

Maternal Predictors of Breastfeeding Duration in the ITFPS-2 Study

Abigail Garman

Advisor: Dr. Samantha Seals

University of West Florida

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Study Purpose



"Feeding My Baby"

- The WIC Infant and Toddler Feeding Practices Study 2 (**ITFPS-2**)—also known as "**Feeding My Baby**"—examines how WIC caregivers feed their infants and toddlers.
- From this study, I obtained the **year 1** dataset, Infant Year Report, which contained a total of **4367** participants. Participant recruitment relied on the partnership of 27 WIC State Agencies and 80 participating sites nationwide.
- Inspired by my experience as a mother, I wanted to understand how **demographic** and **prenatal factors** might affect a woman's decision to stop **breastfeeding**, and whether we can predict that timing through data.

Key Source Reports

Prenatal “Intention to Breastfeed” Report (USDA FNS, 2016)

- Profiles mothers’ **prenatal attitudes and intentions** towards breastfeeding.
- Captures beliefs and social factors **measured before birth** that later influence duration outcomes.
- Highlights associations between maternal confidence, perceived support, and education level.
- Provides a predictive framework for linking prenatal intention to **postpartum breastfeeding behavior**.

Infant Year Report (USDA FNS, 2018)

- Documents breastfeeding intention, initiation, exclusivity, and **duration through 13 months**.
- Provides nationally weighted estimates derived from the study’s **complex-survey design**.
- Key finding: 18% of WIC mothers were **still breastfeeding at 12 months**, compared to 7% in the prior IFPS-1 study.
- Establishes benchmark measures for validating later analytic models.

Why Model
Breastfeeding
Duration Using
Maternal Opinions ?



Literature Review:

Postpartum Symptoms of Depression and Infant Feeding Practices in WIC Mothers
(Weinfield & Anderson, 2022)

Purpose:

Examines how maternal feeding beliefs, feeding practices, and dietary intake relate to **postpartum depression (PPD)**.

Methods:

Structural Equation Modeling
Bivariate chi-square tests
Linear regression models

Key Findings:

Significant associations between feeding beliefs/practices and PPD symptoms
Smoking and lower socioeconomic status increased PPD risk.

SEM allowed deeper modeling of indirect relationships

Literature Review:

Maternity Care Practices and Breastfeeding Intentions at One Month Among Low-Income Women
(Beauregard, J. L., et al., 2019)

Purpose:

Examine whether low-income WIC mothers **met breastfeeding expectations** based on six supportive maternity care practices.

Methods:

Poisson regression with **quasi-likelihood adjustment for overdispersion**

Tested linear trends & racial/ethnic differences (Rao-Scott LRT)

Key Findings:

Early Initiation, exclusive B.F., and avoiding pacifiers **increased odds** of meeting expectations **at 1 month.**

Early PP hospital care strongly influences BF outcomes.

Literature Review:

Prenatal and Postnatal Experiences Predict Breastfeeding Patterns in the WIC Infant and Toddler Feeding Practices Study-2
(Borger, C., et al., 2021)

Purpose:

Examine pre- and postnatal factors associated with continued B.F. among WIC participants

6 months, 1 year, and 1 year exclusively

Methods:

Hierarchical Logistic Regression Models

Predictors:

Intention, pediatrician's recommendation to cont., sociodemographic /attitudinal variables, etc. (other pre- and postnatal factors)

Key Findings:

Higher Prenatal intention significantly increased odds of longer B.F. duration.

Doctor's recommendation to cont. B.F. after going back to work also **sustained duration.**

Mirrors my study's goal of modeling predictors of B.F. duration.

Literature Review:

*WIC Infant and Toddler Feeding Practices Study 2 (ITFPS-2): Fifth Year Report
(U.S. Department of Agriculture, Food and Nutrition Service , 2022)*

Purpose:

Assess and evaluate how length of WIC participation influences children's diet quality **at age five.**

Methods:

Healthy Eating Index-2015 (HEI-2015) scores is the outcome measured.

