Applying the Kitagawa Decomposition
Method to Elucidate Contributors to Trend
Changes of Preterm Birth Rates in Michigan,
2008 vs. 2014 and 2014 vs. 2016

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Data source: Michigan resident live birth files (12/13/2017),
Division for Vital Records and Health Statistics, MDHHS
11/2018

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This presentation provides information about applying the Kitagawa Decomposition Method to elucidate contributors to trend changes of preterm birth rates in the State of Michigan, 2008-2014 vs. 2014-2016.

This presentation was prepared by Yan Tian, Maternal and Child Health Epidemiology Section, Michigan Department of Health and Human Services (MDHHS)

Data source: Michigan resident live birth files (12/13/2017), Division for Vital Records and Health Statistics, MDHHS

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Introduction

- Kitagawa decomposition method can help quantify components, or priority areas, of the difference in health outcomes between two populations over time, geography, or demographic groups.

- Required components for the Kitagawa decomposition method:
  - Outcome/Indicator of interest (Prevalence/rate or mean)
  - Two populations/timepoints to compare
  - One predictor

The Kitagawa decomposition method can help quantify components, or priority areas, of the difference in health outcomes between two populations over time, geography, or demographic groups.

There are some required components for the Kitagawa decomposition method:
1. Outcome/Indicator of interest (Prevalence/rate or mean), e.g. infant mortality, maternal mortality, preterm birth, safe sleep practices, contraceptive utilization, etc.
2. Two populations/timepoints to compare, e.g. geographic areas, demographic groups, time, etc.
3. One predictor, e.g. birthweight, maternal age, socioeconomic status, race/ethnicity, chronic conditions, etc.

Applied Examples
Using Kitagawa Decomposition

First Author (Year)	Outcome	Comparison Groups	Predictor
Hirai (2014)	Infant mortality rate	Geographic region	Gestational age, Race/ethnicity
Callaghan (2016)	Infant mortality rate	Time period (stratified by race/ethnicity)	Gestational age
Ferré (2016)	Preterm birth rate	Time period	Maternal age
Davis (2017)	Maternal mortality ratio	Time periods	Maternal age

- Hirai AH, Sappenfield WM, Kogan MD, Barfield WD, Goodman DA, Ghandour RM, Lu MC. Contributors to excess infant mortality in the U.S. South. *American journal of preventive medicine*. 2014; 46(3):219-27.
- Callaghan WM, MacDorman MF, Shapiro-Mendoza CK, Barfield WD. Explaining the recent decrease in US infant mortality rate, 2007-2013. *American journal of obstetrics and gynecology. 2016; 216*(1): 73.e1-73.e8.
- Ferré C, Callaghan W, Olson C, Sharma A, Barfield W. Effects of Maternal Age and Age-Specific Preterm Birth Rates on Overall Preterm Birth Rates — United States, 2007 and 2014. *MMWR* and *Morbidity and Mortality Weekly Report.* 2016; 65:1181–1184.
- Davis NL, Hoyert DL, Goodman DA, Hirai AH, Callaghan WM. Contribution of maternal age and pregnancy checkbox on maternal mortality ratios in the United States, 1978-2012. *American journal of obstetrics and gynecology*. 2017; 217(3):352.e1-352.e7.

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Kitagawa decomposition methods have been used to answer important questions related to maternal and child health, such as the following 4 articles:

Hirai AH, Sappenfield WM, Kogan MD, Barfield WD, Goodman DA, Ghandour RM, Lu MC. Contributors to excess infant mortality in the U.S. South. *American journal of preventive medicine*. 2014; 46(3):219-27.

Callaghan WM, MacDorman MF, Shapiro-Mendoza CK, Barfield WD. Explaining the recent decrease in US infant mortality rate, 2007-2013. *American journal of obstetrics and gynecology. 2016; 216*(1): 73.e1-73.e8.

Ferré C, Callaghan W, Olson C, Sharma A, Barfield W. Effects of Maternal Age and Age-Specific Preterm Birth Rates on Overall Preterm Birth Rates — United States, 2007 and 2014. *MMWR* and *Morbidity and Mortality Weekly Report.* 2016; 65:1181–1184.

Davis NL, Hoyert DL, Goodman DA, Hirai AH, Callaghan WM. Contribution of maternal age and pregnancy checkbox on maternal mortality ratios in the United States, 1978-2012. *American journal of obstetrics and gynecology*. 2017; 217(3):352.e1-352.e7.

Kitagawa Formula

$$R_{2.} - R_{1.} = \sum_{i=1}^{n} \left((P_{2i} - P_{1i}) \times \frac{(R_{2i} + R_{1i})}{2} \right) + \sum_{i=1}^{n} \left((R_{2i} - R_{1i}) \times \frac{(P_{2i} + p_{1i})}{2} \right)$$

Rate difference (Pop 2 vs 1) = *Distribution Component + Predictor-Specific Rate Component*

$R_{2.}$ and $R_{1.}$ = Overall Rate of an Outcome in Populations 2 and 1
i = Category of predictor variable
P_{2i} and P_{1i} = Proportion of population 2 and 1 in category *i* of predictor
R_{2i} and R_{1i} = Rate of outcome in population 2 and 1 in category *i* of predictor

Interpretation: Difference in crude rates (excess rate) attributable to **distributional differences** in predictor i and differences in **predictor-specific rates** of the outcome.

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According to the Kitagawa formula, the difference in crude rates (excess rate) is attributable to **distributional differences** in predictor i and differences in **predictor-specific rates** of the outcome.

Kitagawa Formula: Distribution Component

$$\sum_{i=1}^{n} \left((P_{2i} - P_{1i}) \times \frac{(R_{2i} + R_{1i})}{2} \right)$$

The distribution component is the difference in proportion of a predictor times the average rate in each stratum (*i*), then sum.

Kitagawa EM. Components of a difference between two rates. J Am Stat Assoc 1955;50(272):1168–94.

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The distribution component is the difference in the proportion of a predictor times the average rate in each stratum (*i*), then sum.

Kitagawa Formula: Rate Component

$$\sum_{i=1}^{n} \left((R_{2i} - R_{1i}) \times \frac{(P_{2i} + P_{1i})}{2} \right)$$

The rate component is the difference in rates times the average proportion of a predictor in each stratum (*i*), then sum.

Kitagawa EM. Components of a difference between two rates. J Am Stat Assoc 1955;50(272):1168–94.

The rate component is the difference in rates times the average proportion of a predictor in each stratum (*i*), then sum.

Assessing Component Contribution to Overall Rate Change

- **Percentage Due to Distribution Changes**
  - Distribution Component Total / Total Rate Change * 100
    - 0.01 / −0.87 * 100 = −1.1%
    - This indicates no effect from the distribution component on the overall rate decrease.

- **Percentage Due to Rate Changes**
  - Rate Component Total / Total Rate Change * 100
    - −0.88 / −0.87 * 100 = 101%
    - All of the overall rate decrease was due to the rate component.

Kitagawa EM. Components of a difference between two rates. J Am Stat Assoc 1955;50(272):1168–94.

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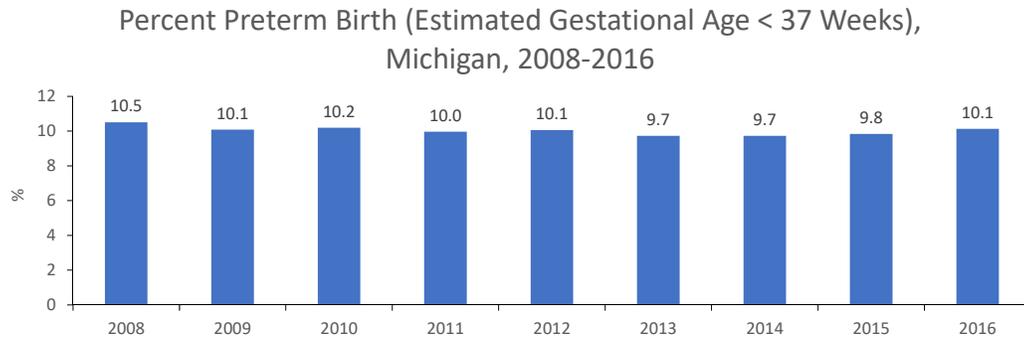**Percentage Due to Distribution Changes =** Distribution Component Total / Total Rate Change * 100

- 0.01 / −0.87 * 100 = −1.1%
- This indicates no effect from the distribution component on the overall rate decrease.

Percentage Due to Rate Changes = Rate Component Total / Total Rate Change * 100

- −0.88 / −0.87 * 100 = 101%
- All of the overall rate decrease was due to the rate component.

Objective

- The preterm birth rate in Michigan decreased from 10.5% of live births in 2008 to 9.7% in 2014, however, it increased from 9.7% in 2014 to 10.1% in 2016.
- The objective of this study was to use Kitagawa decomposition methods to identify potential determinants to changes in preterm birth rate differences in 2008, 2014, and 2016.

Percent Preterm Birth (Estimated Gestational Age < 37 Weeks), Michigan, 2008-2016

Year	%
2008	10.5
2009	10.1
2010	10.2
2011	10.0
2012	10.1
2013	9.7
2014	9.7
2015	9.8
2016	10.1

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This slide shows the figure of percent preterm birth (estimated gestational age <37 weeks) for the state of Michigan, 2008-2016.

The incidence of preterm birth in Michigan was 10.5% in 2008, 10.1% in 2009, 10.2% in 2010, 10.0% in 2011, 10.1% in 2012, 9.7% in 2013, 9.7% in 2014, 9.8% in 2015, and 10.1% in 2016.

The preterm birth rate in Michigan decreased from 10.5% of live births in 2008 to 9.7% in 2014, however, increased from 9.7% in 2014 to 10.1% in 2016.

The objective of this study was to use Kitagawa decomposition methods to identify potential determinants to changes in preterm birth rate differences in 2008, 2014, and 2016.

Data and Measures

- Michigan Vital Records data for all live births to Michigan residents in 2008, 2014, and 2016 were analyzed for the effects of maternal characteristics on the changes in preterm birth rates.

- Preterm birth was defined as a birth of a baby less than 37 completed weeks of gestation and the incidence of preterm birth was expressed as a percentage of live births. Gestational age is determined by the obstetric estimate of gestation.

- The year 2008 was the first year the obstetric estimate was available in Michigan. The year 2014 was the year the preterm birth rate in Michigan was the lowest from 2008 to 2016. The year 2016 was the most recent year with final birth data available at the time of analysis.

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2008 was the first year that obstetric estimate for gestation age was available in Michigan, 2014 was the year that the preterm birth rate in Michigan was the lowest from 2008 to 2016, and 2016 was the most recent year with final birth data available at the time of analysis.

Preterm Births by Maternal Age, Michigan, 2008 vs. 2014

Age (years)	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
<20	12,277	1,293	0.10	10.53	7,037	771	0.06	10.96	-0.04	0.42	0.08	10.74	-0.43	0.03	-0.39
20-24	29,143	2,892	0.24	9.92	27,134	2,532	0.24	9.33	0.00	-0.59	0.24	9.63	-0.03	-0.14	-0.17
25-29	35,542	3,492	0.29	9.82	34,884	3,198	0.30	9.17	0.01	-0.66	0.30	9.50	0.11	-0.20	-0.09
30-34	28,015	2,951	0.23	10.53	30,165	2,900	0.26	9.61	0.03	-0.92	0.25	10.07	0.33	-0.23	0.10
35+	16,243	2,113	0.13	13.01	15,232	1,733	0.13	11.38	0.00	-1.63	0.13	12.19	-0.01	-0.22	-0.23
Total	121,220	12,741		10.51	114,452	11,134		9.73		-0.78			-0.03	-0.75	-0.78
%													4.3%	95.7%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by maternal age in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. A U-shaped relationship between maternal age and preterm birth was present in both years with the lowest preterm birth rate occurring among women aged 25-29 years. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers at all ages ≥20 years. The absolute rate difference was highest among women aged ≥35 years and lowest among teens.
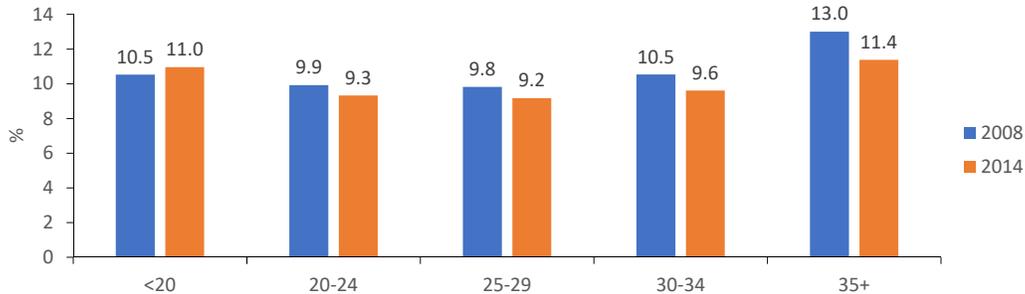
The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, age distribution and age-specific rate components. The change in age distribution contributed to the preterm birth rate decrease among mothers aged ≤24 years. In contrast, the age distribution component for mothers aged ≥25 years, and especially for mothers aged 30-34 years, offset this decline.

When the age distribution components were summed across the age groups, a negligible effect (-0.03) was observed on the overall change in preterm birth rates. The change in age-specific preterm birth rates contributed to the decline in preterm birth rate among mothers aged ≥20 years.

Examining the total effect of both components on the preterm birth rate decline by age group, the largest total effects were observed among mothers aged <20 years and mothers aged ≥35 years. For mothers <20 years, the decrease in age distribution had a larger effect than the increase in the age-specific preterm birth rate. For mothers aged 30-34 years, the total effect of both components did not contribute to the overall preterm birth rate decrease; the rate increases from the age distribution component were greater than the rate decreases from the age-specific rate component.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (-0.03 & −0.75). The percentage due to this distribution component is (−0.03/−0.78)*100 = 4.3 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.75/−0.78)*100 = 95.7 percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Maternal Age, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.03	-0.75	-0.78	4.3%	95.7%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal age in Michigan, 2008 vs 2014.

A U-shaped relationship between maternal age and preterm birth was present in both years with the lowest preterm birth rate occurring among women aged 25-29 years. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers at all ages ≥20 years. The absolute rate difference was highest among women aged ≥35 years and lowest among teens.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (-0.03 & −0.75). The percentage due to this distribution component is (−0.03/−0.78)*100 = 4.3 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.75/−0.78)*100 = 95.7 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Age, Michigan, 2014 vs. 2016

| | 2014 | | | | 2016 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
Age (years)	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
<20	7,037	771	0.06	10.96	5,836	649	0.05	11.12	-0.01	0.16	0.06	11.04	-0.11	0.01	-0.10
20-24	27,134	2,532	0.24	9.33	24,362	2,429	0.21	9.97	-0.02	0.64	0.23	9.65	-0.21	0.14	-0.07
25-29	34,884	3,198	0.30	9.17	35,518	3,346	0.31	9.42	0.01	0.25	0.31	9.29	0.08	0.08	0.16
30-34	30,165	2,900	0.26	9.61	31,393	3,106	0.28	9.89	0.01	0.28	0.27	9.75	0.13	0.08	0.21
35+	15,232	1,733	0.13	11.38	16,263	1,960	0.14	12.05	0.01	0.67	0.14	11.71	0.12	0.09	0.21
Total	114,452	11,134		9.73	113,372	11,490		10.13		0.41			0.01	0.40	0.41
%													1.4%	98.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by maternal age in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. A U-shaped relationship between maternal age and preterm birth was present in both years with the lowest preterm birth rate occurring among women aged 25-29 years. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all age groups. The absolute rate difference was highest among women aged ≥35 years and lowest among teens.
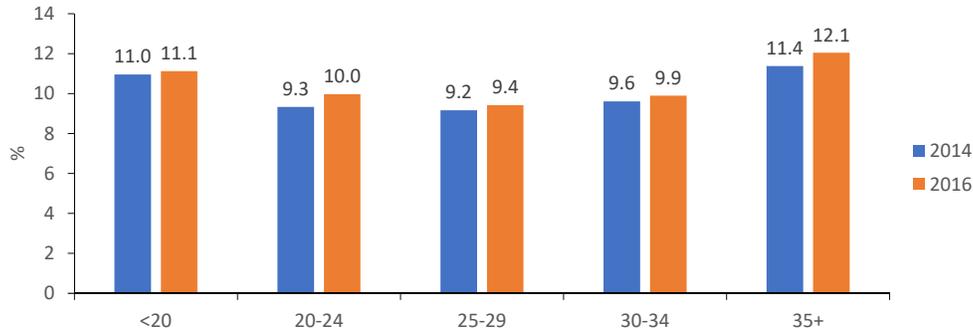
The decomposition analysis partitioned the overall observed rate difference of 0.41 into two parts, age distribution and age-specific rate components. The change in age distribution contributed to the preterm birth rate increase among mothers aged ≥25 years. In contrast, the age distribution component for mothers aged <25 years, and especially for mothers aged 20-24 years, offset this increase.

When the age distribution components were summed across the age groups, a negligible effect (0.01) was observed on the overall change in preterm birth rates. The change in age-specific preterm birth rates contributed to the increase in preterm birth rate across all age groups.

Examining the total effect of both components on the preterm birth rate increase by age group, the largest total effects were observed among mothers aged ≥25 years. For mothers <25 years, the decrease in age distribution had a larger effect than the increase in the age-specific preterm birth rate. For mothers aged ≥25 years, the total effect of both components contributed to the overall preterm birth rate increase; the rate increases from the age distribution component were greater or equate to the rate increases from the age-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.01 & 0.40). The percentage due to the distribution component is (0.01/0.41)*100 = 1.4 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.41)*100 = 98.6 percent. This indicates that most of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Maternal Age, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.01	0.40	0.41	1.4%	98.6%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal age in Michigan, 2014 vs 2016.

A U-shaped relationship between maternal age and preterm birth was present in both years with the lowest preterm birth rate occurring among women aged 25-29 years. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all age groups. The absolute rate difference was highest among women aged ≥35 years and lowest among teens.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.01 & 0.40). The percentage due to the distribution component is (0.01/0.41)*100 = 1.4 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.41)*100 = 98.6 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Maternal Race/Ethnicity, Michigan, 2008 vs. 2014

Race/ Ethnicity	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
White non-Hispanic	83,720	8,131	0.70	9.71	79,138	6,957	0.71	8.79	0.00	-0.92	0.71	9.25	0.04	-0.65	-0.61
Black non-Hispanic	21,899	3,222	0.18	14.71	20,702	2,848	0.19	13.76	0.00	-0.96	0.18	14.24	0.01	-0.18	-0.16
Hispanic	8,682	738	0.07	8.50	7,625	682	0.07	8.94	0.00	0.44	0.07	8.72	-0.04	0.03	-0.01
American Indian	505	57	0.00	11.29	459	48	0.00	10.46	0.00	-0.83	0.00	10.87	0.00	0.00	0.00
Asian/Pacific Islander	3,971	322	0.03	8.11	3,724	319	0.03	8.57	0.00	0.46	0.03	8.34	0.00	0.02	0.01
Total	118,777	12,470		10.50	111,648	10,854		9.72		-0.78			0.01	-0.78	-0.78
%													-1.0%	101.0%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by maternal race/ethnicity in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among Asian/Pacific Islander women and the highest preterm birth rate was found among Black non-Hispanic women. The decrease in preterm birth rates from 2008 to 2014 was observed for Black non-Hispanic, White non-Hispanic, or American Indian mothers. The absolute rate difference was highest among Black non-Hispanic women and lowest among Hispanic women.

The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, race/ethnicity distribution and race/ethnicity-specific rate components. The change in race/ethnicity distribution contributed to the preterm birth rate decrease among Hispanic mothers. In contrast, the race/ethnicity distribution component for White non-Hispanic and Black non-Hispanic mothers,
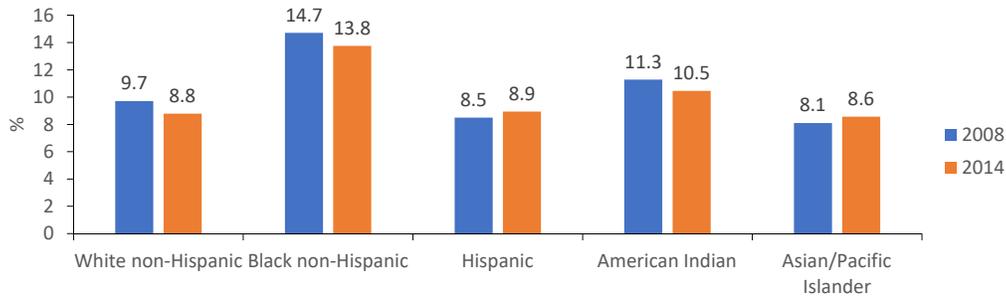
and especially for White non-Hispanic mothers, offset this decline.

