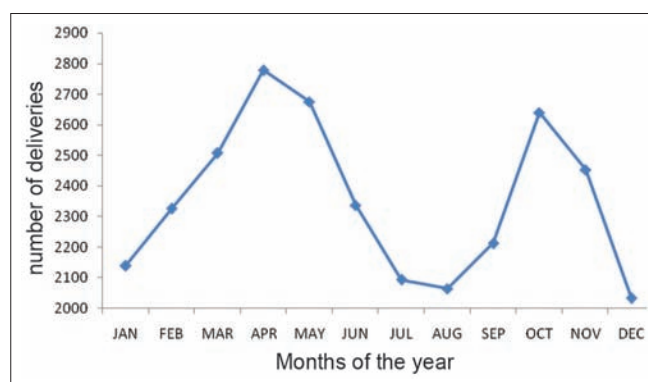


Figure 2: Standardized monthly distribution of total deliveries in Benin City. [Number of deliveries standardized to a 30-day month]

Table 1: Percentage distribution of average monthly deliveries

Month	Standardized number of deliveries	Percentage of annual deliveries	P value <sup>x</sup>	Significance
January	2140	7.57	0.014	NS
February	2326	8.23	0.699	NS
March	2508	8.87	0.063	NS
April	2778	9.83	0.000	S
May	2675	9.46	0.001	S
June	2337	8.27	0.809	NS
July	2094	7.41	0.005	S
August	2065	7.31	0.002	S
September	2213	7.83	0.080	NS
October	2640	9.34	0.003	S
November	2453	8.68	0.212	NS
December	2034	7.20	0.001	S

Average number of deliveries/30-day month-2355

<sup>x</sup>Significance level of number of delivery versus monthly average

## Discussion

This study found a significantly higher monthly delivery rate in the months of April, May, and October, and a significantly lower monthly delivery rate in July, August, and December. The single highest monthly delivery occurred in the month of April and the single lowest in December. This, by implication infers the highest monthly conception to be in July and the lowest monthly conception to be in March. These findings relate favorably with reports in different parts of the world, which have reported a significant variation in the monthly delivery rates. The recent National vital statistics report of the United States, reports that births peak historically in August and reach a nadir in February.<sup>[12]</sup> Studies from Norway and Australia reported seasonal variations in birth rates.<sup>[1,2]</sup> Yadava *et al.*, working in India, reported the maximum indices of deliveries in the months of August to October and lowest from April to June. They extrapolated this to indicate the maximum conception rates in the winter season.<sup>[13]</sup> Warren *et al.* have also reported a significant bimodal seasonal trend in the estimated monthly number of conceptions.<sup>[10]</sup>

Different reasons have been adduced for the seasonal variations observed in these studies. Seasonal variations in sperm quality and also in ovarian activity have been proposed.<sup>[14]</sup> Seasonal variation in coital activity among couples is the possible factor influencing the seasonal variation in conception and delivery. Increase in cohabitation is expected in the cold seasons as in the harmattan festive seasons of December in Nigeria, but the peak conception rate was found to occur in July (which corresponds to the height of the rainy season which is often hot). The effect of photoperiod, melatonin, and temperature are other mechanisms that have also been proposed.<sup>[15]</sup> Despite these, different geographical locations will experience different months of peak and nadir in the number of deliveries, as a result of differences in altitudes and climatic conditions,<sup>[8,16]</sup> as seen in this study compared with others from different climatic regions.<sup>[1,2,12]</sup>

One limitation of this study is that it is hospital-based, and therefore, failed to capture all the births in the community. Nevertheless, this is unlikely to influence the outcome of this study as Benin city is almost entirely urban and well over 70% of deliveries are hospital-based.<sup>[17]</sup> In addition, it is unlikely that there will be significant seasonal variations in access to the studied hospitals, which are located in different parts of the city. Occasional industrial action leading to closure of one or more of the hospitals is another limiting factor. This too is unlikely to affect the findings, as there has been no industrial action that has affected more than one of the centers at the same time, as they are run by different levels of management

and most of the industrial actions have been short and often spared the labor wards of the hospitals from such action.

The study of seasonal variations in health and health-related issues plays a great role in understanding the variables that affect the various events. Understanding the variation in conception and delivery rates is of immense value in time-assisted reproductive procedures, in other issues relating to reproductive care, and when planning for a more efficient service delivery.

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