Univariate Regression of WIC participation duration on HEI-2015

Key Findings:

Longer WIC participation ➔ Higher HEI-2015 scores (**better overall diet quality**)

Longer **breastfeeding duration** strongly linked to **improved diet quality**

Key Research Questions



Which maternal demographic, socioeconomic, support-related, and opinion-based factors significantly predict breastfeeding duration among WIC participants in the ITFPS-2 study?

Can a predictive model based on these maternal variables accurately estimate how long a mother is likely to continue breastfeeding?

Cleaning the Data



A Glimpse of the Untouched Data

ITFPS2_ID <chr>	CoreSupp <dbl>	SCR_PregStat <dbl>	Prenatal_Status <chr>	Mon1_Status <chr>	Mon3_Status <chr>	Mon5_Status <chr>
ITFPS00001	2	1	NA	C1	NA	NA
ITFPS00004	2	1	NA	C1	NA	NA
ITFPS00007	1	1	NA	NA	NA	NA
ITFPS00010	1	1	C1	C1	C1	C1
ITFPS00016	1	1	C1	C1	C1	C1
ITFPS00020	1	1	NA	NA	NA	NA
ITFPS00024	1	1	C1	C1	C1	C1
ITFPS00025	1	1	C1	C1	NA	C1
ITFPS00035	1	2	NA	NA	C1	C1
ITFPS00038	1	1	C1	C1	NA	NA

1-10 of 10 rows | 1-7 of 2388 columns

With in the original dataset, there are **4367 unique IDs** corresponding to a mother or caregiver who enrolled in the WIC program either **during pregnancy** or within the first 3 months of the child's life.

For the purposes of this exploration, we are only interested in pregnant enrollees who initiated breastfeeding.

Filtered Dataset: Prenatal Enrollees Who Initiated Breastfeeding

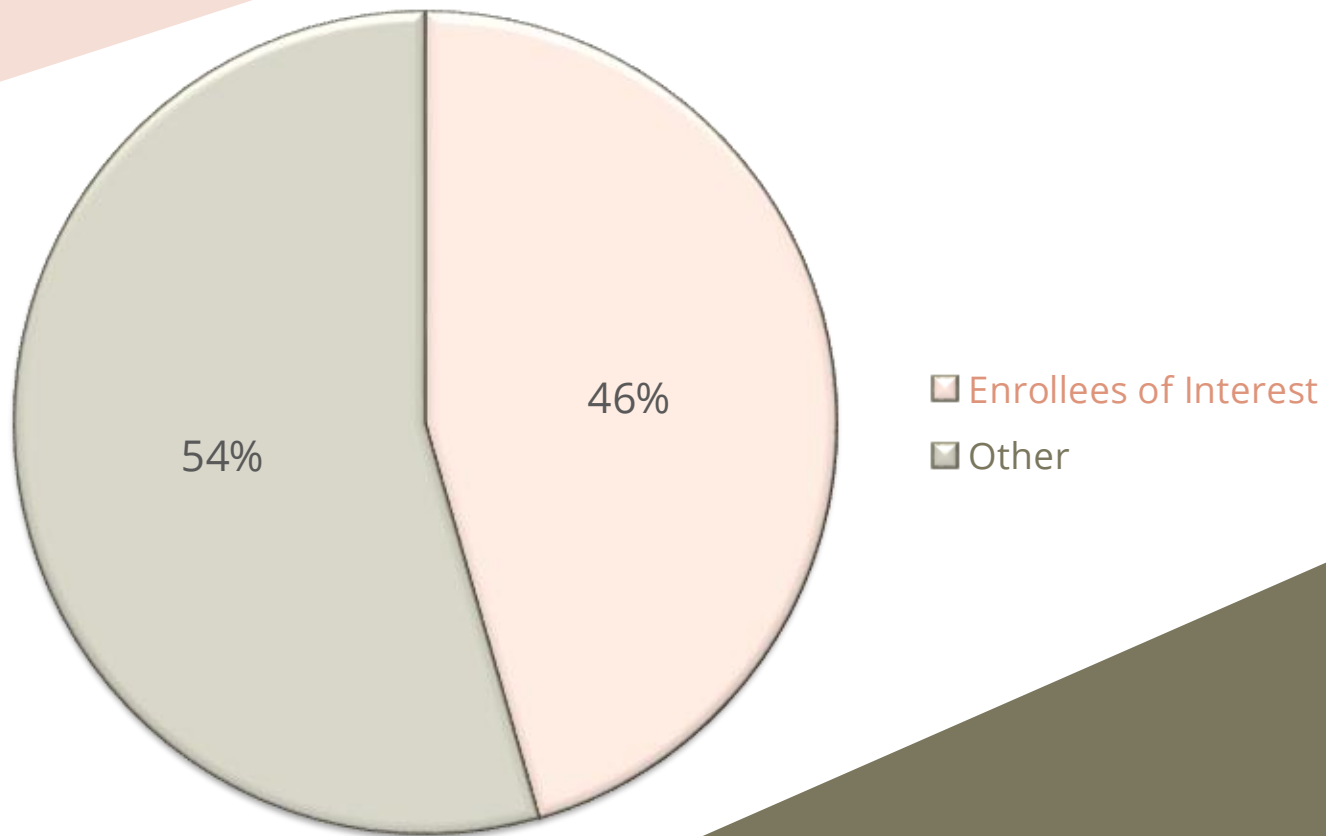
- ✓ Data were filtered to include prenatal WIC enrollees with valid weights ($WCPRECOR > 0$) who initiated breastfeeding.
- ✓ Breastfeeding Initiators Only
- ✓ Kept only mothers with non-missing values for StopBFby!3m and StopBFAge13m