When the race/ethnicity distribution components were summed across the race/ethnicity groups, a negligible effect (0.01) was observed on the overall change in preterm birth rates. The change in race/ethnicity-specific preterm birth rates contributed to the decline in preterm birth rate among White non-Hispanic and Black non-Hispanic mothers.

Examining the total effect of both components on the preterm birth rate decline by race/ethnicity group, the largest total effects were observed among White non-Hispanic and Black non-Hispanic mothers. For White non-Hispanic and Black non-Hispanic mothers, the decrease in the race/ethnicity-specific preterm birth rate had a larger effect than the increase in the race/ethnicity distribution. For Hispanic mothers, the rate decreases from the race/ethnicity distribution component were greater than the rate increases from the race/ethnicity-specific rate component. For American Indian mothers, the total effect of both components did not contribute to the overall preterm birth rate decrease. For Asian/Pacific Islander mothers, the rate increases from the race/ethnicity-specific rate component were greater than the rate decreases from the race/ethnicity distribution component.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.01 & −0.78). The percentage due to the distribution component is (0.01/−0.78)*100 = -1.0 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.78/−0.78)*100 = 101.0 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Maternal Race/Ethnicity, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.01	-0.78	-0.78	-1.0%	101.0%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal race/ethnicity in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among Asian/Pacific Islander women and the highest preterm birth rate was found among Black non-Hispanic women. The decrease in preterm birth rates from 2008 to 2014 was observed for Black non-Hispanic, White non-Hispanic, or American Indian mothers. The absolute rate difference was highest among Black non-Hispanic women and lowest among Hispanic women.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.01 & −0.78). The percentage due to the distribution component is (0.01/−0.78)*100 = -1.0 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.78/−0.78)*100 = 101.0 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Race/Ethnicity, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Race/Ethnicity	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
White non-Hispanic	79,138	6,957	0.71	8.79	77,221	7,029	0.70	9.10	-0.01	0.31	0.70	8.95	-0.07	0.22	0.15
Black non-Hispanic	20,702	2,848	0.19	13.76	20,420	2,942	0.19	14.41	0.00	0.65	0.19	14.08	0.00	0.12	0.12
Hispanic	7,625	682	0.07	8.94	7,759	728	0.07	9.38	0.00	0.44	0.07	9.16	0.02	0.03	0.05
American Indian	459	48	0.00	10.46	410	40	0.00	9.76	0.00	-0.70	0.00	10.11	0.00	0.00	-0.01
Asian/Pacific Islander	3,724	319	0.03	8.57	4,327	402	0.04	9.29	0.01	0.72	0.04	8.93	0.05	0.03	0.08
Total	111,648	10,854		9.72	110,137	11,141		10.12		0.39			0.00	0.39	0.39
%													-0.1%	100.1%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by maternal race/ethnicity in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lowest preterm birth rate was present among Asian/Pacific Islander or White non-Hispanic women and the highest preterm birth rate was found among Black non-Hispanic women. The increase in preterm birth rates from 2014 to 2016 was observed for Black non-Hispanic, White non-Hispanic, Hispanic, or Asian/Pacific Islander mothers. The absolute rate difference was highest among Asian/Pacific Islander women and lowest among White non-Hispanic women.

The decomposition analysis partitioned the overall observed rate difference of 0.39 into two parts, race/ethnicity distribution and race/ethnicity specific rate components. The change in race/ethnicity distribution contributed to the preterm birth rate increase among Asian/Pacific Islander mothers. In contrast, the race/ethnicity distribution component for White non-Hispanic mothers offset this
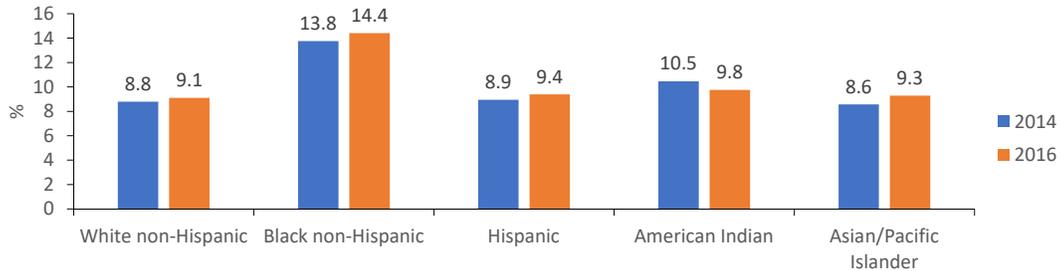
increase.

When the race/ethnicity distribution components were summed across the race/ethnicity groups, a negligible effect (0.00) was observed on the overall change in preterm birth rates. The change in race/ethnicity-specific preterm birth rates contributed to the increase in preterm birth rate among White non-Hispanic and Black non-Hispanic mothers.

Examining the total effect of both components on the preterm birth rate increase by race/ethnicity group, the largest total effects were observed among White non-Hispanic and Black non-Hispanic mothers. For White non-Hispanic and Black non-Hispanic mothers, the increase in the race/ethnicity-specific preterm birth rate had a larger effect than the decrease in the race/ethnicity distribution. For Hispanic mothers, the rate increases from the race/ethnicity-specific rate component were greater than the rate increases from the race/ethnicity distribution component. For American Indian mothers, the total effect of both components did not contribute to the overall preterm birth rate increase. For Asian/Pacific Islander mothers, the rate increases from the race/ethnicity distribution component were greater than the rate decreases from the race/ethnicity-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.39 which equals the sum of the distribution and rate components (0.00 & 0.39). The percentage due to the distribution component is (0.00/0.39)*100 = -0.1 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.39)*100 = 100.1 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Maternal Race/Ethnicity, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.00	0.39	0.39	-0.1%	100.1%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal race/ethnicity in Michigan, 2014 vs 2016.

In both years the lowest preterm birth rate was present among Asian/Pacific Islander or White non-Hispanic women and the highest preterm birth rate was found among Black non-Hispanic women. The increase in preterm birth rates from 2014 to 2016 was observed for Black non-Hispanic, White non-Hispanic, Hispanic, or Asian/Pacific Islander mothers. The absolute rate difference was highest among Asian/Pacific Islander women and lowest among White non-Hispanic women.

The PTB rate difference between 2014 and 2016 was 0.39 which equals the sum of the distribution and rate components (0.00 & 0.39). The percentage due to the distribution component is (0.00/0.39)*100 = -0.1 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.39)*100 = 100.1 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Maternal Education, Michigan, 2008 vs. 2014

Education	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
< High School Diploma or GED	20,006	2,172	0.17	10.86	14,065	1,589	0.12	11.30	-0.04	0.44	0.14	11.08	-0.47	0.06	-0.41
High School Diploma or GED	32,238	3,581	0.27	11.11	28,598	3,077	0.25	10.76	-0.02	-0.35	0.26	10.93	-0.18	-0.09	-0.27
Some College	36,250	3,724	0.30	10.27	38,110	3,542	0.33	9.29	0.03	-0.98	0.32	9.78	0.33	-0.31	0.02
4 or More Years College	31,857	3,123	0.26	9.80	33,040	2,819	0.29	8.53	0.03	-1.27	0.28	9.17	0.23	-0.35	-0.12
Total	120,351	12,600		10.47	113,813	11,027		9.69		-0.78			-0.09	-0.69	-0.78
%													11.5%	88.5%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by maternal education in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among women who finished the 4 or more years college and the highest preterm birth rate was found among women who had at most high school education. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who finished high school or above. The absolute rate difference was highest among mothers who finish 4 or more years college.

The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, education distribution and education-specific rate components. The change in education distribution contributed to the preterm birth rate decrease among mothers who had less than high school education. In contrast, the education distribution component for mothers who had some college or above offset this
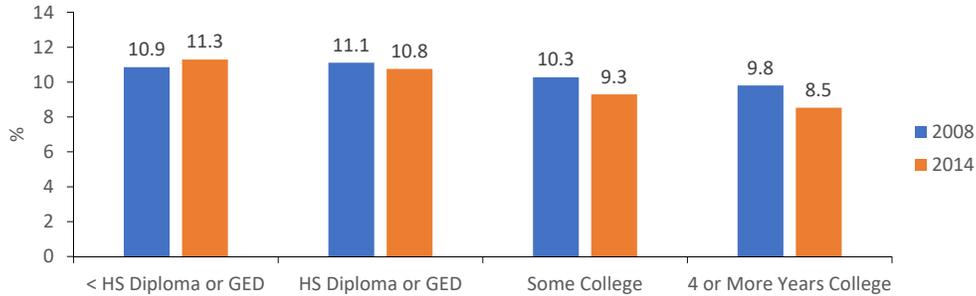
decline.

When the education distribution components were summed across the education groups, a smaller effect (-0.09) was observed on the overall change in preterm birth rates. The change in education-specific preterm birth rates contributed to the decline in preterm birth rate among mothers who had some college or above education.

Examining the total effect of both components on the preterm birth rate decline by education group, the largest total effects were observed among mothers who had at most high school education. For mothers who had at most high school education, the decrease in the education distribution had a larger effect than the change in the education-specific preterm birth rate. For mothers who had some college education, the rate increases from the education distribution component were greater than the rate decreases from the education-specific rate component. For mothers who had 4 or more years college education, the rate decreases from the education-specific rate component were greater than the rate increases from the education distribution component.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (-0.09 & −0.69). The percentage due to the distribution component is (−0.09/−0.78)*100 = 11.5 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.69/−0.78)*100 = 88.5 percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Maternal Education, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.09	-0.69	-0.78	11.5%	88.5%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal education in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among women who finished the 4 or more years college and the highest preterm birth rate was found among women who had at most high school education. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who finished high school or above. The absolute rate difference was highest among mothers who finish 4 or more years college.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (-0.09 & −0.69). The percentage due to the distribution component is (−0.09/−0.78)*100 = 11.5 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.69/−0.78)*100 = 88.5 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Education, Michigan, 2014 vs. 2016

| Education | 2014 | | | | 2016 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
< High School Diploma or GED	14,065	1,589	0.12	11.30	12,871	1,524	0.11	11.84	-0.01	0.54	0.12	11.57	-0.10	0.06	-0.04
High School Diploma or GED	28,598	3,077	0.25	10.76	28,261	3,076	0.25	10.88	0.00	0.12	0.25	10.82	0.01	0.03	0.04
Some College	38,110	3,542	0.33	9.29	36,914	3,687	0.33	9.99	-0.01	0.69	0.33	9.64	-0.06	0.23	0.17
4 or More Years College	33,040	2,819	0.29	8.53	34,200	3,003	0.30	8.78	0.01	0.25	0.30	8.66	0.12	0.07	0.20
Total	113,813	11,027		9.69	112,246	11,290		10.06		0.37			-0.03	0.40	0.37
%													-8.3%	108.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by maternal education in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lowest preterm birth rate was present among women who finished the 4 or more years college and the highest preterm birth rate was found among women who had less than high school education. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all education groups. The absolute rate difference was highest among mothers who had some college.

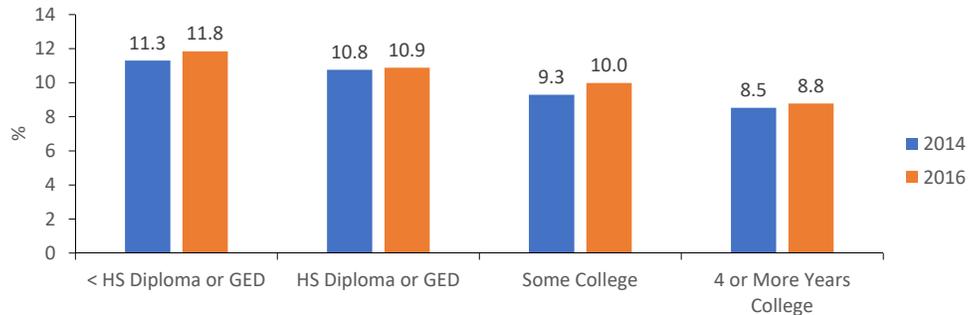The decomposition analysis partitioned the overall observed rate difference of 0.37 into two parts, education distribution and education-specific rate components. The change in education distribution contributed to the preterm birth rate increase among mothers who had 4 or more years college education. In contrast, the education distribution component for mothers who had less than high school education offset this increase.

When the education distribution components were summed across the education groups, a smaller effect (-0.03) was observed on the overall change in preterm birth rates. The change in education-specific preterm birth rates contributed to the increase in preterm birth rate among mothers who had some college or above education.

Examining the total effect of both components on the preterm birth rate increase by education group, the largest total effects were observed among mothers who had some college or above education. For mothers who had less than high school education, the decrease in the education distribution had a larger effect than the change in the education-specific preterm birth rate. For mothers who had high school or some college education, the rate increases from the education-specific rate component were greater than the rate changes from the education distribution component. For mothers who had 4 or more years college education, the rate increases from the education distribution component were greater than the rate increases from the education-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (-0.03 & 0.40). The percentage due to the distribution component is (-0.03/0.37)*100 = -8.3 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.37)*100 = 108.3 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Maternal Education, Michigan, 2014 vs 2016

Education	2014	2016
< HS Diploma or GED	11.3	11.8
HS Diploma or GED	10.8	10.9
Some College	9.3	10.0
4 or More Years College	8.5	8.8

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.03	0.40	0.37	-8.3%	108.3%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by maternal education in Michigan, 2014 vs 2016.

In both years the lowest preterm birth rate was present among women who finished the 4 or more years college and the highest preterm birth rate was found among women who had less than high school education. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all education groups. The absolute rate difference was highest among mothers who had some college.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (-0.03 & 0.40). The percentage due to the distribution component is (-0.03/0.37)*100 = -8.3 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.37)*100 = 108.3 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Maternal Payment Source, Michigan, 2008 vs. 2014

Payment Source	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Private Insurance	65,680	6,660	0.55	10.14	60,753	5,537	0.53	9.11	-0.02	-1.03	0.54	9.63	-0.15	-0.55	-0.71
Medicaid	52,226	5,679	0.44	10.87	49,008	5,083	0.43	10.37	-0.01	-0.50	0.43	10.62	-0.07	-0.22	-0.29
Self-Pay	1,300	162	0.01	12.46	1,778	183	0.02	10.29	0.00	-2.17	0.01	11.38	0.05	-0.03	0.03
Other	593	66	0.00	11.13	2,593	298	0.02	11.49	0.02	0.36	0.01	11.31	0.20	0.01	0.21
Total	119,799	12,567		10.49	114,132	11,101		9.73		-0.76			0.03	-0.80	-0.76
%													-4.2%	104.2%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by payment source in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among women who used private insurance as the payment source and the highest preterm birth rate was found among women who paid by themselves or used other payment source. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who used private insurance, Medicaid, or self-pay. The absolute rate difference was highest among mothers who paid by themselves.

The decomposition analysis partitioned the overall observed rate difference of -0.76 into two parts, payment source distribution and payment source-specific rate components. The change in payment source distribution contributed to the preterm birth rate decrease among mothers who used private insurance or Medicaid. In contrast, the payment source distribution component for mothers who
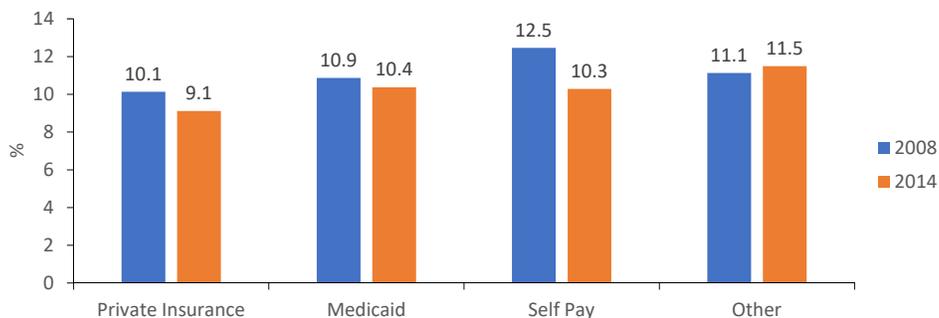
paid by themselves or used other payment source offset this decline.

When the payment source distribution components were summed across the payment source groups, a smaller effect (0.03) was observed on the overall change in preterm birth rates. The change in payment source-specific preterm birth rates contributed to the decline in preterm birth rate among mothers who used private insurance or Medicaid insurance.

Examining the total effect of both components on the preterm birth rate decline by payment source group, the largest total effects were observed among mothers who used private insurance. For mothers who used private insurance or Medicaid insurance, the decrease in the payment source-specific preterm birth rate had a larger effect than the decrease in the payment source distribution. For mothers who paid by themselves or used other payment source, the rate increases from the payment source distribution component were greater than the rate changes from the payment source-specific rate component.

The PTB rate difference between 2008 and 2014 was −0.76 which equals the sum of the distribution and rate components (0.03 & −0.80). The percentage due to the distribution component is (0.03/−0.76)*100 = -4.2 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.80/−0.76)*100 = 104.2 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Payment Source, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.03	-0.80	-0.76	-4.2%	104.2%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by maternal payment source in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among women who used private insurance as the payment source and the highest preterm birth rate was found among women who paid by themselves or used other payment source. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who used private insurance, Medicaid, or self-pay. The absolute rate difference was highest among mothers who paid by themselves.

The PTB rate difference between 2008 and 2014 was −0.76 which equals the sum of the distribution and rate components (0.03 & −0.80). The percentage due to the distribution component is (0.03/−0.76)*100 = -4.2 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.80/−0.76)*100 = 104.2 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Payment Source, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Payment Source	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Private Insurance	60,753	5,537	0.53	9.11	61,964	5,652	0.55	9.12	0.02	0.01	0.54	9.12	0.15	0.00	0.15
Medicaid	49,008	5,083	0.43	10.37	48,699	5,594	0.43	11.49	0.00	1.12	0.43	10.93	0.02	0.48	0.50
Self Pay	1,778	183	0.02	10.29	1,760	159	0.02	9.03	0.00	-1.26	0.02	9.66	0.00	-0.02	-0.02
Other	2,593	298	0.02	11.49	582	45	0.01	7.73	-0.02	-3.76	0.01	9.61	-0.17	-0.05	-0.22
Total	114,132	11,101		9.73	113,005	11,450		10.13		0.41			-0.01	0.41	0.41
%													-1.5%	101.5%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by payment source in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In 2014 the lowest preterm birth rate was present among women who used private insurance as their payment source and the highest preterm birth rate was found among women who used other payment source. In 2016 the lowest preterm birth rate was present among women who used other payment source and the highest preterm birth rate was found among women who used Medicaid as their payment source. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who used private insurance or Medicaid. The absolute rate difference was highest among mothers who used other payment source.

The decomposition analysis partitioned the overall observed rate difference of 0.41 into two parts, payment source distribution and payment source-specific rate components. The change in payment source distribution contributed to the
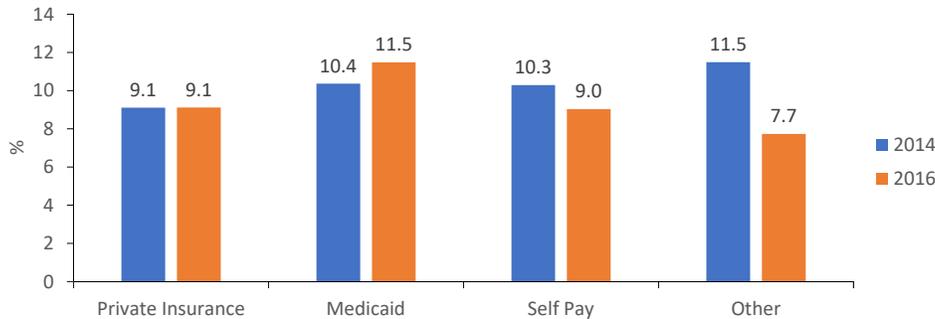
preterm birth rate increase among mothers who used private insurance or Medicaid. In contrast, the payment source distribution component for mothers who used other payment source offset this increase.

