Interpregnancy intervals, or the time from one live birth to the conception of another pregnancy, have been associated with negative perinatal outcomes, including low birthweight, prematurity, small for gestational age, labor complications, and even infant mortality.\(^1,2\)

Although the causal mechanism between interpregnancy intervals and negative perinatal outcomes remains unknown, there are two schools of thought as to the underlying cause. The first asserts that interpregnancy intervals are a marker for social factors, such as marital status or socioeconomic status, that ultimately cause poor outcomes.\(^3,4\) Alternately, some researchers have suggested that maternal nutrient depletion is the reason for negative perinatal outcomes after a short interpregnancy interval.\(^5\)

Recent research has found that interpregnancy intervals that are either too short or too long are associated with negative perinatal outcomes. This is known as a J-shaped relationship (see page 4 for more details). Based on findings from Zhu, 2004, interpregnancy intervals were divided into three categories: short (less than 18 months), optimal (18 to less than 24 months), and long (24 months or more).\(^6\)

The “optimal” interpregnancy interval is the time between pregnancies that has been associated in previous research with the lowest risk of negative outcomes for both mother and infant.

This issue of the *MI PRAMS Delivery* investigates the prevalence, characteristics, and outcomes related to interpregnancy intervals of different lengths, using MI PRAMS data from 2007.\(\diamond\)

### Prevalence of Last Interval Length Among Women with More Than One Child

The MI PRAMS survey is linked to state birth records, which contain information about length of gestation and birth date of the index infant, as well as mother's last live birth month and year. We used 2007 MI PRAMS data to analyze length of gestation.

An estimated total of 69,697 mothers that gave birth in 2007 had at least one previous birth and were included in this analysis. The interpregnancy interval was calculated as the time in months from the last previous birth and the birth of the index infant (2007 in this case), minus the corresponding length of gestation. Using the above three categories of interpregnancy intervals, we found that slightly over 42% of Michigan’s multiparous mothers fell into the category of a short interpregnancy interval, and approximately 46% had a long interval, while 12% conceived at the optimal time — more than 18 months, but less than 24 months, after the last birth.\(\diamond\)

#### Table 1. Distribution of Interpregnancy Intervals, MI PRAMS 2007

<table>
<thead>
<tr>
<th>Interval Length</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short: &lt;18 months</td>
<td>29,447</td>
<td>42.1</td>
</tr>
<tr>
<td>Optimal: 18 to &lt;24 months</td>
<td>8,372</td>
<td>12.0</td>
</tr>
<tr>
<td>Long: 24+ months</td>
<td>32,079</td>
<td>45.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>69,697</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Characteristics of Women With Short, Optimal, and Long Interpregnancy Intervals

We investigated whether or not interpregnancy intervals differed across demographic categories of women with at least one live birth prior to 2007. Teens had the highest prevalence of short interpregnancy interval (95.4%, CI: 89.6-98.1), followed by women aged 20 to 29 (68.0%, CI: 64.0-71.6), while only 56.3% (CI: 51.6-61.0) of women 30 and older had a short interval. This pattern was expected since women can space their pregnancies farther apart as they age and acquire more reproductive years.

Among mothers delivering an infant in 2007, the last interpregnancy interval did not differ statistically among racial/ethnic groups nor mother’s educational status (data not shown).

Three quarters of women with an optimal interpregnancy interval were married, compared to 43.0% of those with a short interval and only 36.6% of those with a long interval (Figure 1).

A similar pattern emerged regarding pregnancy intendedness. Two thirds of women with optimal intervals had intended to become pregnant, while only 52.5% and 59.0% of those with short and long intervals intended their pregnancies, respectively (Figure 2).

Figure 1. Prevalence of married women by interpregnancy interval, MI PRAMS 2007

Figure 2. Prevalence of unintended pregnancy by interpregnancy interval, MI PRAMS 2007
Effective contraception is an important factor for optimal pregnancy spacing. Figure 3 depicts the percent of women who were using any type of birth control at the conception of their 2007 pregnancy. Types include withdrawal, the rhythm method, condoms, hormonal methods, and surgical sterilization.