•4,367 prenatal WIC enrollees

**•1,988 (≈46%)
initiated
breastfeeding and
were responsive to
later interviews**

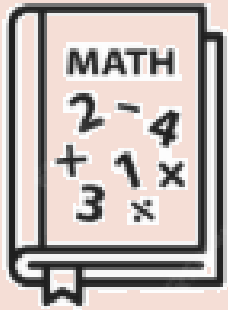


WIC Study Participants



Variables

SL_Parity	First , Second, or Third/Subsequent child?
Der_EduLevel	Mother or Caregiver's highest education level.
SL_Poverty2013s	Poverty level 2013 (Above or below 75% of the poverty guideline)
SL_BFSupportHome	Nature of breastfeeding support at home (Weak, Moderate, Strong)
IP_WC5	Have you received any information from WIC about breastfeeding during this pregnancy? (Yes or No)
IP_KA18a	Breastfeeding is easier than formula feeding. (Strongly Agree-Strongly Disagree)
IP_KA18d	Breastfeeding brings a mother closer to her baby. (Strongly Agree-Strongly Disagree)
IP_KA18j	Breastfeeding is painful. (Strongly Agree-Strongly Disagree)
IP_KA18l	With bottle feeding, mother knows that baby is getting enough to eat. (Strongly Agree-Strongly Disagree)



Binary Logistic Regression Model:

$$\log \left(\frac{\pi_i}{1 - \pi_i} \right) = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki}$$

- π_i : probability that mother i breastfeeds
- $X_{1i}, X_{2i}, \dots, X_{ki}$: predictor variables (e.g., education, income, etc.)
- β_0 : intercept
- β_1, \dots, β_k : change in log-odds of breastfeeding for a one-unit change in each predictor

Design-Based Weighting in ITFPS-2

Weighted mean:

Weight Used: **WCPRECOR**
(prenatal enrollment core-sample weight)

Purpose: Allows analysis to **generalize** to all new WIC mothers who enrolled prenatally

Variances computed with **replicate** (jackknife) weights to maintain **design consistency**.

$$\bar{y}_w = \frac{\sum_{i=1}^n w_{sel_i} \cdot y_i}{\sum_{i=1}^n w_{sel_i}}$$

This final weight equation combines the **base selection**, **nonresponse weight**, and **post-stratification adjustments**.