When the payment source distribution components were summed across the payment source groups, a smaller effect (-0.01) was observed on the overall change in preterm birth rates. The change in payment source-specific preterm birth rates contributed to the increase in preterm birth rate among mothers who used Medicaid insurance as their payment source.

Examining the total effect of both components on the preterm birth rate increase by payment source group, the largest total effects were observed among mothers who used Medicaid insurance. For mothers who used Medicaid insurance, the increase in the payment source-specific preterm birth rate had a larger effect than the increase in the payment source distribution. For mothers who used private insurance or other payment source, the rate changes from the payment source distribution component were greater than the rate changes from the payment source-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (-0.01 & 0.41). The percentage due to the distribution component is (-0.01/0.41)*100 = -1.5 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.41)*100 = 101.5 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Payment Source, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.01	0.41	0.41	-1.5%	101.5%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by maternal payment source in Michigan, 2014 vs 2016.

In 2014 the lowest preterm birth rate was present among women who used private insurance as their payment source and the highest preterm birth rate was found among women who used other payment source. In 2016 the lowest preterm birth rate was present among women who used other payment source and the highest preterm birth rate was found among women who used Medicaid as their payment source. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who used Medicaid insurance. The absolute rate difference was highest among mothers who used other payment source.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (-0.01 & 0.41). The percentage due to the distribution component is (-0.01/0.41)*100 = -1.5 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.41)*100 = 101.5 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Maternal Prenatal BMI, Michigan, 2008 vs. 2014

Prenatal BMI	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Underweight	4,431	584	0.04	13.18	3,466	412	0.03	11.89	-0.01	-1.29	0.03	12.53	-0.08	-0.04	-0.13
Normal weight	55,131	5,416	0.47	9.82	47,676	4,293	0.43	9.00	-0.04	-0.82	0.45	9.41	-0.39	-0.37	-0.77
Overweight	29,008	2,874	0.25	9.91	28,338	2,498	0.26	8.82	0.01	-1.09	0.25	9.36	0.07	-0.28	-0.21
Obese	27,594	3,092	0.24	11.21	30,691	3,214	0.28	10.47	0.04	-0.73	0.26	10.84	0.44	-0.19	0.26
Total	116,164	11,966		10.30	110,171	10,417		9.46		-0.85			0.04	-0.88	-0.85
%													-4.4%	104.4%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by prenatal body mass index (BMI) in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In 2008 the lowest preterm birth rate was present among normal weight women and the highest preterm birth rate was found among underweight women. In 2014 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all prenatal BMI groups. The absolute rate difference was highest among underweight mothers.
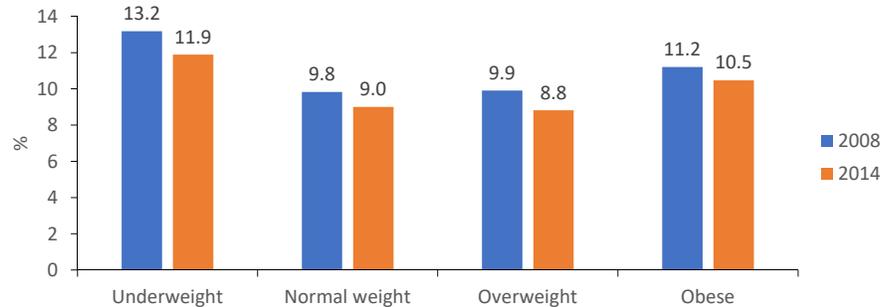
The decomposition analysis partitioned the overall observed rate difference of -0.85 into two parts, prenatal BMI distribution and prenatal BMI-specific rate components. The change in prenatal BMI distribution contributed to the preterm birth rate decrease among normal weight mothers. In contrast, the prenatal BMI distribution component for obese mothers offset this decline.

When the prenatal BMI distribution components were summed across the prenatal BMI groups, a smaller effect (0.04) was observed on the overall change in preterm birth rates. The change in prenatal BMI-specific preterm birth rates contributed to the decline in preterm birth rate among normal weight or overweight mothers.

Examining the total effect of both components on the preterm birth rate decline by prenatal BMI group, the largest total effects were observed among normal weight mothers. For underweight or normal weight, the decrease in the prenatal BMI distribution had a larger effect than the decrease in the prenatal BMI-specific preterm birth rate. For overweight mothers, the rate decrease from the prenatal BMI-specific rate component were greater than the rate increases from the prenatal BMI distribution component. For obese mothers, the rate increases from the prenatal BMI distribution component were greater than the rate decrease from the prenatal BMI-specific rate component.

The PTB rate difference between 2008 and 2014 was −0.85 which equals the sum of the distribution and rate components (0.04 & −0.88). The percentage due to the distribution component is (0.04/−0.85)*100 = -4.4 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.88/−0.85)*100 = 104.4 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Prenatal Body Mass Index, Michigan, 2008 vs 2014

	Underweight	Normal weight	Overweight	Obese
2008	13.2	9.8	9.9	11.2
2014	11.9	9.0	8.8	10.5

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.04	-0.88	-0.85	-4.4%	104.4%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by maternal prenatal body mass index (BMI) in Michigan, 2008 vs 2014.

In 2008 the lowest preterm birth rate was present among normal weight women and the highest preterm birth rate was found among underweight women. In 2014 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all prenatal BMI groups. The absolute rate difference was highest among underweight mothers.

The PTB rate difference between 2008 and 2014 was −0.85 which equals the sum of the distribution and rate components (0.04 & −0.88). The percentage due to the distribution component is (0.04/−0.85)*100 = -4.4 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.88/−0.85)*100 = 104.4 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Prenatal BMI, Michigan, 2014 vs. 2016

Prenatal BMI	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Underweight	3,466	412	0.03	11.89	3,318	382	0.03	11.51	0.00	-0.37	0.03	11.70	-0.01	-0.01	-0.03
Normal weight	47,676	4,293	0.43	9.00	45,928	4,157	0.42	9.05	-0.01	0.05	0.43	9.03	-0.12	0.02	-0.10
Overweight	28,338	2,498	0.26	8.82	28,463	2,737	0.26	9.62	0.00	0.80	0.26	9.22	0.02	0.21	0.23
Obese	30,691	3,214	0.28	10.47	31,879	3,477	0.29	10.91	0.01	0.43	0.28	10.69	0.13	0.12	0.26
Total	110,171	10,417		9.46	109,588	10,753		9.81		0.36			0.02	0.34	0.36
%													5.0%	95.0%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied elucidate contributors to the increase of the incidence of preterm birth by prenatal body mass index (BMI) in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In 2014 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. In 2016 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all prenatal BMI groups except underweight mothers. The absolute rate difference was highest among overweight mothers.

The decomposition analysis partitioned the overall observed rate difference of 0.36 into two parts, prenatal BMI distribution and prenatal BMI-specific rate components. The change in prenatal BMI distribution contributed to the preterm birth rate increase among obese and overweight mothers. In contrast, the prenatal
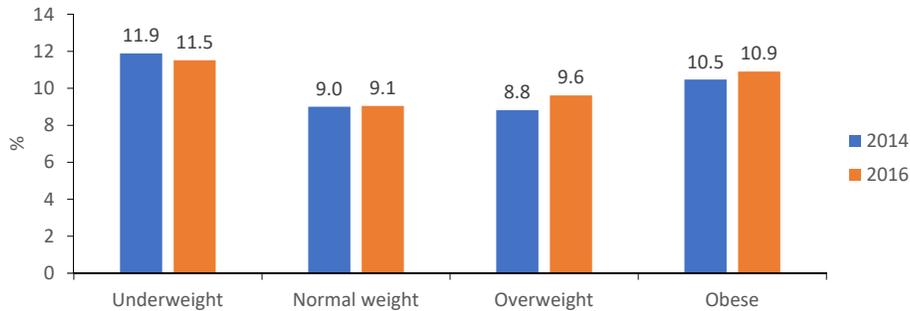
BMI distribution component for normal weight mothers offset this increase.

When the prenatal BMI distribution components were summed across the prenatal BMI groups, a smaller effect (0.02) was observed on the overall change in preterm birth rates. The change in prenatal BMI-specific preterm birth rates contributed to the increase in preterm birth rate among overweight or obese mothers.

Examining the total effect of both components on the preterm birth rate increase by prenatal BMI group, the largest total effects were observed among obese and overweight mothers. For underweight or normal weight, the decrease in the prenatal BMI distribution had a larger effect than the change in the prenatal BMI-specific preterm birth rate. For overweight mothers, the rate increase from the prenatal BMI-specific rate component were greater than the rate increases from the prenatal BMI distribution component. For obese mothers, the rate increases from the prenatal BMI distribution component were greater than the rate increase from the prenatal BMI-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.36 which equals the sum of the distribution and rate components (0.02 & 0.34). The percentage due to the distribution component is (0.02/0.36)*100 = 5.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.34/0.36)*100 = 95.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Prenatal Body Mass Index, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.02	0.34	0.36	5.0%	95.0%

This slide shows the incidence of preterm birth by maternal prenatal body mass index (BMI) in Michigan, 2014 vs 2016.

In 2014 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. In 2016 the lowest preterm birth rate was present among overweight women and the highest preterm birth rate was found among underweight women. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all prenatal body mass index (BMI) groups except underweight mothers. The absolute rate difference was highest among overweight mothers.

The PTB rate difference between 2014 and 2016 was 0.36 which equals the sum of the distribution and rate components (0.02 & 0.34). The percentage due to the distribution component is (0.02/0.36)*100 = 5.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.34/0.36)*100 = 95.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Maternal Prenatal Care Began, Michigan, 2008 vs. 2014

| Prenatal Care Began | 2008 | | | | 2014 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
None	2,862	731	0.02	25.54	1,500	400	0.01	26.67	-0.01	1.13	0.02	26.10	-0.28	0.02	-0.26
1st trimester	88,791	8,983	0.76	10.12	83,196	7,651	0.75	9.20	-0.01	-0.92	0.75	9.66	-0.07	-0.69	-0.77
2nd trimester	21,582	2,126	0.18	9.85	21,644	2,075	0.20	9.59	0.01	-0.26	0.19	9.72	0.11	-0.05	0.06
3rd trimester	3,910	306	0.03	7.83	4,537	399	0.04	8.79	0.01	0.97	0.04	8.31	0.06	0.04	0.10
Total	117,145	12,146		10.37	110,877	10,525		9.49		-0.88			-0.19	-0.69	-0.88
%													21.6%	78.4%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by months prenatal care began in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among women who began prenatal care in the 3rd trimester and the highest preterm birth rate was found among women who did not have prenatal care. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who began prenatal care in the 1st and 2nd trimester. The absolute rate difference was highest among mothers who did not have prenatal care.

The decomposition analysis partitioned the overall observed rate difference of -0.88 into two parts, prenatal care distribution and prenatal care-specific rate components. The change in prenatal care distribution contributed to the preterm birth rate decrease among mothers who did not have prenatal care. In contrast, the prenatal care distribution component for mothers who began prenatal care in the
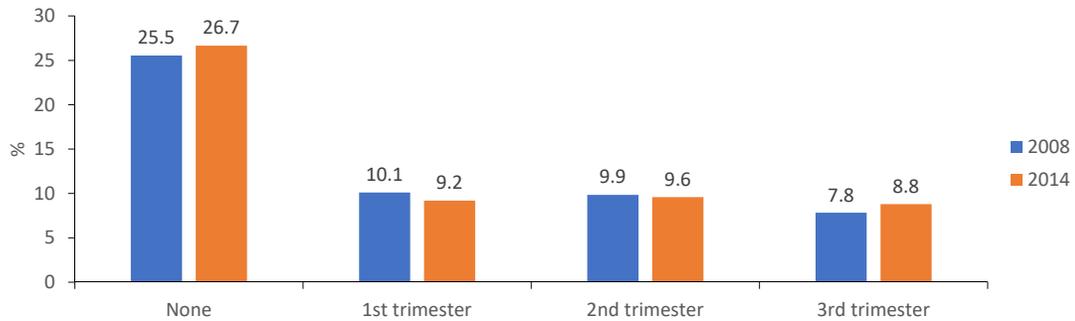
2nd or 3rd trimester offset this decline.

When the prenatal care distribution components were summed across the prenatal care groups, some effect (-0.19) was observed on the overall change in preterm birth rates. The change in prenatal care-specific preterm birth rates contributed to the decline in preterm birth rate among mothers who began prenatal care in the 1st or 2nd trimester.

Examining the total effect of both components on the preterm birth rate decline by prenatal care group, the largest total effects were observed among mothers who began prenatal care in the 1st trimester. For mothers who began prenatal care in the 1st trimester, the decrease in the prenatal care-specific preterm birth rate had a larger effect than the decrease in the prenatal care distribution. For mothers who did not have prenatal care, the rate decrease from the prenatal care distribution component were greater than the rate increases from the prenatal care-specific rate component . For mothers who began prenatal care in the 2nd or 3rd trimester, the rate increases from the prenatal care distribution component were greater than the rate change from the prenatal care-specific rate component.

The PTB rate difference between 2008 and 2014 was -0.88 which equals the sum of the distribution and rate components (-0.19 & -0.69). The percentage due to the distribution component is $(-0.19/-0.88)*100 = 21.6$ percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is $(-0.69/-0.88)*100 = 78.4$ percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Prenatal Care Began, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.19	-0.69	-0.88	21.6%	78.4%

This slide shows the incidence of preterm birth by months prenatal care began in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among women who began prenatal care in the 3rd trimester and the highest preterm birth rate was found among women who did not have prenatal care. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers who began prenatal care in the 1st and 2nd trimester. The absolute rate difference was highest among mothers who did not have prenatal care.

The PTB rate difference between 2008 and 2014 was −0.88 which equals the sum of the distribution and rate components (-0.19 & −0.69). The percentage due to the distribution component is (−0.19/−0.88)*100 = 21.6 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.69/−0.88)*100 = 78.4 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Prenatal Care Began, Michigan, 2014 vs. 2016

| Prenatal Care Began | 2014 | | | | 2016 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
None	1,500	400	0.01	26.67	1,571	467	0.01	29.73	0.00	3.06	0.01	28.20	0.02	0.04	0.06
1st trimester	83,196	7,651	0.75	9.20	83,104	7,865	0.75	9.46	0.00	0.27	0.75	9.33	0.03	0.20	0.23
2nd trimester	21,644	2,075	0.20	9.59	21,057	2,131	0.19	10.12	0.00	0.53	0.19	9.85	-0.04	0.10	0.06
3rd trimester	4,537	399	0.04	8.79	4,539	394	0.04	8.68	0.00	-0.11	0.04	8.74	0.00	0.00	0.00
Total	110,877	10,525		9.49	110,271	10,857		9.85	0.35				0.01	0.34	0.35
%													3.2%	96.8%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by months prenatal care began in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lowest preterm birth rate was present among women who began prenatal care in the 3rd trimester and the highest preterm birth rate was found among women who did not have prenatal care. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who did not have prenatal care or began prenatal care in the 1st and 2nd trimester. The absolute rate difference was highest among mothers who did not have prenatal care.
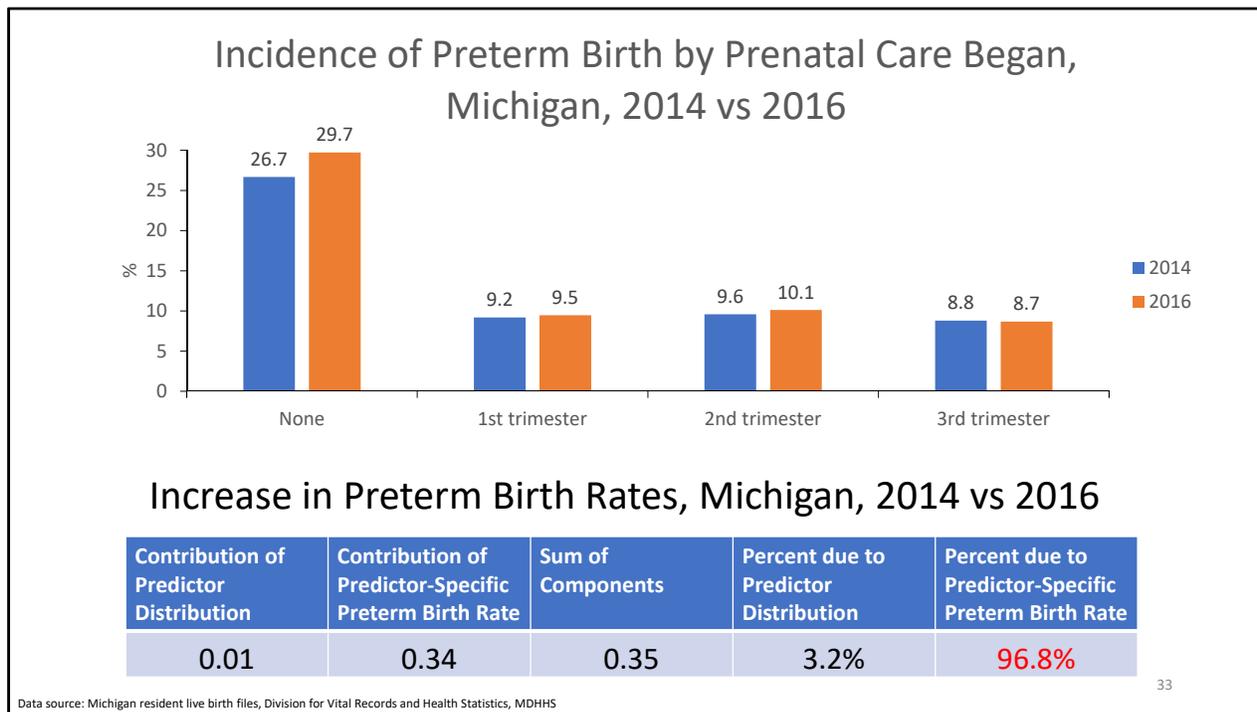
The decomposition analysis partitioned the overall observed rate difference of 0.35 into two parts, prenatal care distribution and prenatal care-specific rate components. The change in prenatal care distribution contributed to the preterm birth rate increase among mothers who did not have prenatal care or began prenatal care in the 1st trimester. In contrast, the prenatal care distribution

component for mothers who began prenatal care in the 2nd trimester offset this increase.

When the prenatal care distribution components were summed across the prenatal care groups, a smaller effect (0.01) was observed on the overall change in preterm birth rates. The change in prenatal care-specific preterm birth rates contributed to the increase in preterm birth rate among mothers who began prenatal care in the 1st or 2nd trimester.

Examining the total effect of both components on the preterm birth rate increase by prenatal care group, the largest total effects were observed among mothers who began prenatal care in the 1st trimester. For mothers who did not have prenatal care or began prenatal care in the 1st or 2nd trimester, the increase in the prenatal care-specific preterm birth rate had a larger effect than the increase in the prenatal care distribution. For mothers who began prenatal care in the 3rd trimester, the total effect of both components did not contribute to the overall preterm birth rate increase.

The PTB rate difference between 2014 and 2016 was 0.35 which equals the sum of the distribution and rate components (0.01 & 0.34). The percentage due to the distribution component is (0.01/0.35)*100 = 3.2 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.34/0.35)*100 = 96.8 percent. This indicates that most of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Prenatal Care Began, Michigan, 2014 vs 2016

	None	1st trimester	2nd trimester	3rd trimester
2014	26.7	9.2	9.6	8.8
2016	29.7	9.5	10.1	8.7

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.01	0.34	0.35	3.2%	96.8%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by months prenatal care began in Michigan, 2014 vs 2016.

In both years the lowest preterm birth rate was present among women who began prenatal care in the 3rd trimester and the highest preterm birth rate was found among women who did not have prenatal care. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who did not have prenatal care or began prenatal care in the 1st and 2nd trimester. The absolute rate difference was highest among mothers who did not have prenatal care.