The prevalence of preconception birth control use was similar across interpregnancy interval groups. However, 39.0 to 44.0% of women were using some type of contraception when they conceived their infant born in 2007. This may indicate that particular contraceptive methods were either not effective or not used correctly in more than a third of women from all interval categories.

Patient education regarding the most effective, reversible contraception methods is essential in the effort to assist women in achieving healthy interpregnancy intervals.

### Prevalence of Birth Control Use at Conception of 2007 Birth by Interpregnancy Interval Length

![Bar chart showing prevalence of birth control use at conception of 2007 birth by interpregnancy interval](chart)

<table>
<thead>
<tr>
<th>Interval Length</th>
<th>Percent Using Birth Control</th>
<th>Percent No Birth Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short (&lt;18 months)</td>
<td>61.0%</td>
<td>56.0%</td>
</tr>
<tr>
<td>Optimal (18 to &lt;24 months)</td>
<td>39.0%</td>
<td>61.0%</td>
</tr>
<tr>
<td>Long (24+ months)</td>
<td>44.0%</td>
<td>56.0%</td>
</tr>
</tbody>
</table>

Since previous research has linked both short and long interpregnancy intervals with several negative outcomes for mothers and infants, a series of logistic regression models were created in order to test those associations using the 2007 MI PRAMS data.

Variables considered for confounding included maternal age, race, education, marital status, insurance status, parity, and pregnancy intendedness.

The results of the logistic regression analysis showed no significant differences between short, optimal, and long interpregnancy intervals for the following outcome measures: hospitalization during pregnancy, infant mortality, low birth weight, premature rupture of membranes, premature delivery, birth defects, or admission to NICU.

An association was found between interpregnancy interval and the presence of labor or delivery complications. Compared to women with optimal intervals, women with short intervals between pregnancies were 3.4 times more likely to experience labor or delivery complications (95% confidence interval: 1.4-8.8) and women with long intervals were 4.0 times more likely to have complications (95% confidence interval: 1.5-10.4).

These results support the findings of an earlier analysis of births to multiparous Michigan mothers from 1994-2002. Zhu, et al reported that compared to intervals of less than 2 years, increasing interpregnancy intervals were associated with a higher proportions of labor complications. This association was strongest for women with 10+ years between pregnancies (1.5 times the odds of complications as those with an interval of less than 2 years).

<table>
<thead>
<tr>
<th>Interval Length</th>
<th>Adjusted Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>3.4</td>
<td>(1.4—8.8)</td>
</tr>
<tr>
<td>Optimal</td>
<td>1.0</td>
<td>Reference</td>
</tr>
<tr>
<td>Long</td>
<td>4.0</td>
<td>(1.5—10.4)</td>
</tr>
</tbody>
</table>
### Epi Corner: J-shaped Curves

The most well known relationship between two variables is a linear one: for example, as age increases, so does the average number of births per woman. Linear relationships are intuitive and relatively easy to spot on a graph.

J-shaped relationships are sometimes overlooked because they are more difficult to detect using common analytic methods. When graphed, they appear as a curve shaped like the letter “J”. These relationships are characterized by high risk at the extremes of the dependent variable, along with an “optimal” range that is at the lowest risk for a given outcome. Perhaps the J-shaped curve led to the old adage, “Everything in moderation.”

![Figure 4. J-shaped relationship between interpregnancy interval (X axis) and labor complications odds ratio (Y axis)](image)

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### About Michigan’s PRAMS

The Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based survey, is a CDC initiative to reduce infant mortality and low birth weight.

It is a combination mail/telephone survey designed to monitor selected self-reported maternal behaviors and experiences of women who delivered a live infant in Michigan that occur before and during pregnancy, as well as early postpartum periods. Information regarding the health of the infant is also collected for analysis. Annually, over 2,000 mothers are selected at random to participate from a frame of eligible birth certificates. Women who delivered a low-birth weight infant were over-sampled in order to ensure adequate representation. The results are weighted to represent the entire cohort of women who delivered during that time frame.

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### References


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