$$W_{final_i} = W_{sel_i} \cdot W_{nr_i} \cdot W_{ps_i}$$

Understanding Survey Weights

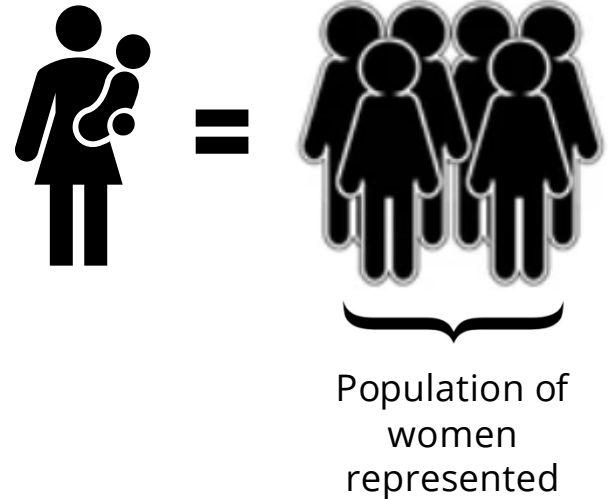
Survey weights tells us how many people that respondent stands for in national estimates.

Adjust for unequal probabilities of selection
(**oversampling**)

Necessary because of the study employs a **complex survey design** – not a simple random sample.

For example:

if one mother's weight = 200, she represents 200 mothers in the U.S. WIC population.



Predicting Breastfeeding Status:

- Began by modeling **whether a mother breastfed (Yes/No)** using the variable `StopBFby13m_bin`.
- Outcome coded as:
 - 1 = Stopped breastfeeding by 13 months
 - 0 = Continued breastfeeding



Findings:

- Most variables showed **no statistically significant relationship** ($p > 0.05$)
- The binary model had limited significant predictors, suggesting that **breastfeeding duration (continuous)** may capture more meaningful variation than a simple yes/no response.

Binary Model

As we can see, there are **no significant predictors** to say whether a mother will stop breastfeeding by 13 months or not.

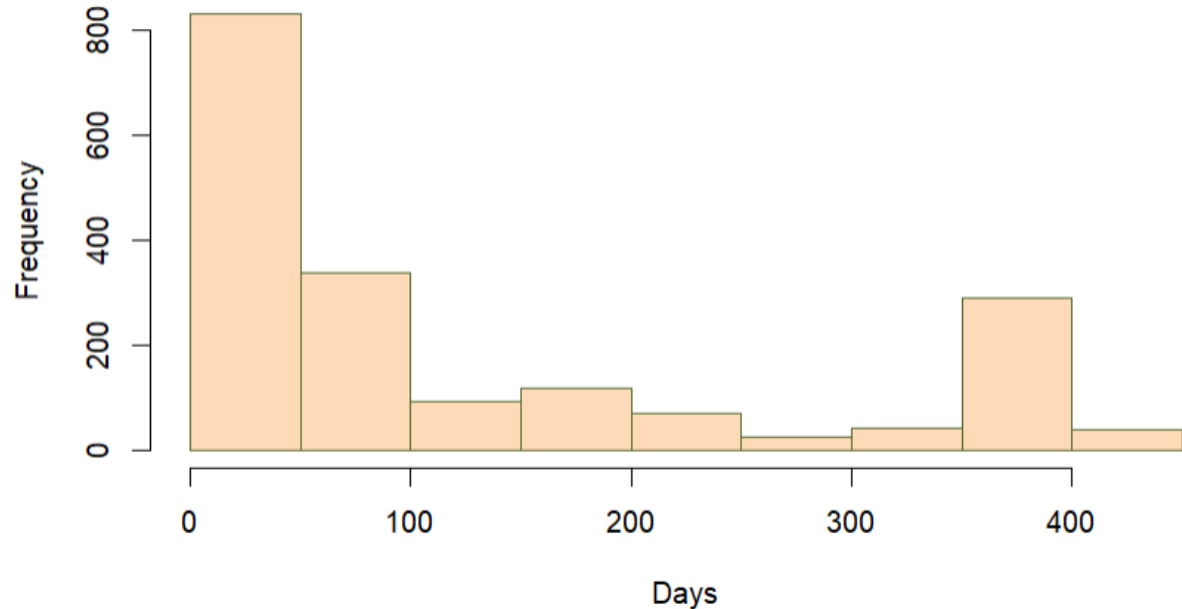
StopBFby13m_binary			
Predictor		$\hat{\beta}$ (OR($\hat{\beta}$))	p-value
IP_WC5	Yes	0.191 → OR = 1.210	0.750
	No	-----Reference-----	
KA18a	Agree	-0.401 → OR = 0.670	0.606
	Neutral	-0.171 → OR = 0.843	0.856
	Disagree	-----Reference-----	
KA18d	Agree	-1.420 → OR = 0.242	0.695
	Neutral	-1.014 → OR = 0.363	0.793
	Disagree	-----Reference-----	
KA18j	Agree	0.329 → OR = 1.390	0.603
	Neutral	0.035 → OR = 1.035	0.968
	Disagree	-----Reference-----	
KA18l	Agree	0.393 → OR = 1.482	0.513
	Neutral	-0.015 → OR = 0.985	0.986
	Disagree	-----Reference-----	
SL_Parity		-0.273 → OR = 0.761	0.525
Der_EduLevel		-0.233 → OR = 0.792	0.705
SL_Poverty2013s		-0.223 → OR = 0.800	0.626
SL_BFSupportHome		-0.303 → OR = 0.738	0.645