The PTB rate difference between 2014 and 2016 was 0.35 which equals the sum of the distribution and rate components (0.01 & 0.34). The percentage due to the distribution component is (0.01/0.35)*100 = 3.2 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.34/0.35)*100 = 96.8 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Maternal Kotelchuck Index, Michigan, 2008 vs. 2014

	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Kotelchuck Index	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Adequate Plus	37,667	7,118	0.33	18.90	42,085	6,555	0.38	15.58	0.06	-3.32	0.36	17.24	0.99	-1.18	-0.19
Adequate	48,201	2,148	0.42	4.46	41,490	1,486	0.38	3.58	-0.04	-0.87	0.40	4.02	-0.16	-0.35	-0.51
Intermediate	13,048	660	0.11	5.06	10,035	476	0.09	4.74	-0.02	-0.31	0.10	4.90	-0.11	-0.03	-0.14
Inadequate	16,335	1,949	0.14	11.93	15,958	1,755	0.15	11.00	0.00	-0.93	0.14	11.46	0.04	-0.13	-0.09
Total	115,251	11,875		10.30	109,568	10,272		9.38		-0.93			0.77	-1.70	-0.93
%													-82.6%	182.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by Kotelchuck Index in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among women who had adequate Kotelchuck Index and the highest preterm birth rate was found among women who had adequate plus Kotelchuck Index. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all Kotelchuck Index groups. The absolute rate difference was highest among mothers who had adequate plus Kotelchuck Index.

The decomposition analysis partitioned the overall observed rate difference of -0.93 into two parts, Kotelchuck Index distribution and Kotelchuck Index-specific rate components. The change in Kotelchuck Index distribution contributed to the preterm birth rate decrease among mothers who had adequate or intermediate Kotelchuck Index. In contrast, the Kotelchuck Index distribution component for
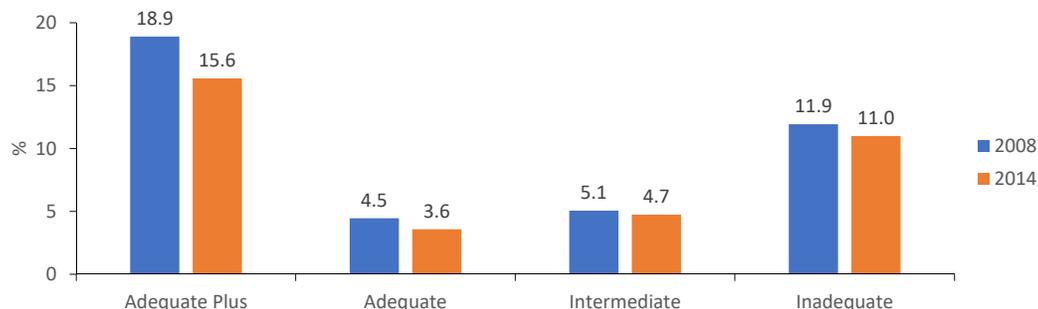
mothers who had adequate plus or inadequate Kotelchuck Index offset this decline.

When the Kotelchuck Index distribution components were summed across the Kotelchuck Index groups, some effect (0.77) was observed on the overall change in preterm birth rates. The change in Kotelchuck Index-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who had adequate plus Kotelchuck Index.

Examining the total effect of both components on the preterm birth rate decline by Kotelchuck Index group, the largest total effects were observed among mothers who had adequate Kotelchuck Index. For mothers who had adequate plus, adequate, or inadequate Kotelchuck Index, the decrease in the Kotelchuck Index-specific preterm birth rate had a larger effect than the change in the Kotelchuck Index distribution. For mothers who had intermediate Kotelchuck Index, the rate decrease from the Kotelchuck Index distribution component were greater than the rate decreases from the Kotelchuck Index-specific rate component .

The PTB rate difference between 2008 and 2014 was −0.93 which equals the sum of the distribution and rate components (0.77 & −1.70). The percentage due to the distribution component is (0.77/−0.93)*100 = -82.6 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−1.70/−0.93)*100 = 182.6 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Kotelchuck Index, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.77	-1.70	-0.93	-82.6%	182.6%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by Kotelchuck Index in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among women who had adequate Kotelchuck Index and the highest preterm birth rate was found among women who had adequate plus Kotelchuck Index. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all Kotelchuck Index groups. The absolute rate difference was highest among mothers who had adequate plus Kotelchuck Index.

The PTB rate difference between 2008 and 2014 was −0.93 which equals the sum of the distribution and rate components (0.77 & −1.70). The percentage due to the distribution component is (0.77/−0.93)*100 = -82.6 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−1.70/−0.93)*100 = 182.6 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Kotelchuck Index, Michigan, 2014 vs. 2016

| Kotelchuck Index | 2014 | | | | 2016 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Adequate Plus	42,085	6,555	0.38	15.58	47,019	7,434	0.43	15.81	0.05	0.24	0.41	15.69	0.73	0.10	0.83
Adequate	41,490	1,486	0.38	3.58	39,383	1,076	0.36	2.73	-0.02	-0.85	0.37	3.16	-0.06	-0.31	-0.37
Intermediate	10,035	476	0.09	4.74	7,279	296	0.07	4.07	-0.02	-0.68	0.08	4.40	-0.11	-0.05	-0.16
Inadequate	15,958	1,755	0.15	11.00	15,487	1,832	0.14	11.83	0.00	0.83	0.14	11.41	-0.04	0.12	0.08
Total	109,568	10,272		9.38	109,168	10,638		9.74		0.37			0.52	-0.15	0.37
%													141.2%	-41.2%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

36

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by Kotelchuck Index in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lowest preterm birth rate was present among women who had adequate Kotelchuck Index and the highest preterm birth rate was found among women who had adequate plus Kotelchuck Index. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who had inadequate or adequate plus Kotelchuck Index. The absolute rate difference was highest among mothers who had adequate Kotelchuck Index.
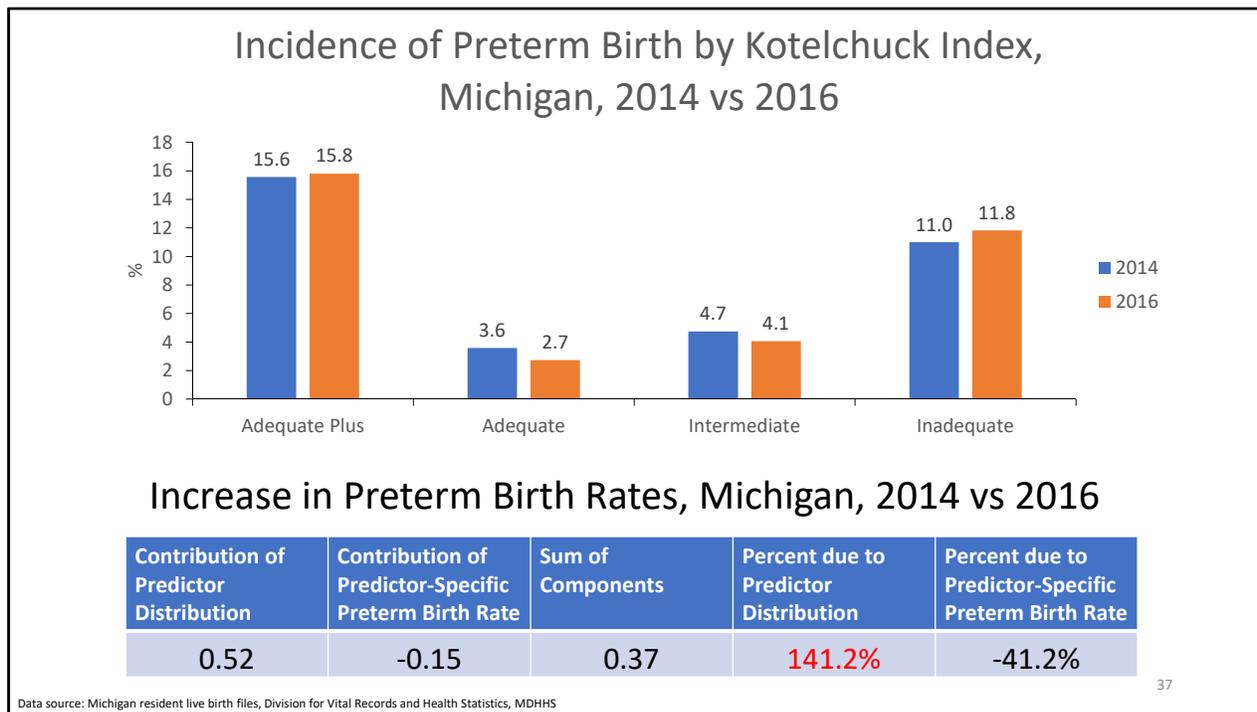
The decomposition analysis partitioned the overall observed rate difference of 0.37 into two parts, Kotelchuck Index distribution and Kotelchuck Index-specific rate components. The change in Kotelchuck Index distribution contributed to the preterm birth rate increase among mothers who had adequate plus Kotelchuck Index. In contrast, the Kotelchuck Index distribution component for mothers who

had adequate, intermediate or inadequate Kotelchuck Index offset this increase.

When the Kotelchuck Index distribution components were summed across the Kotelchuck Index groups, some effect (0.52) was observed on the overall change in preterm birth rates. The change in Kotelchuck Index-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who had adequate plus or inadequate Kotelchuck Index.

Examining the total effect of both components on the preterm birth rate increase by Kotelchuck Index group, the largest total effects were observed among mothers who had adequate plus Kotelchuck Index. For mothers who had adequate plus Kotelchuck Index, the rate increase from the Kotelchuck Index distribution component were greater than the rate increases from the Kotelchuck Index-specific rate component. For mothers who had adequate or inadequate Kotelchuck Index, the change in the Kotelchuck Index-specific preterm birth rate had a larger effect than the decrease in the Kotelchuck Index distribution. For mothers who had intermediate Kotelchuck Index, the rate decrease from the Kotelchuck Index distribution component were greater than the rate decreases from the Kotelchuck Index-specific rate component.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (0.52 & -0.15). The percentage due to the distribution component is (0.52/0.37)*100 = 141.2 percent. This indicates that all of the overall rate increase was due to the distribution component. The percentage due to the rate component is (-0.15/0.37)*100 = -41.2 percent. This indicates no effect from the rate component on the overall rate increase.

Incidence of Preterm Birth by Kotelchuck Index, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.52	-0.15	0.37	141.2%	-41.2%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by Kotelchuck Index in Michigan, 2014 vs 2016.

In both years the lowest preterm birth rate was present among women who had adequate Kotelchuck Index and the highest preterm birth rate was found among women who had adequate plus Kotelchuck Index. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who had inadequate or adequate plus Kotelchuck Index. The absolute rate difference was highest among mothers who had adequate Kotelchuck Index.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (0.52 & -0.15). The percentage due to the distribution component is (0.52/0.37)*100 = 141.2 percent. This indicates that all of the overall rate increase was due to the distribution component. The percentage due to the rate component is (-0.15/0.37)*100 = -41.2 percent. This indicates no effect from the rate component on the overall rate increase.

Preterm Births by Maternal Smoking, Michigan, 2008 vs. 2014

Smoking	2008				2014				Kitagawa Decomposition						
	N Births	N PTB Births	P1 Predictor Distrib	R1 PTB Rate	N Births	N PTB Births	P2 Predictor Distrib	R2 PTB Rate	Sub-Components				Components		
									Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	24,767	2,831	0.21	11.43	23,369	2,558	0.20	10.95	0.00	-0.48	0.21	11.19	-0.02	-0.10	-0.12
No	95,142	9,706	0.79	10.20	90,771	8,515	0.80	9.38	0.00	-0.82	0.79	9.79	0.02	-0.65	-0.63
Total	119,909	12,537		10.46	114,140	11,073		9.70		-0.75			0.00	-0.75	-0.75
%													0.4%	99.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by maternal smoking in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who did not smoke and the higher preterm birth rate was found among women who smoked during pregnancy. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all smoking groups. The absolute rate difference was higher among mothers who did not smoke during pregnancy.
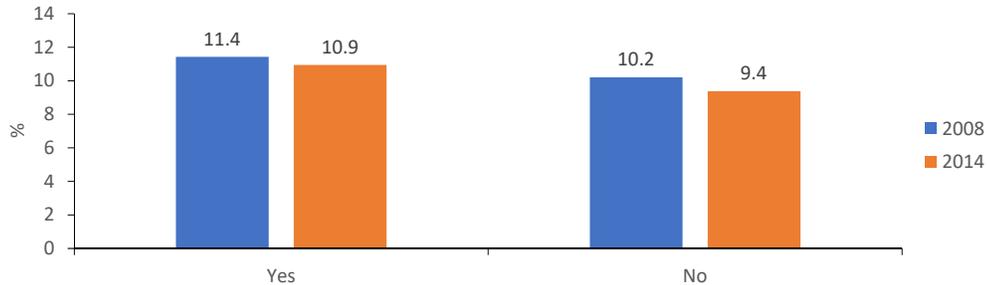
The decomposition analysis partitioned the overall observed rate difference of -0.75 into two parts, smoking distribution and smoking-specific rate components. The change in smoking distribution contributed to the preterm birth rate decrease among mothers who smoked. In contrast, the smoking distribution component for mothers who did not smoke offset this decline.

When the smoking distribution components were summed across the smoking groups, a very smaller effect (0.00) was observed on the overall change in preterm birth rates. The change in smoking-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who did not smoke.

Examining the total effect of both components on the preterm birth rate decline by smoking group, the larger total effects were observed among mothers who did not smoke. For all mothers, the decrease in the smoking-specific preterm birth rate had a larger effect than the change in the smoking distribution.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.00 & −0.75). The percentage due to the distribution component is (0.00/−0.75)*100 = 0.4 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.75/−0.75)*100 = 99.6 percent. This indicates that almost all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Maternal Smoking Status, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.00	-0.75	-0.75	0.4%	99.6%

This slide shows the incidence of preterm birth by maternal smoking status in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who did not smoke and the higher preterm birth rate was found among women who smoked during pregnancy. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all smoking groups. The absolute rate difference was higher among mothers who did not smoke during pregnancy.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.00 & −0.75). The percentage due to the distribution component is (0.00/−0.75)*100 = 0.4 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.75/−0.75)*100 = 99.6 percent. This indicates that almost all of the overall rate decrease was due to the rate component.

Preterm Births by Maternal Smoking, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Smoking	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Yes	23,369	2,558	0.20	10.95	20,860	2,488	0.19	11.93	-0.02	0.98	0.19	11.44	-0.23	0.19	-0.03
No	90,771	8,515	0.80	9.38	91,876	8,867	0.81	9.65	0.02	0.27	0.81	9.52	0.19	0.22	0.41
Total	114,140	11,073		9.70	112,736	11,355		10.07		0.37			-0.04	0.41	0.37
%													-10.2%	110.2%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by maternal smoking in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who did not smoke and the higher preterm birth rate was found among women who smoked during pregnancy. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all smoking groups. The absolute rate difference was higher among mothers who smoked during pregnancy.
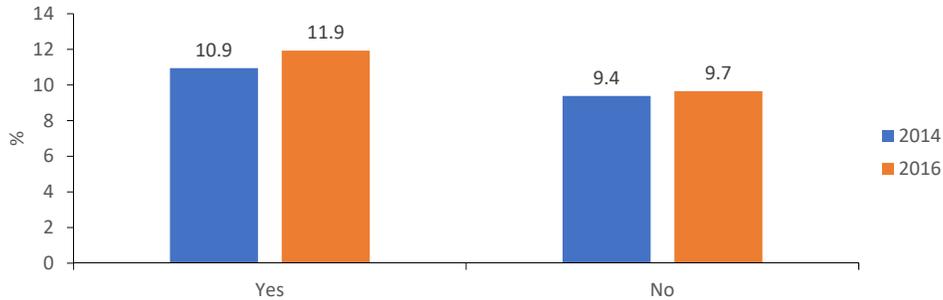
The decomposition analysis partitioned the overall observed rate difference of 0.37 into two parts, smoking distribution and smoking-specific rate components. The change in smoking distribution contributed to the preterm birth rate increase among mothers who did not smoke. In contrast, the smoking distribution component for mothers who smoked offset this increase.

When the smoking distribution components were summed across the smoking groups, a very smaller effect (-0.04) was observed on the overall change in preterm birth rates. The change in smoking-specific preterm birth rates contributed to the decline in preterm birth rate among all mothers.

Examining the total effect of both components on the preterm birth rate increase by smoking group, the larger total effects were observed among mothers who did not smoke. For mothers who did not smoke, the increase in the smoking-specific preterm birth rate had a larger effect than the increase in the smoking distribution. For mothers who smoked, the decrease in the smoking distribution had a larger effect than the increase in the smoking-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (-0.04 & 0.41). The percentage due to the distribution component is (-0.04/0.37)*100 = -10.2 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.37)*100 = 110.2 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Maternal Smoking Status, Michigan, 2014 vs 2016

%

14
12
10
8
6
4
2
0

Yes: 10.9 (2014), 11.9 (2016)
No: 9.4 (2014), 9.7 (2016)

- 2014
- 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.04	0.41	0.37	-10.2%	110.2%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by maternal smoking status in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who did not smoke and the higher preterm birth rate was found among women who smoked during pregnancy. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all smoking groups. The absolute rate difference was higher among mothers who smoked during pregnancy.

The PTB rate difference between 2014 and 2016 was 0.37 which equals the sum of the distribution and rate components (-0.04 & 0.41). The percentage due to the distribution component is (-0.04/0.37)*100 = -10.2 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.37)*100 = 110.2 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Others in Household Smoking, Michigan, 2008 vs. 2014

Others in Household smoking	2008				2014				Kitagawa Decomposition					
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components	
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	19,330	2,121	0.17	10.97	16,915	1,800	0.15	10.64	-0.02	-0.33	0.16	10.81	-0.17	-0.05	-0.22
No	94,301	9,435	0.83	10.01	92,683	8,587	0.85	9.26	0.02	-0.74	0.84	9.64	0.15	-0.62	-0.47
Total	113,631	11,556		10.17	109,598	10,387		9.48		-0.69			-0.02	-0.67	-0.69
%													2.7%	97.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by second-hand smoking in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who did not have others in household smoking and the higher preterm birth rate was found among women who had others in household smoking. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all second-hand smoking groups. The absolute rate difference was higher among mothers who did not have others in household smoking.

The decomposition analysis partitioned the overall observed rate difference of -0.69 into two parts, second-hand smoking distribution and second-hand smoking-specific rate components. The change in second-hand smoking distribution contributed to the preterm birth rate decrease among mothers who had others in household smoking. In contrast, the smoking distribution component for mothers
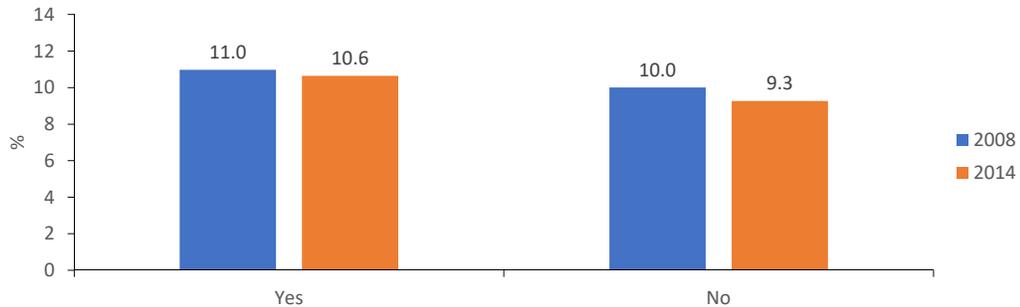
who did not have others in household smoking offset this decline.

When the second-hand smoking distribution components were summed across the second-hand smoking groups, a very smaller effect (-0.02) was observed on the overall change in preterm birth rates. The change in second-hand smoking-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who did not have others in household smoking.

Examining the total effect of both components on the preterm birth rate decline by second-hand smoking group, the larger total effects were observed among mothers who did not have others in household smoking. For mothers who did not have others in household smoking, the decrease in the second-hand smoking-specific preterm birth rate had a larger effect than the decrease in the second-hand smoking distribution. For mothers who had others in household smoking, the decrease in the second-hand smoking distribution had a larger effect than the decrease in the second-hand smoking-specific preterm birth rate.

