Interpregnancy interval in lower versus higher human development index countries: a hypothesis about pregnancy spacing

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Background: A secondary analysis was conducted of two separate datasets to observe the association between maternal age and interpregnancy interval (IPI).

Methods: The IPI in a middle-income country (Guatemala) was compared with that of a very-high-income country (USA) among women with two pregnancies.

Results: A regression model found that with each increasing year of age, the IPI increases by 1.26 months (p<0.001) in Guatemala. A regression model found that IPI decreased as women aged in the USA.

Conclusions: It is hypothesized that as countries progress in their development indices, women may delay childbearing, which may result in reduced IPI, as was the case in the USA compared with Guatemala in these datasets.

Keywords: human development index, interpregnancy interval.

Introduction

The World Health Organization (WHO) recommends that the interval a woman should wait before attempting a subsequent pregnancy after a live birth is at least 24 months. The March of Dimes, a US-based organization, published a recommendation for an interpregnancy interval (IPI, the time from a live birth to subsequent conception) of 18 months. These recommendations are made to reduce the risk of adverse maternal, perinatal and infant outcomes, which are prevalent at all ages. However, it is not clear how adverse outcomes vary by maternal age when comparing mothers in low- or middle-income countries with those in high-income settings, so we compared low-income Guatemalan women with a nationally representative cohort of Americans.

The practical importance of this study is in exploring how IPI changes as a country develops and the implications that a changing IPI could have on pregnancy outcomes. The hypothesis was that as countries develop, women likely delay childbearing and potentially have a shorter IPI, which increases the risk of adverse outcomes. Other authors have suggested that a clear focus on improving access to high-quality maternal healthcare and a focus on continuous quality improvement as health systems develop in low- and middle-income countries should be required to reduce pregnancy-related morbidity and mortality.

Methods

Two datasets were accessed, one of which is a convenience cohort of women enrolled in a community antenatal and postnatal care program called Madres Sanas, in a rural area of Guatemala known as the Southwest Trifinio region. During routine care provided between 1 October 2018 and 1 October 2019, the IPIs of women were inputted into a quality improvement database stored in REDCap. The second dataset was provided by the Centers for Disease Control and Prevention (Atlanta, GA, USA) and is known as the National Survey of Family Growth (NSFG). It is a nationally representative survey of women living in the USA. De-identified data on women from the 2013–2015 cohort was downloaded from the website free of charge and sampling methods are detailed there.

In order to calculate an IPI, women had to have a history of a prior delivery and a subsequent conception with a completed interpregnancy interval. In the Madres Sanas dataset we were only...
able to calculate one interval (as this information was just added to the data collection forms in 2018) and in the NSFG dataset, all intervals that were completed were included in the analysis and the number of prior pregnancies was included as a covariate. If an interviewed woman was still in an interval, her interval to date was censored because calculating an IPI was not possible.

### Results

The results of our analysis are shown by a linear regression of maternal age to IPI and illustrates that among 142 women enrolled in the Madres Sanas program in Guatemala, with each increasing year of age, the IPI increases by 1.26 months (p < 0.001; Figure 1A). The mean interval was 36.6 months and the median interval was 34.3 months. Figure 1B illustrates the model coefficient estimates of the gamma regression model for women from the USA. The null hypothesis for this sample corresponds to a log mean ratio of 1; in the figure the data visualization shows that compared with a log mean ratio of 1, the reference group of the youngest women (< 20 y), women 20–30 y of age have no real difference in IPI, while the interval becomes shorter as women age, with woman 30–35 y of age having a significantly shorter interval and women >35 y having an even shorter average interval. The mean IPI among 5755 pregnancies (2581 women) in the NSFG cohort was 31.5 months and the median was 21.0 months.

### Discussion

Our analysis comparing the IPIs among a convenience sample of women in the Southwest Trifinio region of Guatemala and a nationally representative sample of women from the USA suggests that the interval lengthens as women age in the Guatemalan cohort and the interval shortens as women age in the USA cohort. Women in Guatemala had a total fertility rate of 2.92 children per women in 2017, while the number in the USA was 1.77 according to World Bank data. While the mean interval achieved the WHO recommended 24 months between delivery and conception in both settings, the length of that interval varied by the country in which the woman delivered.

The previously noted variation in recommendations regarding IPI between high- and low-income countries in the background section likely reflects a number of pregnancy-related factors that might vary by country of residence, such as maternal nutritional status and recovery time from pregnancy-related inflammatory processes. However, it has also been suggested that prior data on variations in pregnancy spacing may be the result of spurious associations, that statistical adjustment for confounders is incomplete and leads to bias and that the current state of knowledge regarding IPI is unreliable. Therefore we wonder if future recommendations should be made not only by the country’s human development index, but should also consider maternal age.

This analysis is limited by the convenience sampling and small sample size of low-income women in Guatemala, which represents a rural sample, while women from the USA are a nationally representative sample. An analysis of women from the USA hailing from rural areas with data on socio-economic status might be a more interesting comparison for future analyses. Additionally, the two datasets represent different time periods, with the Guatemala data collected in 2018–2019 and the US data representing a 2013–2015 cohort. The inverse relationship we observed between the shortening of the IPI among women living in higher human development index countries is one deserving further exploration. As organizations such as the WHO conduct large-scale research into the IPI and how it varies by development index, they should consider not only pregnancy outcomes, but variations and implications related to maternal age as well.

### Authors’ contributions

The author conceived of and wrote the article without assistance from other authors.
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Data availability: Data is available publically for the National Survey of Family Growth. Data is not available for the Madres Sanas program for privacy reasons.

References
1 World Health Organization. Report of a WHO technical consultation on birth spacing. Available from: https://apps.who.int/iris/bitstream/handle/10665/69855/WHO_RHR_07.1_eng.pdf [accessed 19 June 2020].
2 March of Dimes. Birth spacing and birth outcomes 2015. Available from: https://www.marchofdimes.org/MOD-Birth-Spacing-Factsheet-November-2015.pdf [accessed 19 June 2020].
3 Schummers L, Hutcheon JA, Hernandez-Diaz S, et al. Association of short interpregnancy interval with pregnancy outcomes according to maternal age. JAMA Intern Med. 2018;178(12):1661–70.
4 Nasrin M, Sarker MNI, Huda N, editors. Determinants of health care seeking behavior of pregnant slums dwellers in Bangladesh. Med Sci. 2019;23(95):35–41.
5 Centers for Disease Control and Prevention. National survey of family growth. Available from: https://www.cdc.gov/nchs/nsfg/index.htm [accessed 19 June 2020].
6 Marinovich ML, Regan AK, Gissler M, et al. Developing evidence-based recommendations for optimal interpregnancy intervals in high-income countries: protocol for an international cohort study. BMJ Open. 2019;9(1):e027941.