Shifting the Focus

The analysis then shifted to modeling **breastfeeding duration** as the outcome variable, providing a richer distribution of data for examining maternal and demographic predictors.



Distribution of StopBFAge13m_clean



Strong positive skew and long right tail indicate overdispersion relative to a normal distribution, supporting the use of a gamma or quasi-Poisson regression model for duration analysis.

Adjusting the Outcome Variable for Better Interpretation

Original Measurement:

- The ITFPS-2 variable `StopBF`Age13m recorded **breastfeeding duration in days.**



Conversion to weeks:

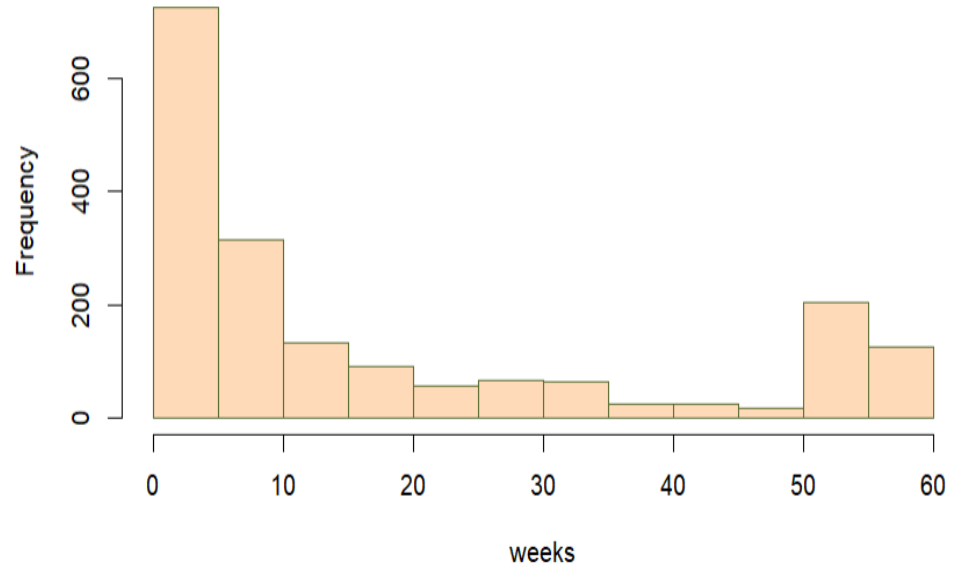
- **Improves interpretability:** Weekly values (e.g., 8, 26, 52) are easier to relate to real-world milestones like “2 months” or “6 months.”
- **Aligns with prior research:** Many studies on breastfeeding duration report results in **weeks or months**, making comparison more consistent.
- **Simplifies model scaling:** Coefficients represent changes in duration per **one-week difference**, providing clearer effect sizes.