The PTB rate difference between 2008 and 2014 was −0.69 which equals the sum of the distribution and rate components (-0.02 & −0.67). The percentage due to the distribution component is (−0.02/−0.69)*100 = 2.7 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.67/−0.69)*100 = 97.3 percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Others Smoking in the Household, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.02	-0.67	-0.69	2.7%	97.3%

This slide shows the incidence of preterm birth by second-hand smoking status in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who did not have others in household smoking and the higher preterm birth rate was found among women who had others in household smoking. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all second-hand smoking groups. The absolute rate difference was higher among mothers who did not have others in household smoking.

The PTB rate difference between 2008 and 2014 was −0.69 which equals the sum of the distribution and rate components (-0.02 & −0.67). The percentage due to the distribution component is (−0.02/−0.69)*100 = 2.7 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.67/−0.69)*100 = 97.3 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Others in Household Smoking, Michigan, 2014 vs. 2016

Others in Household Smoking	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Yes	16,915	1,800	0.15	10.64	14,520	1,636	0.13	11.27	-0.02	0.63	0.14	10.95	-0.23	0.09	-0.14
No	92,683	8,587	0.85	9.26	94,628	9,077	0.87	9.59	0.02	0.33	0.86	9.43	0.20	0.28	0.48
Total	109,598	10,387		9.48	109,148	10,713		9.82		0.34			-0.03	0.37	0.34
%													-9.6%	109.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by second-hand smoking in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who did not have others in household smoking and the higher preterm birth rate was found among women who had others in household smoking. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all second-hand smoking groups. The absolute rate difference was higher among mothers who had others in household smoking.

The decomposition analysis partitioned the overall observed rate difference of 0.34 into two parts, second-hand smoking distribution and second-hand smoking-specific rate components. The change in second-hand smoking distribution contributed to the preterm birth rate increase among mothers who did not have others in household smoking. In contrast, the smoking distribution component for
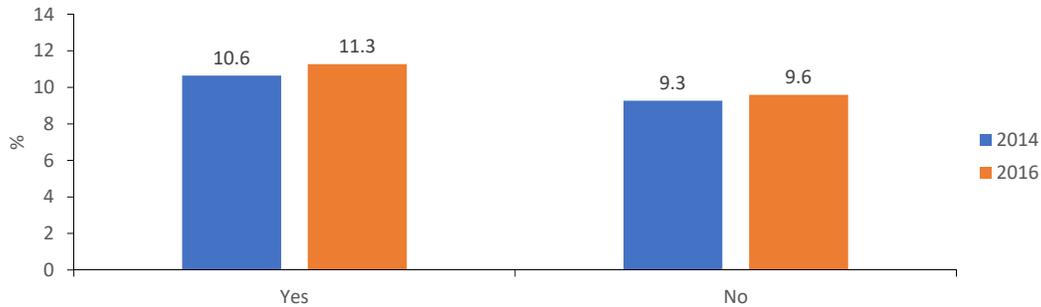
mothers who had others in household smoking offset this increase.

When the second-hand smoking distribution components were summed across the second-hand smoking groups, a very smaller effect (-0.03) was observed on the overall change in preterm birth rates. The change in second-hand smoking-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who did not have others in household smoking.

Examining the total effect of both components on the preterm birth rate increase by second-hand smoking group, the larger total effects were observed among mothers who did not have others in household smoking. For mothers who did not have others in household smoking, the increase in the second-hand smoking-specific preterm birth rate had a larger effect than the increase in the second-hand smoking distribution. For mothers who had others in household smoking, the decrease in the second-hand smoking distribution had a larger effect than the increase in the second-hand smoking-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.34 which equals the sum of the distribution and rate components (-0.03 & 0.37). The percentage due to the distribution component is (-0.03/0.34)*100 = -9.6 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.37/0.34)*100 = 109.6 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Others Smoking in the Household, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.03	0.37	0.34	-9.6%	109.6%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by second-hand smoking status in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who did not have others in household smoking and the higher preterm birth rate was found among women who had others in household smoking. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all second-hand smoking groups. The absolute rate difference was higher among mothers who had others in household smoking.

The PTB rate difference between 2014 and 2016 was 0.34 which equals the sum of the distribution and rate components (-0.03 & 0.37). The percentage due to the distribution component is (-0.03/0.34)*100 = -9.6 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.37/0.34)*100 = 109.6 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Gravidity, Michigan, 2008 vs. 2014

| | 2008 | | | | 2014 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
Gravidity	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
First time mother	40,126	3,840	0.33	9.57	36,276	3,229	0.32	8.90	-0.01	-0.67	0.32	9.24	-0.13	-0.22	-0.35
Non first time mother	80,878	8,862	0.67	10.96	77,962	7,871	0.68	10.10	0.01	-0.86	0.68	10.53	0.15	-0.58	-0.43
Total	121,004	12,702		10.50	114,238	11,100		9.72		-0.78			0.02	-0.80	-0.78
%													-2.3%	102.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by gravidity in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who were first time mothers and the higher preterm birth rate was found among women who were not first time mothers. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gravidity groups. The absolute rate difference was higher among mothers who were not first time mothers.

The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, gravidity distribution and gravidity-specific rate components. The change in gravidity distribution contributed to the preterm birth rate decrease among women who were first time mothers. In contrast, the gravidity distribution component for women who were not first time mothers offset this decline.

When the gravidity distribution components were summed across the gravidity groups, a very smaller effect (0.02) was observed on the overall change in preterm birth rates. The change in gravidity-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who were not first time mothers.

Examining the total effect of both components on the preterm birth rate decline by gravidity group, the larger total effects were observed among mothers who were not first time mothers. For all mothers, the decrease in the gravidity-specific preterm birth rate had a larger effect than the change in the gravidity distribution.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.02 & −0.80). The percentage due to the distribution component is (0.02/−0.78)*100 = -2.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.80/−0.78)*100 = 102.3 percent. This indicates that almost all of the overall rate decrease was due to the rate component.

This slide shows the incidence of preterm birth by gravidity in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who were first time mothers and the higher preterm birth rate was found among women who were not first time mothers. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gravidity groups. The absolute rate difference was higher among mothers who were not first time mothers.
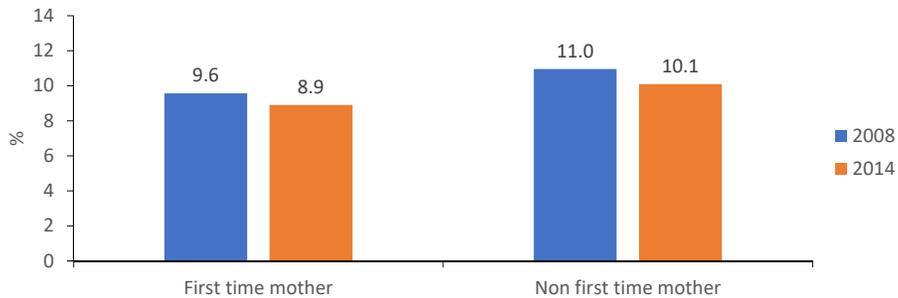
The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.02 & −0.80). The percentage due to the distribution component is (0.02/−0.78)*100 = -2.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.80/−0.78)*100 = 102.3 percent. This indicates that almost all of the overall rate decrease was due to the rate component.

Preterm Births by Gravidity, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Gravidity	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
First time mother	36,276	3,229	0.32	8.90	34,402	3,112	0.30	9.05	-0.01	0.14	0.31	8.97	-0.12	0.05	-0.08
Non first time mother	77,962	7,871	0.68	10.10	78,711	8,342	0.70	10.60	0.01	0.50	0.69	10.35	0.14	0.35	0.48
Total	114,238	11,100		9.72	113,113	11,454		10.13		0.41			0.02	0.39	0.41
%													4.5%	95.5%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by gravidity in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who were first time mothers and the higher preterm birth rate was found among women who were not first time mothers. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all gravidity groups. The absolute rate difference was higher among mothers who were not first time mothers.

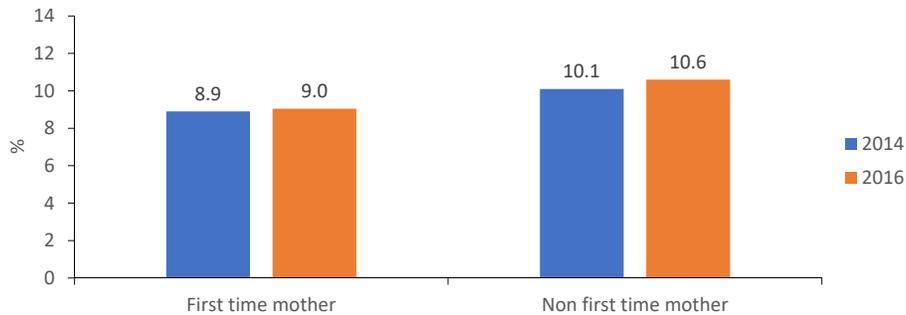The decomposition analysis partitioned the overall observed rate difference of 0.41 into two parts, gravidity distribution and gravidity-specific rate components. The change in gravidity distribution contributed to the preterm birth rate increase among women who were not first time mothers. In contrast, the gravidity distribution component for women who were first time mothers offset this increase.

When the gravidity distribution components were summed across the gravidity groups, a very smaller effect (0.02) was observed on the overall change in preterm birth rates. The change in gravidity-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who were not first time mothers.

Examining the total effect of both components on the preterm birth rate increase by gravidity group, the larger total effects were observed among mothers who were not first time mothers. For women who were not first time mothers, the increase in the gravidity-specific preterm birth rate had a larger effect than the increase in the gravidity distribution. For women who were first time mothers, the decrease in the gravidity distribution had a larger effect than the increase in the gravidity-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.02 & 0.39). The percentage due to the distribution component is (0.02/0.41)*100 = 4.5 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.41)*100 = 95.5 percent. This indicates that most of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Gravidity, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.02	0.39	0.41	4.5%	95.5%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by gravidity in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who were first time mothers and the higher preterm birth rate was found among women who were not first time mothers. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all gravidity groups. The absolute rate difference was higher among mothers who were not first time mothers.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.02 & 0.39). The percentage due to the distribution component is (0.02/0.41)*100 = 4.5 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.41)*100 = 95.5 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Previous C-Section Delivery, Michigan, 2008 vs. 2014

| Previous C-Section Delivery | 2008 | | | | 2014 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	14,168	1,675	0.12	11.82	15,890	1,683	0.14	10.59	0.02	-1.23	0.13	11.21	0.24	-0.16	0.08
No	105,825	10,897	0.88	10.30	98,173	9,410	0.86	9.59	-0.02	-0.71	0.87	9.94	-0.21	-0.62	-0.83
Total	119,993	12,572		10.48	114,063	11,093		9.73		-0.75			0.03	-0.78	-0.75
%													-3.6%	103.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by previous c-section delivery in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who did not have previous c-section delivery and the higher preterm birth rate was found among women who had previous c-section delivery. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all previous c-section delivery groups. The absolute rate difference was higher among mothers who had previous c-section delivery.

The decomposition analysis partitioned the overall observed rate difference of -0.75 into two parts, previous c-section delivery distribution and previous c-section delivery-specific rate components. The change in previous c-section delivery distribution contributed to the preterm birth rate decrease among mothers who did not have previous c-section delivery. In contrast, the previous c-section delivery
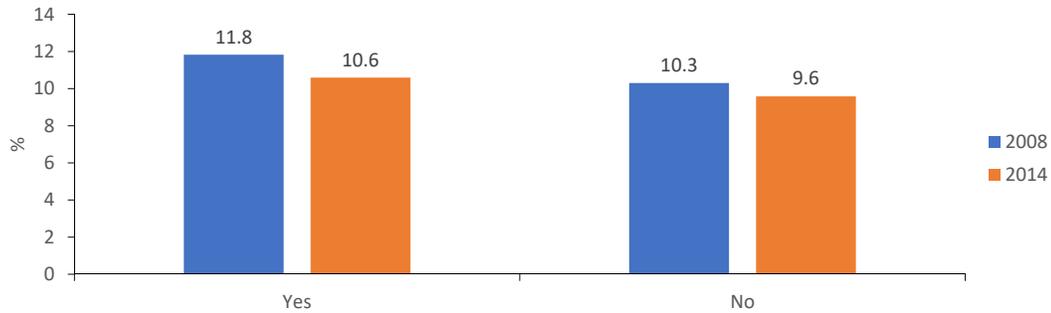
distribution component for mothers who had previous c-section delivery offset this decline.

When the previous c-section delivery distribution components were summed across the previous c-section delivery groups, a very smaller effect (0.03) was observed on the overall change in preterm birth rates. The change in previous c-section delivery-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who did not have previous c-section delivery.

Examining the total effect of both components on the preterm birth rate decline by previous c-section delivery group, the larger total effects were observed among mothers who did not have previous c-section delivery. For mothers who did not have previous c-section delivery, the decrease in the previous c-section delivery-specific preterm birth rate had a larger effect than the decrease in the previous c-section delivery distribution. For mothers who had previous c-section delivery, the increase in the previous c-section delivery distribution had a larger effect than the decrease in the previous c-section delivery-specific preterm birth rate.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.03 & −0.78). The percentage due to the distribution component is (0.03/−0.75)*100 = -3.6 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.78/−0.75)*100 = 103.6 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Previous C-Section Delivery, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.03	-0.78	-0.75	-3.6%	103.6%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by previous c-section delivery in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who did not have previous c-section delivery and the higher preterm birth rate was found among women who had previous c-section delivery. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all previous c-section delivery groups. The absolute rate difference was higher among mothers who had previous c-section delivery.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.03 & −0.78). The percentage due to the distribution component is (0.03/−0.75)*100 = -3.6 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.78/−0.75)*100 = 103.6 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Previous C-Section Delivery, Michigan, 2014 vs. 2016

Previous C-Section Delivery	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Yes	15,890	1,683	0.14	10.59	16,172	1,732	0.14	10.71	0.00	0.12	0.14	10.65	0.04	0.02	0.06
No	98,173	9,410	0.86	9.59	96,906	9,714	0.86	10.02	0.00	0.44	0.86	9.80	-0.04	0.38	0.34
Total	114,063	11,093		9.73	113,078	11,446		10.12		0.40			0.00	0.40	0.40
%													0.8%	99.2%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by previous c-section delivery in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who did not have previous c-section delivery and the higher preterm birth rate was found among women who had previous c-section delivery. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all previous c-section delivery groups. The absolute rate difference was higher among mothers who did not have previous c-section delivery.

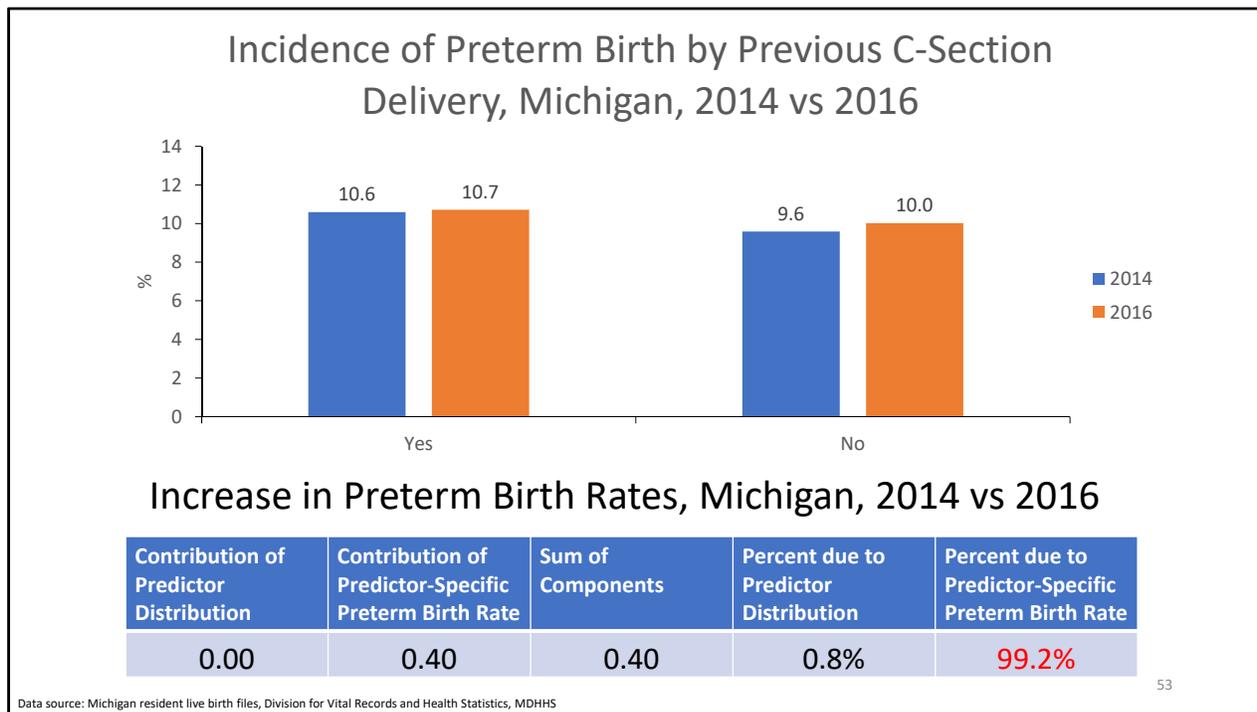The decomposition analysis partitioned the overall observed rate difference of -0.75 into two parts, previous c-section delivery distribution and previous c-section delivery-specific rate components. The change in previous c-section delivery distribution contributed to the preterm birth rate decrease among mothers who did not have previous c-section delivery. In contrast, the previous c-section delivery

distribution component for mothers who had previous c-section delivery offset this increase.

When the previous c-section delivery distribution components were summed across the previous c-section delivery groups, a very smaller effect (0.00) was observed on the overall change in preterm birth rates. The change in previous c-section delivery-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who did not have previous c-section delivery.

Examining the total effect of both components on the preterm birth rate increase by previous c-section delivery group, the larger total effects were observed among mothers who did not have previous c-section delivery. For mothers who did not have previous c-section delivery, the increase in the previous c-section delivery-specific preterm birth rate had a larger effect than the decrease in the previous c-section delivery distribution. For mothers who had previous c-section delivery, the increase in the previous c-section delivery distribution had a larger effect than the increase in the previous c-section delivery-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.00 & 0.40). The percentage due to the distribution component is (0.00/0.40)*100 = 0.8 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.40)*100 = 99.2 percent. This indicates that almost all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Previous C-Section Delivery, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.00	0.40	0.40	0.8%	99.2%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by previous c-section delivery in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who did not have previous c-section delivery and the higher preterm birth rate was found among women who had previous c-section delivery. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all previous c-section delivery groups. The absolute rate difference was higher among mothers who did not have previous c-section delivery.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.00 & 0.40). The percentage due to the distribution component is (0.00/0.40)*100 = 0.8 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.40/0.40)*100 = 99.2 percent. This indicates that almost all of the overall rate increase was due to the rate component.

Preterm Births by Newborn NICU Admission, Michigan, 2008 vs. 2014

Newborn NICU Admission	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	7,417	4,554	0.06	61.40	8,434	4,852	0.07	57.53	0.01	-3.87	0.07	59.46	0.66	-0.26	0.39
No	110,840	7,913	0.94	7.14	105,917	6,266	0.93	5.92	-0.01	-1.22	0.93	6.53	-0.07	-1.14	-1.21
Total	118,257	12,467		10.54	114,351	11,118		9.72		-0.82			0.58	-1.40	-0.82
%													-71.3%	171.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by newborn NICU admission in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women whose infants did not have NICU admission and the higher preterm birth rate was found among women whose infants had NICU admission. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all newborn NICU admission groups. The absolute rate difference was higher among mothers whose infants had NICU admission.

The decomposition analysis partitioned the overall observed rate difference of -0.82 into two parts, newborn NICU admission distribution and newborn NICU admission-specific rate components. The change in newborn NICU admission distribution contributed to the preterm birth rate decrease among mothers whose infants did not have NICU admission. In contrast, the newborn NICU admission distribution component for mothers whose infants had NICU admission offset this decline.

When the newborn NICU admission distribution components were summed across the newborn NICU admission groups, some effect (0.58) was observed on the overall change in preterm birth rates. The change in newborn NICU admission-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers whose infants did not have NICU admission.

Examining the total effect of both components on the preterm birth rate decline by newborn NICU admission group, the larger total effects were observed among mothers whose infants did not have NICU admission. For mothers whose infants did not have NICU admission, the decrease in the newborn NICU admission-specific preterm birth rate had a larger effect than the decrease in the newborn NICU admission distribution. For mothers whose infants had NICU admission, the increase in the newborn NICU admission distribution had a larger effect than the decrease in the newborn NICU admission-specific preterm birth rate.

The PTB rate difference between 2008 and 2014 was −0.82 which equals the sum of the distribution and rate components (0.58 & −1.40). The percentage due to the distribution component is (0.58/−0.82)*100 = -71.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−1.40/−0.82)*100 = 171.3 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Newborn NICU Admission, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.58	-1.40	-0.82	-71.3%	171.3%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by newborn NICU admission in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women whose infants did not have NICU admission and the higher preterm birth rate was found among women whose infants had NICU admission. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all newborn NICU admission groups. The absolute rate difference was higher among mothers whose infants had NICU admission.

The PTB rate difference between 2008 and 2014 was −0.82 which equals the sum of the distribution and rate components (0.58 & −1.40). The percentage due to the distribution component is (0.58/−0.82)*100 = -71.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−1.40/−0.82)*100 = 171.3 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Newborn NICU Admission, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Newborn NICU Admission	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Yes	8,434	4,852	0.07	57.53	8,805	4,924	0.08	55.92	0.00	-1.61	0.08	56.73	0.23	-0.12	0.10
No	105,917	6,266	0.93	5.92	104,480	6,543	0.92	6.26	0.00	0.35	0.92	6.09	-0.02	0.32	0.30
Total	114,351	11,118		9.72	113,285	11,467		10.12		0.40			0.20	0.20	0.40
%													50.3%	49.7%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by newborn NICU admission in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women whose infants did not have NICU admission and the higher preterm birth rate was found among women whose infants had NICU admission. The increase in preterm birth rates from 2014 to 2016 was observed for mothers whose infants did not have NICU admission. The absolute rate difference was higher among mothers whose infants had NICU admission.

The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, newborn NICU admission distribution and newborn NICU admission-specific rate components. The change in newborn NICU admission distribution contributed to the preterm birth rate increase among mothers whose infants had NICU admission. In contrast, the newborn NICU admission distribution component for mothers whose infants did not have NICU admission offset this increase.

When the newborn NICU admission distribution components were summed across the newborn NICU admission groups, some effect (0.20) was observed on the overall change in preterm birth rates. The change in newborn NICU admission-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers whose infants did not have NICU admission.

Examining the total effect of both components on the preterm birth rate increase by newborn NICU admission group, the larger total effects were observed among mothers whose infants did not have NICU admission. For mothers whose infants did not have NICU admission, the increase in the newborn NICU admission-specific preterm birth rate had a larger effect than the decrease in the newborn NICU admission distribution. For mothers whose infants had NICU admission, the increase in the newborn NICU admission distribution had a larger effect than the decrease in the newborn NICU admission-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.20 & 0.20). The percentage due to the distribution component is (0.20/0.40)*100 = 50.3 percent. This indicates that almost half of the overall rate increase was due to the distribution component. The percentage due to rate component is (0.20/0.40)*100 = 49.7 percent. This indicates that the other half of the overall rate increase was due to the rate component.

70
60
57.5
55.9
50
40 %
30
20
10
5.9
6.3
0

Yes   No

2014
2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.20	0.20	0.40	50.3%	49.7%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by newborn NICU admission in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women whose infants did not have NICU admission and the higher preterm birth rate was found among women whose infants had NICU admission. The increase in preterm birth rates from 2014 to 2016 was observed for mothers whose infants did not have NICU admission. The absolute rate difference was higher among mothers whose infants had NICU admission.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.20 & 0.20). The percentage due to the distribution component is (0.20/0.40)*100 = 50.3 percent. This indicates that almost half of the overall rate increase was due to the distribution component. The percentage due to rate component is (0.20/0.40)*100 = 49.7 percent. This indicates that the other half of the overall rate increase was due to the rate component.

Preterm Births by Infant Birthweight, Michigan, 2008 vs. 2014

Birthweight	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Very Low (<1500 grams)	2,191	1,934	0.02	88.27	1,736	1,710	0.02	98.50	0.00	10.23	0.02	93.39	-0.27	0.17	-0.10
Low (1500 - 2499 grams)	8,148	5,282	0.07	64.83	7,856	4,880	0.07	62.12	0.00	-2.71	0.07	63.47	0.09	-0.18	-0.09
Normal (2500 -3999 grams)	100,018	5,418	0.83	5.42	94,577	4,468	0.83	4.72	0.00	-0.69	0.83	5.07	0.01	-0.57	-0.56
High (≥ 4000 grams)	10,874	109	0.09	1.00	10,245	70	0.09	0.68	0.00	-0.32	0.09	0.84	0.00	-0.03	-0.03
Total	121,231	12,743		10.51	114,414	11,128		9.73	-0.79				-0.17	-0.61	-0.79
%													21.7%	78.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

58

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by infant birthweight in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lowest preterm birth rate was present among women whose infants had high birthweight and the highest preterm birth rate was found among women whose infants had very low birthweight. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all infant birthweight groups except among mothers whose infants had very low birthweight. The absolute rate difference was higher among mothers whose infants had very low birthweight.

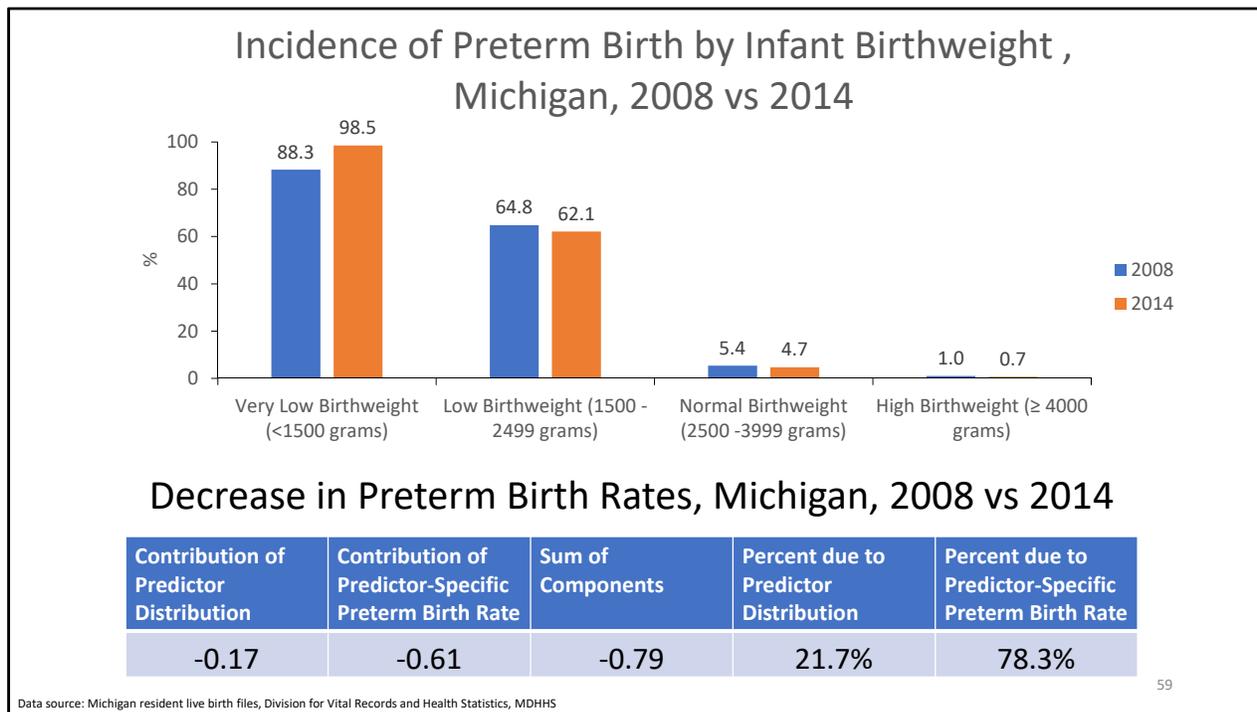The decomposition analysis partitioned the overall observed rate difference of -0.79 into two parts, infant birthweight distribution and infant birthweight-specific rate components. The change in infant birthweight distribution contributed to the preterm birth rate decrease among mothers whose infants had low birthweight. In contrast, the infant birthweight distribution component for mothers whose infants

had very low birthweight offset this decline.

When the infant birthweight distribution components were summed across the infant birthweight groups, a smaller effect (-0.17) was observed on the overall change in preterm birth rates. The change in infant birthweight-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers whose infants had normal birthweight.

Examining the total effect of both components on the preterm birth rate decline by infant birthweight group, the larger total effects were observed among mothers whose infants had normal birthweight. For all mothers except mothers whose infants had very low birthweight, the decrease in the infant birthweight-specific preterm birth rate had a larger effect than the change in the infant birthweight distribution. For mothers whose infants had very low birthweight, the decrease in the infant birthweight distribution had a larger effect than the increase in the infant birthweight-specific preterm birth rate.

The PTB rate difference between 2008 and 2014 was −0.79 which equals the sum of the distribution and rate components (-0.17 & −0.61). The percentage due to the distribution component is (−0.17/−0.79)*100 = 21.7 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.61/−0.79)*100 = 78.3 percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Infant Birthweight, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.17	-0.61	-0.79	21.7%	78.3%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by infant birthweight in Michigan, 2008 vs 2014.

In both years the lowest preterm birth rate was present among women whose infants had high birthweight and the highest preterm birth rate was found among women whose infants had very low birthweight. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all infant birthweight groups except among mothers whose infants had very low birthweight. The absolute rate difference was higher among mothers whose infants had very low birthweight.

The PTB rate difference between 2008 and 2014 was −0.79 which equals the sum of the distribution and rate components (-0.17 & −0.61). The percentage due to the distribution component is (−0.17/−0.79)*100 = 21.7 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.61/−0.79)*100 = 78.3 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Infant Birthweight, Michigan, 2014 vs. 2016

Birthweight	2014 N Births	2014 N PTB Births	2014 P1 Predictor Distrib	2014 R1 PTB Rate	2016 N Births	2016 N PTB Births	2016 P2 Predictor Distrib	2016 R2 PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Very Low (<1500 grams)	1,736	1,710	0.02	98.50	1,699	1,679	0.01	98.82	0.00	0.32	0.02	98.66	-0.02	0.00	-0.01
Low (1500 - 2499 grams)	7,856	4,880	0.07	62.12	8,009	5,040	0.07	62.93	0.00	0.81	0.07	62.52	0.12	0.06	0.18
Normal (2500 -3999 grams)	94,577	4,468	0.83	4.72	93,670	4,686	0.83	5.00	0.00	0.28	0.83	4.86	0.00	0.23	0.23
High (≥ 4000 grams)	10,245	70	0.09	0.68	9,967	75	0.09	0.75	0.00	0.07	0.09	0.72	0.00	0.01	0.00
Total	114,414	11,128		9.73	113,345	11,480		10.13		0.40			0.10	0.30	0.40
%													26.0%	74.0%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by infant birthweight in Michigan, 2014 vs 2016.
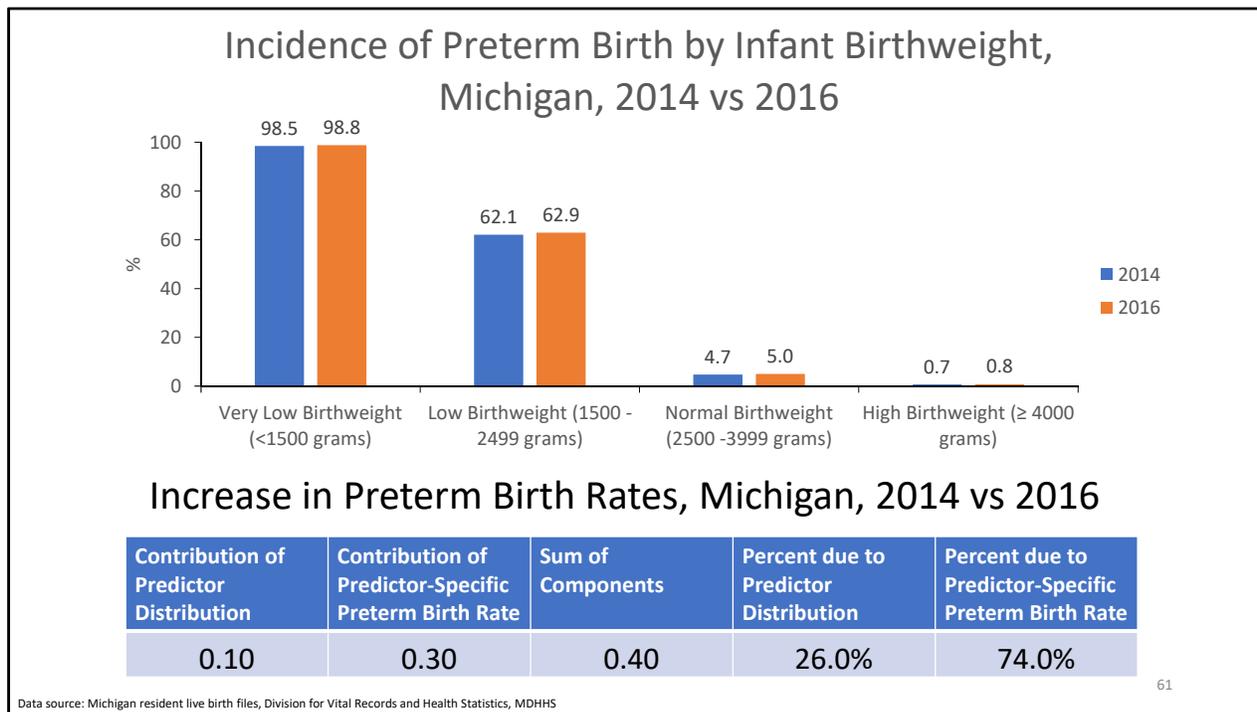
From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lowest preterm birth rate was present among women whose infants had high birthweight and the highest preterm birth rate was found among women whose infants had very low birthweight. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all infant birthweight groups. The absolute rate difference was higher among mothers whose infants had low birthweight.

The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, infant birthweight distribution and infant birthweight-specific rate components. The change in infant birthweight distribution contributed to the preterm birth rate increase among mothers whose infants had low birthweight. In contrast, the infant birthweight distribution component for mothers whose infants had very low birthweight offset this increase.

When the infant birthweight distribution components were summed across the infant birthweight groups, some effect (0.10) was observed on the overall change in preterm birth rates. The change in infant birthweight-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers whose infants had normal birthweight.

Examining the total effect of both components on the preterm birth rate increase by infant birthweight group, the larger total effects were observed among mothers whose infants had normal birthweight. For all mothers whose infants had very low or low birthweight, the change in the infant birthweight distribution had a larger effect than the change in the infant birthweight-specific preterm birth rate. For mothers whose infants had normal or high birthweight, the increase in the infant birthweight-specific preterm birth rate had a larger effect than the change in the infant birthweight distribution.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.10 & 0.30). The percentage due to the distribution component is (0.10/0.40)*100 = 26.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.30/0.40)*100 = 74.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Infant Birthweight, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.10	0.30	0.40	26.0%	74.0%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by infant birthweight in Michigan, 2014 vs 2016.

In both years the lowest preterm birth rate was present among women whose infants had high birthweight and the highest preterm birth rate was found among women whose infants had very low birthweight. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all infant birthweight groups. The absolute rate difference was higher among mothers whose infants had low birthweight.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.10 & 0.30). The percentage due to the distribution component is (0.10/0.40)*100 = 26.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.30/0.40)*100 = 74.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Marital Status, Michigan, 2008 vs. 2014

Marital Status	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Married	71,686	7,023	0.59	9.80	65,883	5,785	0.58	8.78	-0.02	-1.02	0.58	9.29	-0.16	-0.59	-0.75
Other	49,215	5,685	0.41	11.55	48,529	5,348	0.42	11.02	0.02	-0.53	0.42	11.29	0.19	-0.22	-0.03
Total	120,901	12,708		10.51	114,412	11,133		9.73		-0.78			0.03	-0.81	-0.78
%													-4.4%	104.4%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by marital status in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who were married and the higher preterm birth rate was found among women who were not married. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all marital status groups. The absolute rate difference was higher among mothers who were married.

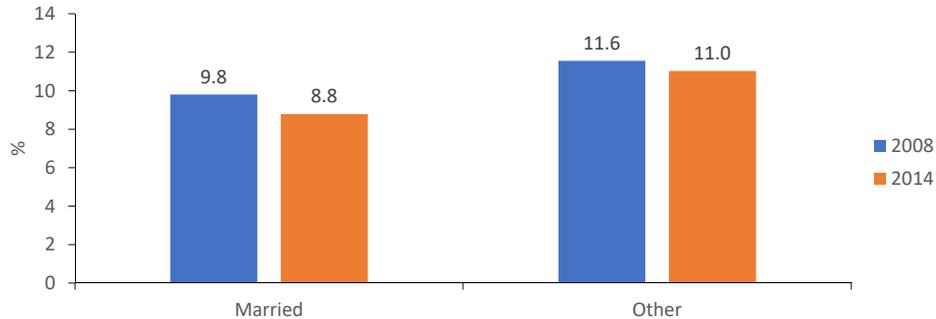The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, marital status distribution and marital status-specific rate components. The change in marital status distribution contributed to the preterm birth rate decrease among mothers who were married. In contrast, the marital status distribution component for mothers who were not married offset this decline.

When the marital status distribution components were summed across the marital status groups, a very smaller effect (0.03) was observed on the overall change in preterm birth rates. The change in marital status-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who were married.

Examining the total effect of both components on the preterm birth rate decline by marital status group, the larger total effects were observed among mothers who were married. For all mothers, the decrease in the marital status-specific preterm birth rate had a larger effect than the change in the marital status distribution.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.03 & −0.81). The percentage due to the distribution component is (0.03/−0.78)*100 = -4.4 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.81/−0.78)*100 = 104.4 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Marital Status, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.03	-0.81	-0.78	-4.4%	104.4%

This slide shows the incidence of preterm birth by marital status in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who were married and the higher preterm birth rate was found among women who were not married. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all marital status groups. The absolute rate difference was higher among mothers who were married.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.03 & −0.81). The percentage due to the distribution component is (0.03/−0.78)*100 = -4.4 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.81/−0.78)*100 = 104.4 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Marital Status, Michigan, 2014 vs. 2016

Marital Status	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Married	65,883	5,785	0.58	8.78	65,904	5,913	0.58	8.97	0.01	0.19	0.58	8.88	0.05	0.11	0.16
Other	48,529	5,348	0.42	11.02	47,400	5,561	0.42	11.73	-0.01	0.71	0.42	11.38	-0.07	0.30	0.23
Total	114,412	11,133		9.73	113,304	11,474		10.13		0.40			-0.01	0.41	0.40
%													-3.7%	103.7%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by marital status in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who were married and the higher preterm birth rate was found among women who were not married. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all marital status groups. The absolute rate difference was higher among mothers who were not married.

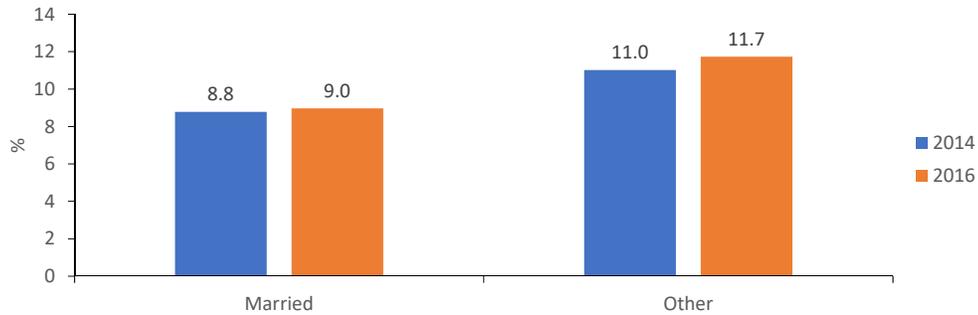The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, marital status distribution and marital status-specific rate components. The change in marital status distribution contributed to the preterm birth rate increase among mothers who were married. In contrast, the marital status distribution component for mothers who were not married offset this increase.