Distribution of Breastfeeding Duration Among WIC Participants



- A smaller group continues throughout the first year, with a visible increase **near 52-60 weeks (those who breastfeed close to a year).**

- This pattern highlights **early cessation as the most common outcome**, emphasizing the importance of understanding factors that support longer breastfeeding duration.



Design-Based Weighting in ITFPS-2

Weighted mean:

Weight Used: **WCPRECOR**
(prenatal enrollment core-sample weight)

Purpose: Allows analysis to **generalize** to all new WIC mothers who enrolled prenatally

Variances computed with **replicate** (jackknife) weights to maintain **design consistency**.

$$\bar{y}_w = \frac{\sum_{i=1}^n w_{sel_i} \cdot y_i}{\sum_{i=1}^n w_{sel_i}}$$

This final weight equation combines the **base selection**, **nonresponse weight**, and **post-stratification adjustments**.

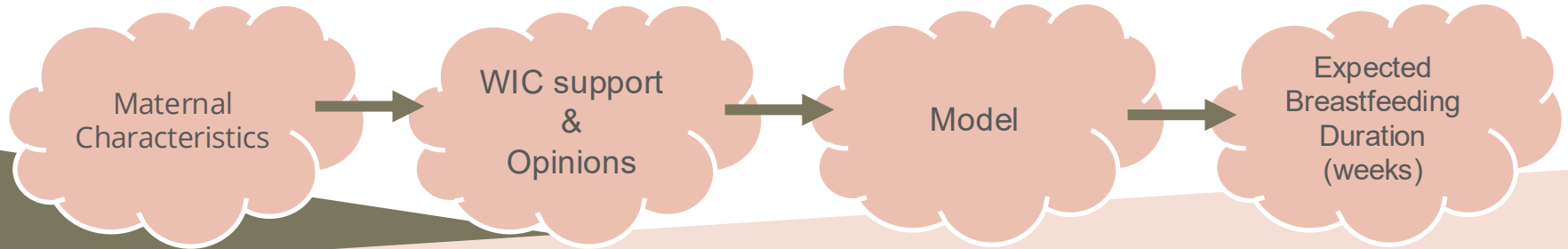
$$W_{final_i} = W_{sel_i} \cdot W_{nr_i} \cdot W_{ps_i}$$

Model Specification

- **Outcome:** Breastfeeding Duration
- **Predictors:** Demographics, Support variables, Maternal opinions
- **Survey Design:** Weighted using WCPRECOR
- **Software:** R (survey package, svyglm function)

Modeling Approach

- **Survey-weighted Poisson regression**
- Used because breastfeeding duration is a **count variable (weeks)** and cannot be negative
- **Weights** (WCPRECOR) ensure results **represent the full U.S. WIC population**



Modeling Breastfeeding Duration with Poisson Regression



$$\ln[E(Y_i)] = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki}$$

- $E(Y_i)$: **expected** number of weeks of **breastfeeding** for mother i
- $X_{1i}, X_{2i}, \dots, X_{ki}$: predictors (e.g., education, income, etc.)
- β_0 : intercept (baseline log of expected duration)
- β_1, \dots, β_k : change in log of expected duration for a **one-unit change** in each predictor

Survey-Weighted Regression Results:

Predictors with $p < 0.05$ were considered statistically **significant**, indicating that their association with breastfeeding duration is unlikely due to random chance.

Poisson Regression			
Predictor	β (Estimate)	Exp(β) [95% CI]	p-value
Intercept	0.989	2.69 [1.38 – 5.23]	0.0017
IP_WC5Yes	-0.208	0.81 [0.71 – 0.92]	<0.001
KA18a	Agree	0.311	1.36 [1.14 – 1.63]
	Neutral	-0.016	0.98 [0.78 – 1.24]
	Disagree	-----Reference-----	
KA18d	Agree	0.834	2.30 [1.57 – 3.38]
	Neutral	0.55	1.73 [1.00 – 2.99]
	Disagree	-----Reference-----	
KA18j	Agree	-0.178	0.84 [0.73 – 0.95]
	Neutral	0.04	1.04 [0.88 – 1.23]
	Disagree	-----Reference-----	
KA18l	Agree	-0.217	0.80 [0.68 – 0.94]
	Neutral	-0.036	0.96 [0.78 – 1.19]
	Disagree	-----Reference-----	
SL_Parity	0.134	1.14 [1.06 – 1.23]	<0.001
Der_EduLevel	0.195	1.22 [1.08 – 1.39]	0.001
SL_Poverty2013s	0.133	1.14 [1.05 – 1.25]	0.002
SL_BFSupportHome	0.186	1.20 [1.06 – 1.36]	0.003

Poisson Regression Model of Breastfeeding Duration

$$\begin{aligned} & \ln(E[\text{StopBF}Age13m_{wk}]) \\ &= 0.99 - 0.21_{IP_{WC5Yes}} + 0.31_{IP_{KA18aAgree}} - 0.02_{IP_{KA18aNuetral}} + 0.83_{IP_{KA18dAgree}} \\ &+ 0.55_{IP_{KA18dNeutral}} - 0.18_{IP_{KA18jAgree}} + 0.04_{IP_{KA18jNuetral}} - 0.22_{IP_{KA18lAgree}} \\ &- 0.04_{IP_{KA18lNuetral}} + 0.13_{SL_{Parity}} + 0.20_{Der_{EduLevel}} + 0.13_{SL_{Poverty1013s}} \\ &+ 0.19_{SL_{BFSupportHome}} \end{aligned}$$

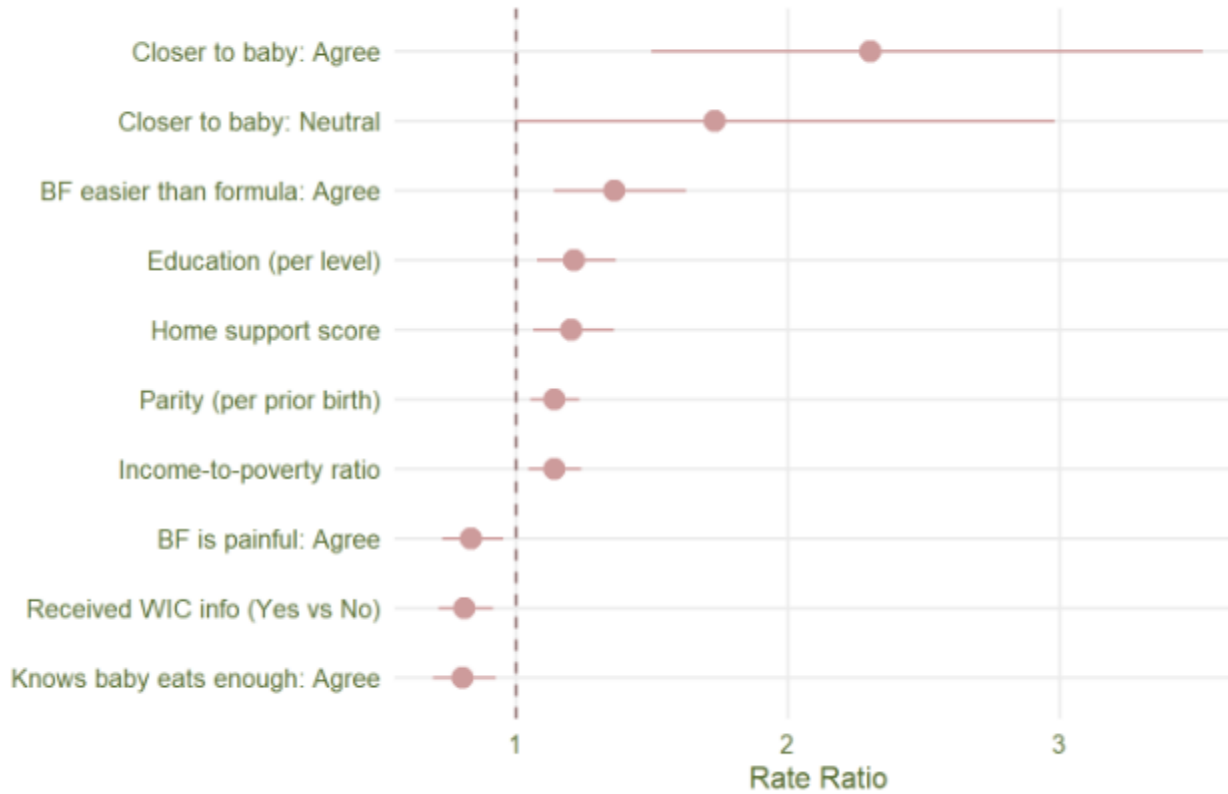
To be able to better interpret the results of this model, we will get the **rate ratios** by exponentiating the coefficients of the log link function.