When the marital status distribution components were summed across the marital status groups, a very smaller effect (-0.01) was observed on the overall change in preterm birth rates. The change in marital status-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who were not married.

Examining the total effect of both components on the preterm birth rate increase by marital status group, the larger total effects were observed among mothers who were not married. For all mothers, the increase in the marital status-specific preterm birth rate had a larger effect than the change in the marital status distribution.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (-0.01 & 0.41). The percentage due to the distribution component is (-0.01/0.40)*100 = -3.7 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.40)*100 = 103.7 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Marital Status, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.01	0.41	0.40	-3.7%	103.7%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by marital status in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who were married and the higher preterm birth rate was found among women who were not married. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all marital status groups. The absolute rate difference was higher among mothers who were not married.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (-0.01 & 0.41). The percentage due to the distribution component is (-0.01/0.40)*100 = -3.7 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.41/0.40)*100 = 103.7 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Plurality, Michigan, 2008 vs. 2014

| | 2008 | | | | 2014 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
Plurality	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Single Birth	116,882	9,921	0.96	8.49	110,231	8,579	0.96	7.78	0.00	-0.71	0.96	8.14	-0.01	-0.68	-0.69
Multiple Births	4,349	2,822	0.04	64.89	4,226	2,557	0.04	60.51	0.00	-4.38	0.04	62.70	0.07	-0.16	-0.09
Total	121,231	12,743		10.51	114,457	11,136		9.73		-0.78			0.06	-0.84	-0.78
%													-7.3%	107.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by plurality in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who had single birth and the higher preterm birth rate was found among women who had multiple births. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all plurality groups. The absolute rate difference was higher among mothers who had multiple births.

The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, plurality distribution and plurality-specific rate components. The change in plurality distribution contributed to the preterm birth rate decrease among mothers who had single birth. In contrast, the plurality distribution component for mothers who had multiple births offset this decline.

When the plurality distribution components were summed across the plurality groups, a smaller effect (0.06) was observed on the overall change in preterm birth rates. The change in plurality-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who had single birth.

Examining the total effect of both components on the preterm birth rate decline by plurality group, the larger total effects were observed among mothers who had single birth. For all mothers, the decrease in the plurality-specific preterm birth rate had a larger effect than the change in the plurality distribution.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.06 & −0.84). The percentage due to the distribution component is (0.06/−0.78)*100 = -7.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.84/−0.78)*100 = 107.3 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Plurality, Michigan, 2008 vs 2014
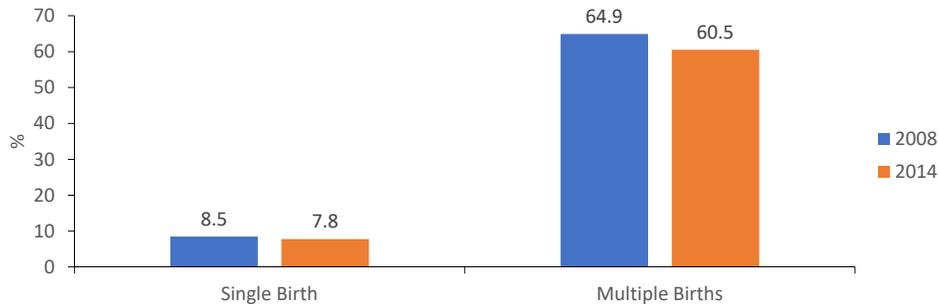
	Single Birth	Multiple Births
2008	8.5	64.9
2014	7.8	60.5

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.06	-0.84	-0.78	-7.3%	107.3%

This slide shows the incidence of preterm birth by plurality in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who had single birth and the higher preterm birth rate was found among women who had multiple births. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all plurality groups. The absolute rate difference was higher among mothers who had multiple births.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.06 & −0.84). The percentage due to the distribution component is (0.06/−0.78)*100 = -7.3 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.84/−0.78)*100 = 107.3 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Plurality, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Plurality	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Single Birth	110,231	8,579	0.96	7.78	108,997	8,798	0.96	8.07	0.00	0.29	0.96	7.93	-0.01	0.28	0.26
Multiple Births	4,226	2,557	0.04	60.51	4,376	2,692	0.04	61.52	0.00	1.01	0.04	61.01	0.10	0.04	0.14
Total	114,457	11,136		9.73	113,373	11,490		10.14		0.41			0.09	0.32	0.41
%													22.0%	78.0%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by plurality in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who had single birth and the higher preterm birth rate was found among women who had multiple births. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all plurality groups. The absolute rate difference was higher among mothers who had multiple births.
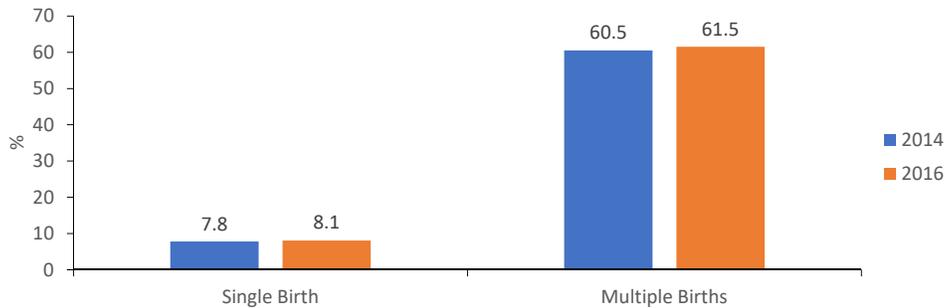
The decomposition analysis partitioned the overall observed rate difference of 0.41 into two parts, plurality distribution and plurality-specific rate components. The change in plurality distribution contributed to the preterm birth rate increase among mothers who had multiple births. In contrast, the plurality distribution component for mothers who had single birth offset this increase.

When the plurality distribution components were summed across the plurality groups, a smaller effect (0.09) was observed on the overall change in preterm birth rates. The change in plurality-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who had single birth.

Examining the total effect of both components on the preterm birth rate increase by plurality group, the larger total effects were observed among mothers who had single birth. For mothers who had single birth, the increase in the plurality-specific preterm birth rate had a larger effect than the decrease in the plurality distribution. For mothers who had multiple births, the increase in the plurality distribution had a larger effect than the increase in the plurality-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.09 & 0.32). The percentage due to the distribution component is (0.09/0.41)*100 = 22.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.32/0.41)*100 = 78.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.09	0.32	0.41	22.0%	78.0%

This slide shows the incidence of preterm birth by plurality in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who had single birth and the higher preterm birth rate was found among women who had multiple births. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all plurality groups. The absolute rate difference was higher among mothers who had multiple births.

The PTB rate difference between 2014 and 2016 was 0.41 which equals the sum of the distribution and rate components (0.09 & 0.32). The percentage due to the distribution component is (0.09/0.41)*100 = 22.0 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.32/0.41)*100 = 78.0 percent. This indicates that most of the overall rate increase was due to the rate component.

Preterm Births by Delivery Method, Michigan, 2008 vs. 2014

Delivery Method	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
C-Section	38,019	6,057	0.31	15.93	37,447	5,607	0.33	14.97	0.01	-0.96	0.32	15.45	0.20	-0.31	-0.11
Other	82,907	6,658	0.69	8.03	76,982	5,529	0.67	7.18	-0.01	-0.85	0.68	7.61	-0.10	-0.58	-0.67
Total	120,926	12,715		10.51	114,429	11,136		9.73		-0.78			0.10	-0.88	-0.78
%													-12.9%	112.9%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by delivery method in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who had other delivery method and the higher preterm birth rate was found among women who had c-section delivery. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all delivery method groups. The absolute rate difference was higher among mothers who had c-section delivery.

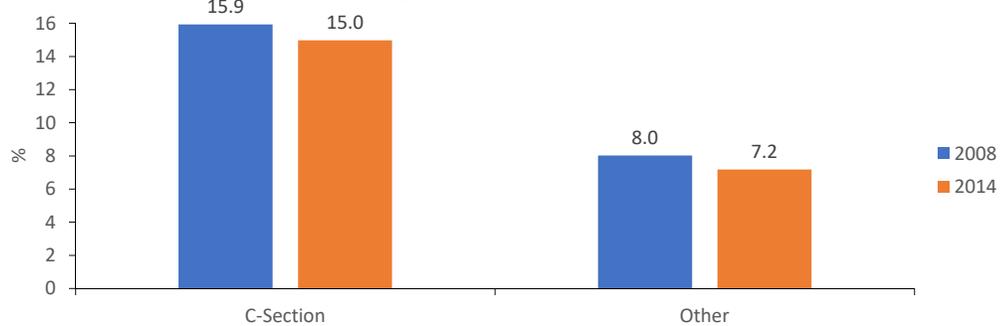The decomposition analysis partitioned the overall observed rate difference of -0.78 into two parts, delivery method distribution and delivery method-specific rate components. The change in delivery method distribution contributed to the preterm birth rate decrease among mothers who had other delivery method. In contrast, the delivery method distribution component for mothers who had c-section delivery offset this decline.

When the delivery method distribution components were summed across the delivery method groups, a smaller effect (0.10) was observed on the overall change in preterm birth rates. The change in delivery method-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who had other delivery method.

Examining the total effect of both components on the preterm birth rate decline by delivery method group, the larger total effects were observed among mothers who had other delivery method. For all mothers, the decrease in the delivery method-specific preterm birth rate had a larger effect than the change in the delivery method distribution.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.10& −0.88). The percentage due to the distribution component is (0.10/−0.78)*100 = -12.9 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.88/−0.78)*100 = 112.9 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Delivery Method, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.10	-0.88	-0.78	-12.9%	112.9%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by delivery method in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who had other delivery method and the higher preterm birth rate was found among women who had c-section delivery. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all delivery method groups. The absolute rate difference was higher among mothers who had c-section delivery.

The PTB rate difference between 2008 and 2014 was −0.78 which equals the sum of the distribution and rate components (0.10& −0.88). The percentage due to the distribution component is (0.10/−0.78)*100 = -12.9 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.88/−0.78)*100 = 112.9 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Delivery Method, Michigan, 2014 vs. 2016

Delivery Method	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
C-Section	37,447	5,607	0.33	14.97	36,221	5,632	0.32	15.55	-0.01	0.58	0.32	15.26	-0.12	0.19	0.07
Other	76,982	5,529	0.67	7.18	77,127	5,856	0.68	7.59	0.01	0.41	0.68	7.39	0.06	0.28	0.33
Total	114,429	11,136		9.73	113,348	11,488		10.14		0.40			-0.06	0.46	0.40
%													-15.0%	115.0%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by delivery method in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who had other delivery method and the higher preterm birth rate was found among women who had c-section delivery. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all delivery method groups. The absolute rate difference was higher among mothers who had c-section delivery.

The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, delivery method distribution and delivery method-specific rate components. The change in delivery method distribution contributed to the preterm birth rate increase among mothers who had other delivery method. In contrast, the delivery method distribution component for mothers who had c-section delivery offset this increase.

When the delivery method distribution components were summed across the delivery method groups, a smaller effect (-0.06) was observed on the overall change in preterm birth rates. The change in delivery method-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who had other delivery method.

Examining the total effect of both components on the preterm birth rate increase by delivery method group, the larger total effects were observed among mothers who had other delivery method. For all mothers, the increase in the delivery method-specific preterm birth rate had a larger effect than the change in the delivery method distribution.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (-0.06 & 0.46). The percentage due to the distribution component is (-0.06/0.40)*100 = -15.0 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.46/0.40)*100 = 115.0 percent. This indicates that all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Delivery Method, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
-0.06	0.46	0.40	-15.0%	115.0%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by delivery method in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who had other delivery method and the higher preterm birth rate was found among women who had c-section delivery. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all delivery method groups. The absolute rate difference was higher among mothers who had c-section delivery.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (-0.06 & 0.46). The percentage due to the distribution component is (-0.06/0.40)*100 = -15.0 percent. This indicates no effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.46/0.40)*100 = 115.0 percent. This indicates that all of the overall rate increase was due to the rate component.

Preterm Births by Gestational Diabetes, Michigan, 2008 vs. 2014

| | 2008 | | | | 2014 | | | | Kitagawa Decomposition | | | | | | |
| | N | N | P1 | R1 | N | N | P2 | R2 | Sub-Components | | | | Components | | |
Gestational Diabetes	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	4,574	714	0.04	15.61	5,727	818	0.05	14.28	0.01	-1.33	0.04	14.95	0.18	-0.06	0.12
No	115,419	11,858	0.96	10.27	108,352	10,281	0.95	9.49	-0.01	-0.79	0.96	9.88	-0.12	-0.75	-0.87
Total	119,993	12,572		10.48	114,079	11,099		9.73		-0.75			0.06	-0.81	-0.75
%													-8.2%	108.2%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by gestational diabetes in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who did not have gestational diabetes and the higher preterm birth rate was found among women who had gestational diabetes. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gestational diabetes groups. The absolute rate difference was higher among mothers who had gestational diabetes.

The decomposition analysis partitioned the overall observed rate difference of -0.75 into two parts, gestational diabetes distribution and gestational diabetes-specific rate components. The change in gestational diabetes distribution contributed to the preterm birth rate decrease among mothers who did not have gestational diabetes. In contrast, the gestational diabetes distribution component for mothers who had gestational diabetes offset this decline.

When the gestational diabetes distribution components were summed across the gestational diabetes groups, a smaller effect (0.06) was observed on the overall change in preterm birth rates. The change in gestational diabetes-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who did not have gestational diabetes.

Examining the total effect of both components on the preterm birth rate decline by gestational diabetes group, the larger total effects were observed among mothers who did not have gestational diabetes. For mothers who did not have gestational diabetes, the decrease in the gestational diabetes-specific preterm birth rate had a larger effect than the decrease in the gestational diabetes distribution. For mothers who had gestational diabetes, the increase in the gestational diabetes distribution had a larger effect than the decrease in the gestational diabetes-specific preterm birth rate.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.06 & −0.81). The percentage due to the distribution component is (0.06/−0.75)*100 = -8.2 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.81/−0.75)*100 = 108.2 percent. This indicates that all of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Gestational Diabetes, Michigan, 2008 vs 2014

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.06	-0.81	-0.75	-8.2%	108.2%

This slide shows the incidence of preterm birth by gestational diabetes in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who did not have gestational diabetes and the higher preterm birth rate was found among women who had gestational diabetes. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gestational diabetes groups. The absolute rate difference was higher among mothers who had gestational diabetes.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.06 & −0.81). The percentage due to the distribution component is (0.06/−0.75)*100 = -8.2 percent. This indicates no effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.81/−0.75)*100 = 108.2 percent. This indicates that all of the overall rate decrease was due to the rate component.

Preterm Births by Gestational Diabetes, Michigan, 2014 vs. 2016

Gestational Diabetes	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	5,727	818	0.05	14.28	5,963	814	0.05	13.65	0.00	-0.63	0.05	13.97	0.04	-0.03	0.00
No	108,352	10,281	0.95	9.49	107,138	10,638	0.95	9.93	0.00	0.44	0.95	9.71	-0.02	0.42	0.39
Total	114,079	11,099		9.73	113,101	11,452		10.14		0.40			0.01	0.39	0.40
%													2.7%	97.3%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by gestational diabetes in Michigan, 2014 vs 2016.

From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who did not have gestational diabetes and the higher preterm birth rate was found among women who had gestational diabetes. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who did not have gestational diabetes. The absolute rate difference was higher among mothers who had gestational diabetes.

The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, gestational diabetes distribution and gestational diabetes-specific rate components. The change in gestational diabetes distribution contributed to the preterm birth rate increase among mothers who had gestational diabetes. In contrast, the gestational diabetes distribution component for mothers who did not have gestational diabetes offset this increase.

When the gestational diabetes distribution components were summed across the gestational diabetes groups, a smaller effect (0.01) was observed on the overall change in preterm birth rates. The change in gestational diabetes-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who did not have gestational diabetes.

Examining the total effect of both components on the preterm birth rate increase by gestational diabetes group, the larger total effects were observed among mothers who did not have gestational diabetes. For mothers who did not have gestational diabetes, the increase in the gestational diabetes-specific preterm birth rate had a larger effect than the decrease in the gestational diabetes distribution. For mothers who had gestational diabetes, the increase in the gestational diabetes distribution had a larger effect than the decrease in the gestational diabetes-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.01 & 0.39). The percentage due to the distribution component is (0.01/0.40)*100 = 2.7 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.40)*100 = 97.3 percent. This indicates that almost all of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Gestational Diabetes, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.01	0.39	0.40	2.7%	97.3%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the incidence of preterm birth by gestational diabetes in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who did not have gestational diabetes and the higher preterm birth rate was found among women who had gestational diabetes. The increase in preterm birth rates from 2014 to 2016 was observed for mothers who did not have gestational diabetes. The absolute rate difference was higher among mothers who had gestational diabetes.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.01 & 0.39). The percentage due to the distribution component is (0.01/0.40)*100 = 2.7 percent. This indicates a smaller effect from the distribution component on the overall rate increase. On the other hand, the percentage due to the rate component is (0.39/0.40)*100 = 97.3 percent. This indicates that almost all of the overall rate increase was due to the rate component.

Preterm Births by Gestational Hypertension, Michigan, 2008 vs. 2014

Gestational Hyper-tension	2008				2014				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change P2-P1	Rate change R2-R1	average P (P2+P1)/2	average R (R2+R1)/2	Distrib	Rate	Total
Yes	5,302	1,368	0.04	25.80	5,876	1,254	0.05	21.34	0.01	-4.46	0.05	23.57	0.17	-0.21	-0.04
No	114,691	11,204	0.96	9.77	108,203	9,845	0.95	9.10	-0.01	-0.67	0.95	9.43	-0.07	-0.64	-0.71
Total	119,993	12,572		10.48	114,079	11,099		9.73	-0.75				0.10	-0.85	-0.75
%													-13.8%	113.8%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the decline of the incidence of preterm birth by gestational hypertension in Michigan, 2008 vs 2014.

From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent. In both years the lower preterm birth rate was present among women who did not have gestational hypertension and the higher preterm birth rate was found among women who had gestational hypertension. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gestational hypertension groups. The absolute rate difference was higher among mothers who had gestational hypertension.

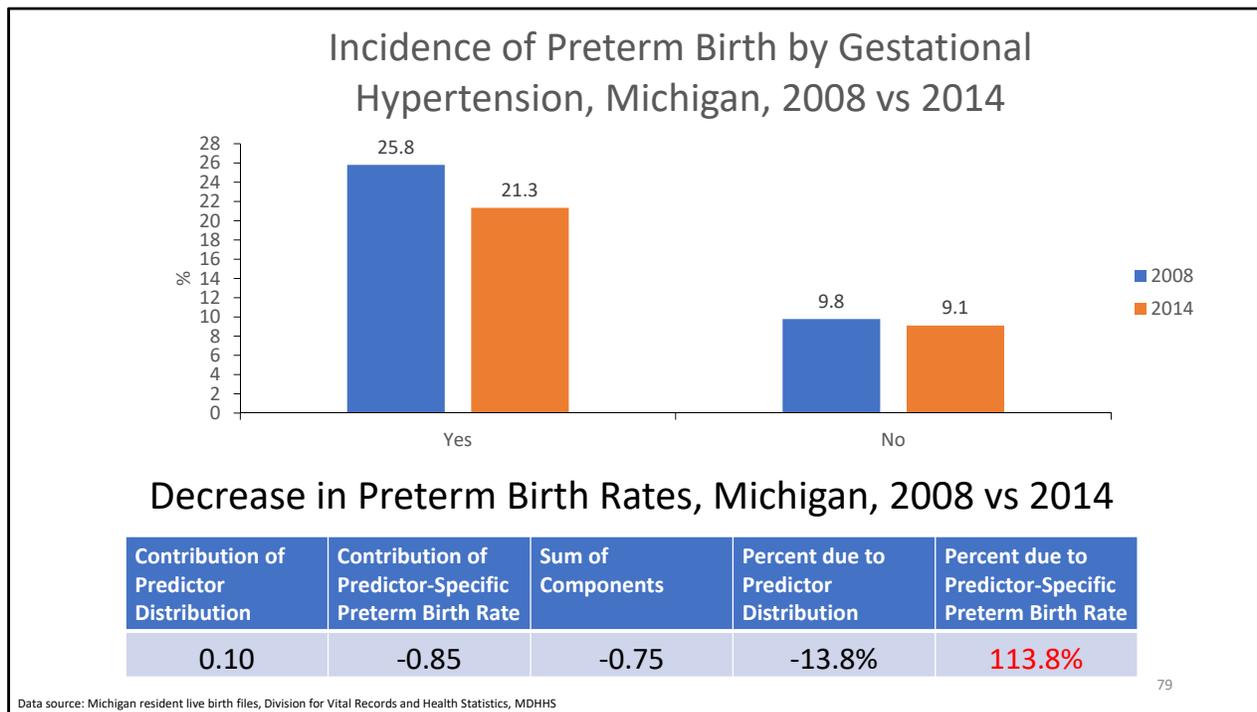The decomposition analysis partitioned the overall observed rate difference of -0.75 into two parts, gestational hypertension distribution and gestational hypertension-specific rate components. The change in gestational hypertension distribution contributed to the preterm birth rate decrease among mothers who did not have gestational hypertension. In contrast, the gestational hypertension distribution

component for mothers who had gestational hypertension offset this decline.

When the gestational hypertension distribution components were summed across the gestational hypertension groups, a smaller effect (0.10) was observed on the overall change in preterm birth rates. The change in gestational hypertension-specific preterm birth rates contributed to the decline in preterm birth rate mainly among mothers who did not have gestational hypertension.

Examining the total effect of both components on the preterm birth rate decline by gestational hypertension group, the larger total effects were observed among mothers who did not have gestational hypertension. For mothers who did not have gestational hypertension, the decrease in the gestational hypertension-specific preterm birth rate had a larger effect than the decrease in the gestational hypertension distribution. For mothers who had gestational hypertension, the decrease in the gestational hypertension-specific preterm birth rate had a larger effect than the increase in the gestational hypertension distribution.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.10 & 0.85). The percentage due to the distribution component is (0.10/−0.75)*100 = 11.5 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.85/−0.75)*100 = 88.5 percent. This indicates that most of the overall rate decrease was due to the rate component.

Incidence of Preterm Birth by Gestational Hypertension, Michigan, 2008 vs 2014

Bar chart — % on y-axis (0 to 28). Yes: 2008 = 25.8, 2014 = 21.3. No: 2008 = 9.8, 2014 = 9.1. Legend: 2008, 2014.

Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.10	-0.85	-0.75	-13.8%	113.8%

Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

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This slide shows the incidence of preterm birth by gestational hypertension in Michigan, 2008 vs 2014.

In both years the lower preterm birth rate was present among women who did not have gestational hypertension and the higher preterm birth rate was found among women who had gestational hypertension. The decrease in preterm birth rates from 2008 to 2014 was observed for mothers across all gestational hypertension groups. The absolute rate difference was higher among mothers who had gestational hypertension.

The PTB rate difference between 2008 and 2014 was −0.75 which equals the sum of the distribution and rate components (0.10 & 0.85). The percentage due to the distribution component is (0.10/−0.75)*100 = 11.5 percent. This indicates a smaller effect from the distribution component on the overall rate decrease. On the other hand, the percentage due to the rate component is (−0.85/−0.75)*100 = 88.5 percent. This indicates that most of the overall rate decrease was due to the rate component.

Preterm Births by Gestational Hypertension, Michigan, 2014 vs. 2016

	2014				2016				Kitagawa Decomposition						
	N	N	P1	R1	N	N	P2	R2	Sub-Components				Components		
Gestational Hyper-tension	Births	PTB Births	Predictor Distrib	PTB Rate	Births	PTB Births	Predictor Distrib	PTB Rate	Dist change	Rate change	average P	average R	Distrib	Rate	Total
									P2-P1	R2-R1	(P2+P1)/2	(R2+R1)/2			
Yes	5,876	1,254	0.05	21.34	7,368	1,639	0.07	22.24	0.01	0.90	0.06	21.79	0.30	0.05	0.35
No	108,203	9,845	0.95	9.10	105,733	9,813	0.93	9.28	-0.01	0.18	0.94	9.19	-0.13	0.17	0.05
Total	114,079	11,099		9.73	113,101	11,452		10.13		0.40			0.17	0.22	0.40
%													43.4%	56.6%	

Predictor Distrib is the predictor distribution calculated as the proportion of births in predictor strata compared to total births.
PTB rate is the preterm birth rate per 100 births.

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Data source: Michigan resident live birth files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the table in which the Kitagawa decomposition method is applied to elucidate contributors to the increase of the incidence of preterm birth by gestational hypertension in Michigan, 2014 vs 2016.
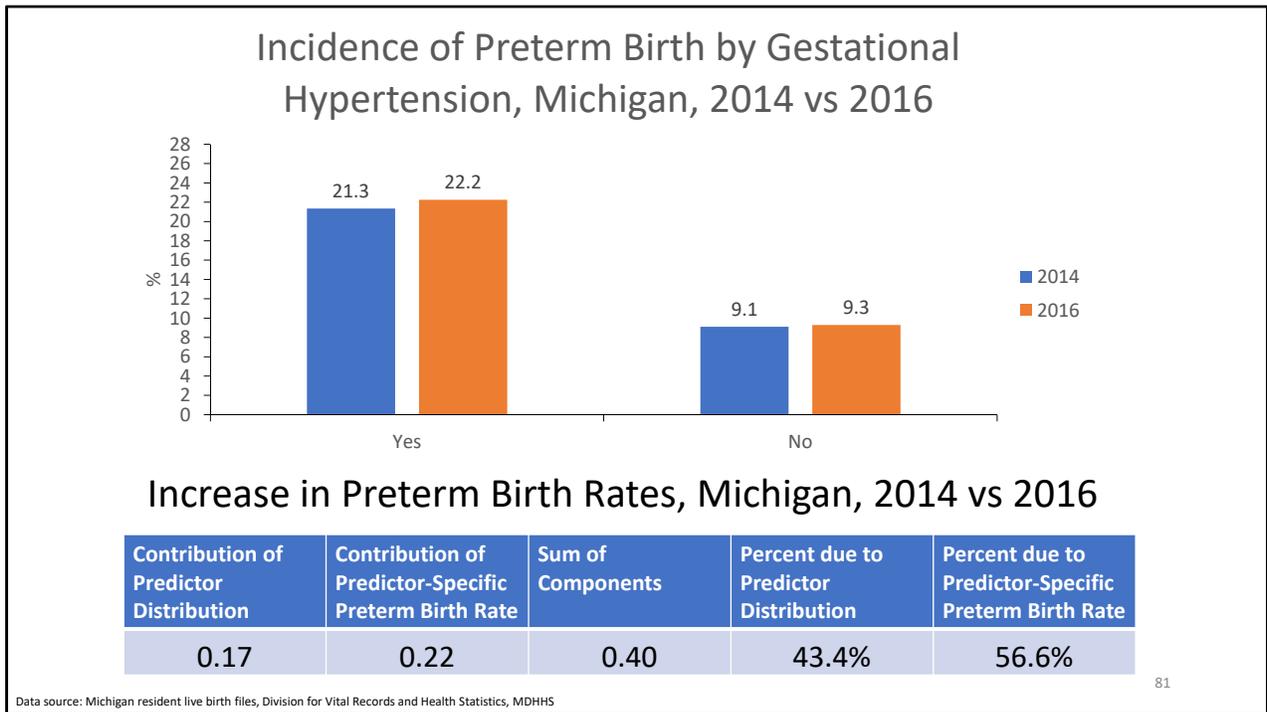
From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent. In both years the lower preterm birth rate was present among women who did not have gestational hypertension and the higher preterm birth rate was found among women who had gestational hypertension. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all gestational hypertension groups. The absolute rate difference was higher among mothers who had gestational hypertension.

The decomposition analysis partitioned the overall observed rate difference of 0.40 into two parts, gestational hypertension distribution and gestational hypertension-specific rate components. The change in gestational hypertension distribution contributed to the preterm birth rate increase among mothers who had gestational hypertension. In contrast, the gestational hypertension distribution component for mothers who did not have gestational hypertension offset this increase.

When the gestational hypertension distribution components were summed across the gestational hypertension groups, a smaller effect (0.17) was observed on the overall change in preterm birth rates. The change in gestational hypertension-specific preterm birth rates contributed to the increase in preterm birth rate mainly among mothers who did not have gestational hypertension.

Examining the total effect of both components on the preterm birth rate increase by gestational hypertension group, the larger total effects were observed among mothers who had gestational hypertension. For mothers who did not have gestational hypertension, the increase in the gestational hypertension-specific preterm birth rate had a larger effect than the decrease in the gestational hypertension distribution. For mothers who had gestational hypertension, the increase in the gestational hypertension distribution had a larger effect than the increase in the gestational hypertension-specific preterm birth rate.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.17 & 0.22). The percentage due to the distribution component is (0.17/0.40)*100 = 43.4 percent. This indicates that almost half of the overall rate increase was due to the distribution component. The percentage due to the rate component is (0.22/0.40)*100 = 56.6 percent. This indicates that the other half of the overall rate increase was due to the rate component.

Incidence of Preterm Birth by Gestational Hypertension, Michigan, 2014 vs 2016

Increase in Preterm Birth Rates, Michigan, 2014 vs 2016

Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
0.17	0.22	0.40	43.4%	56.6%

This slide shows the incidence of preterm birth by gestational hypertension in Michigan, 2014 vs 2016.

In both years the lower preterm birth rate was present among women who did not have gestational hypertension and the higher preterm birth rate was found among women who had gestational hypertension. The increase in preterm birth rates from 2014 to 2016 was observed for mothers across all gestational hypertension groups. The absolute rate difference was higher among mothers who had gestational hypertension.

The PTB rate difference between 2014 and 2016 was 0.40 which equals the sum of the distribution and rate components (0.17 & 0.22). The percentage due to the distribution component is (0.17/0.40)*100 = 43.4 percent. This indicates that almost half of the overall rate increase was due to the distribution component. The percentage due to the rate component is (0.22/0.40)*100 = 56.6 percent. This indicates that the other half of the overall rate increase was due to the rate component.

Summary

	Decrease in Preterm Birth Rates, Michigan, 2008 vs 2014					Increase in Preterm Birth Rates, Michigan, 2014 vs 2016				
	Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate	Contribution of Predictor Distribution	Contribution of Predictor-Specific Preterm Birth Rate	Sum of Components	Percent due to Predictor Distribution	Percent due to Predictor-Specific Preterm Birth Rate
Maternal Age	-0.03	-0.75	-0.78	4.30%	95.70%	0.01	0.40	0.41	1.40%	98.60%
Maternal Race/Ethnicity	0.01	-0.78	-0.78	-1.00%	101.00%	0.00	0.39	0.39	-0.10%	100.10%
Maternal Education	-0.09	-0.69	-0.78	11.50%	88.50%	-0.03	0.40	0.37	-8.30%	108.30%
Payment Source	0.03	-0.80	-0.76	-4.20%	104.20%	-0.01	0.41	0.41	-1.50%	101.50%
Marital Status	0.03	-0.81	-0.78	-4.40%	104.40%	-0.01	0.41	0.40	-3.70%	103.70%
Prenatal BMI	0.04	-0.88	-0.85	-4.40%	104.40%	0.02	0.34	0.36	5.00%	95.00%
Smoking	0.00	-0.75	-0.75	0.40%	99.60%	-0.04	0.41	0.37	-10.20%	110.20%
Others in Household Smoke	-0.02	-0.67	-0.69	2.70%	97.30%	-0.03	0.37	0.34	-9.60%	109.60%
Prenatal Care Began	-0.19	-0.69	-0.88	21.60%	78.40%	0.01	0.34	0.35	3.20%	96.80%
Kotelchuck Index	0.77	-1.70	-0.93	-82.60%	182.60%	0.52	-0.15	0.37	141.20%	-41.20%
Gravidity	0.02	-0.80	-0.78	-2.30%	102.30%	0.02	0.39	0.41	4.50%	95.50%
Previous C-Section Delivery	0.03	-0.78	-0.75	-3.60%	103.60%	0.00	0.40	0.40	0.80%	99.20%
Gestational Diabetes	0.06	-0.81	-0.75	-8.20%	108.20%	0.01	0.39	0.40	2.70%	97.30%
Gestational Hypertension	0.10	-0.85	-0.75	-13.80%	113.80%	0.17	0.22	0.40	43.40%	56.60%
Delivery Method	0.10	-0.88	-0.78	-12.90%	112.90%	-0.06	0.46	0.40	-15.00%	115.00%
Plurality	0.06	-0.84	-0.78	-7.30%	107.30%	0.09	0.32	0.41	22.00%	78.00%
Newborn NICU Admission	0.58	-1.40	-0.82	-71.30%	171.30%	0.20	0.20	0.40	50.30%	49.70%
Infant Birthweight	-0.17	-0.61	-0.79	21.70%	78.30%	0.10	0.30	0.40	26.00%	74.00%

This slide shows the summary table that details the results from the Kitagawa decomposition method that was applied to elucidate contributors to the decline of the incidence of preterm birth by maternal and infant characteristics in Michigan, 2008 vs 2014, and the increase of the incidence of preterm birth by maternal and infant characteristics in Michigan, 2014 vs 2016.

The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in **predictor-specific preterm birth rates** in the following predictors: maternal age, maternal race/ethnicity, payment source, marital status, prenatal body mass index (BMI), smoking, others in household smoke, Kotelchuck Index, gravidity, previous c-section delivery, gestational diabetes, gestational hypertension, delivery method, plurality, newborn NICU admission.

The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in predictor-specific preterm birth rates and a decrease in prevalence of **predictor distribution** in the following predictors: maternal education, month prenatal care began, and infant birthweight.

The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in **predictor-specific preterm birth rates** in the following predictors: maternal age, maternal race/ethnicity, maternal education, payment source, marital status, prenatal body mass index (BMI), smoking, others in household smoke, month prenatal care began, gravidity, previous c-section delivery, gestational diabetes, and delivery method.

The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in predictor-specific preterm birth rates and increase in prevalence of **predictor distribution** in the following predictors: gestational Hypertension, plurality, newborn NICU admission, and infant birthweight.

For maternal education and month prenatal care began, both distribution component and rate component contributed to the decrease in the preterm birth rates from 2008 to 2014; however, only rate component contributed to the increase in the preterm birth rates from 2014 to 2016.

For Kotelchuck Index, only rate component contributed to the decrease in the preterm birth rates from 2008 to 2014; however, only distribution component contributed to the increase in the preterm birth rates from 2014 to 2016.

For gestational hypertension, plurality, and new born admission, only rate component contributed to the decrease in the preterm birth rates from 2008 to 2014; however, both distribution component and rate component contributed to the increase in the preterm birth rates from 2014 to 2016.

Conclusions

- From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51% to 9.73%, an absolute rate difference of -0.78%.

- The decomposition analysis partitioned the overall observed rate difference of -0.78% into two parts, predictor distribution and predictor-specific rate components.

- The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in predictor-specific preterm birth rates and a decrease in prevalence of **predictor distribution**:
  - Maternal education
  - Prenatal care began
  - Infant birthweight

- The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in **predictor-specific preterm birth rates**:
  - Maternal age
  - Maternal race/ethnicity
  - Payment source
  - Marital status
  - Prenatal body mass index (BMI)
  - Smoking
  - Others in household smoke
  - Kotelchuck Index
  - Gravidity
  - Previous c-section delivery
  - Gestational diabetes
  - Gestational hypertension
  - Delivery method
  - Plurality
  - Newborn NICU admission

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From 2008 to 2014, the preterm birth rate in Michigan decreased from 10.51 percent to 9.73 percent, an absolute rate difference of -0.78 percent.

The decomposition analysis partitioned the overall observed rate difference of -0.78 percent into two parts, predictor distribution and predictor-specific rate components.

The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in **predictor-specific preterm birth rates** in the following predictors: maternal age, maternal race/ethnicity, payment source, marital status, prenatal body mass index (BMI), smoking, others in household smoke, Kotelchuck Index, gravidity, previous c-section delivery, gestational diabetes, gestational hypertension, delivery method, plurality, and newborn NICU admission.

The overall decline in the preterm birth rates from 2008 to 2014 was related to declines in predictor-specific preterm birth rates and a decrease in prevalence of **predictor distribution** in the following predictors: maternal education, month prenatal care began, and infant birthweight.

Conclusions

- From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73% to 10.13%, an absolute rate difference of 0.40%.

- The decomposition analysis partitioned the overall observed rate difference of 0.40% into two parts, predictor distribution and predictor-specific rate components.

- The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in predictor-specific preterm birth rates and increase in prevalence of **predictor distribution:**
  - Gestational hypertension
  - Plurality
  - Newborn NICU admission
  - Infant birthweight

- The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in **predictor-specific preterm birth rates**:
  - Maternal age
  - Maternal race/ethnicity
  - Maternal education
  - Payment source
  - Marital status
  - Prenatal body mass index (BMI)
  - Smoking
  - Others in household smoke
  - Prenatal care began
  - Gravidity
  - Previous c-section delivery
  - Gestational diabetes
  - Delivery method

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From 2014 to 2016, the preterm birth rate in Michigan increased from 9.73 percent to 10.13 percent, an absolute rate difference of 0.40 percent.

The decomposition analysis partitioned the overall observed rate difference of 0.40 percent into two parts, predictor distribution and predictor-specific rate components.

The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in **predictor-specific preterm birth rates** in the following predictors: maternal age, maternal race/ethnicity, maternal education, payment source, marital status, prenatal body mass index (BMI), smoking, others in household smoke, month prenatal care began, gravidity, previous c-section delivery, gestational diabetes, and delivery method.

The overall increase in the preterm birth rates from 2014 to 2016 was related to increase in predictor-specific preterm birth rates and increase in prevalence of **predictor distribution** in the following predictors: gestational Hypertension, plurality, newborn NICU admission, and infant birthweight.

Conclusions

- The preterm birth rate decreased from 10.51% of live births in 2008 to 9.73% in 2014, however, increased from 9.73% in 2014 to 10.13% in 2016.

- Kitagawa decomposition method was used to identify potential determinants to changes in preterm birth rate differences:
  - Maternal education: predictor distribution & predictor-specific rate → predictor-specific rate
  - Prenatal care began: predictor distribution & predictor-specific rate → predictor-specific rate
  - Kotelchuck Index: predictor-specific rate → predictor distribution
  - Gestational Hypertension: predictor-specific rate → predictor distribution & predictor-specific rate
  - Plurality: predictor-specific rate → predictor distribution & predictor-specific rate
  - Newborn NICU Admission: predictor-specific rate → predictor distribution & predictor-specific rate

- Effective public health strategies for further reducing preterm birth rates need to be tailored to different maternal determinant groups.

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The preterm birth rate decreased from 10.51 percent of live births in 2008 to 9.73 percent in 2014, however, increased from 9.73 percent in 2014 to 10.13 percent in 2016.

Kitagawa decomposition method was used to identify potential determinants to changes in preterm birth rate differences.

For maternal education and month prenatal care began, both the distribution and rate components contributed to the decrease in the preterm birth rates from 2008 to 2014; however, only the rate component contributed to the increase in the preterm birth rates from 2014 to 2016.

For Kotelchuck Index, only the rate component contributed to the decrease in the preterm birth rates from 2008 to 2014; however, only the distribution component contributed to the increase in the preterm birth rates from 2014 to 2016.

For gestational hypertension, plurality, and new born admission, only the rate component contributed to the decrease in the preterm birth rates from 2008 to

2014; however, both the distribution and rate components contributed to the increase in the preterm birth rates from 2014 to 2016.

Effective public health strategies for further reducing preterm birth rates need to be tailored to different maternal determinant groups.

Kitagawa --- Considerations

- Kitagawa decomposition method is a fundamental descriptive epidemiology skill and works well when we only want to examine one predictor (or we could cross-classify multiple predictors); there is no opportunity to adjust for potential confounding.

- We should be interested in both the predictor distribution and the predictor-specific rates.

- Overall component totals:
  - If percentage explained >100%, all of rate difference was explained by the component.
  - If percentage explained is a negative percent, none of the rate difference was explained by the component.

This slide shows some consideration for the Kitagawa decomposition method.

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