$$e^{\beta_j} = \text{Rate Ratio}$$



Significant Predictors of Breastfeeding Duration

Poisson model ($\exp(\beta)$ and 95% CI)



$RR > 1 = \text{longer duration}$

$RR < 1 = \text{shorter duration}$

Exponentiated Coefficients

Predictor	B (odds conf)	exp(β)	Interpretation
IP_WC5Yes	-0.2083	0.81	19% shorter duration
IP_KA18aAgree	0.3106	1.36	36% longer duration
IP_KA18dAgree	0.8344	2.30	130% longer duration
IP_KA18dNeutral	0.5502	1.73	73% longer duration
IP_KA18jAgree	-0.1777	0.84	16% shorter duration
IP_KA18lAgree	-0.2167	0.81	19% shorter duration
SL_Parity	0.1344	1.14	14% longer duration
Der_EduLevel	0.1955	1.22	22% longer duration
SL_Poverty2013s	0.1329	1.14	14% longer duration
SL_BFSupportHome	0.1864	1.20	20% longer duration

Results and conclusions

Positive Predictors

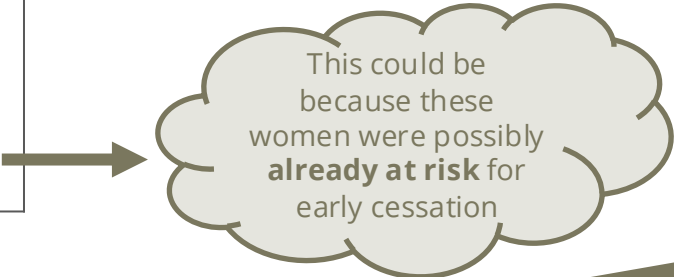
- Mothers who **agreed** that **breastfeeding brings a mother closer to her baby** breastfed **~2.3x longer** than mothers who disagreed.
- Mothers who **agreed** that **BF is easier** than formula feeding are predicted to breastfeed **36% longer**.
- Higher education, income, and previous births were each linked to **longer breastfeeding**.

Negative Predictors

- **Agreement** with '**breastfeeding is painful**' or '**formula ensures baby eats enough**' statements led to 16-19% **shorter** durations.
- Mothers **receiving WIC breastfeeding information** during pregnancy breastfed **~19% shorter**.

Conclusions

1. Mothers' beliefs and support systems mattered more for duration than any single demographic factor.
2. Positive beliefs about closeness and ease of breastfeeding were the strongest predictors of longer duration.



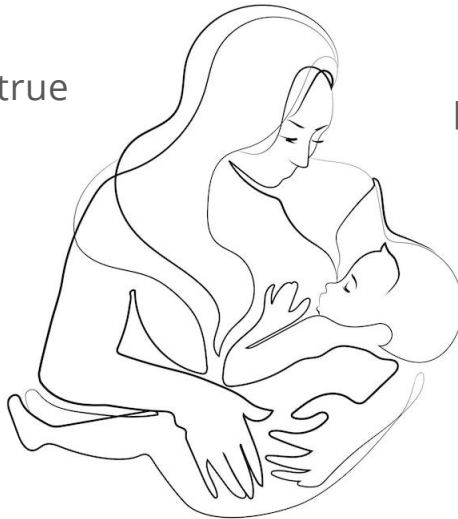
This could be because these women were possibly **already at risk** for early cessation

Limitations

Breastfeeding continuation beyond 13 months

This data is from **'Year 1'** meaning information is not included for beyond 13 months of age.

Leads to **underestimation** of true breastfeeding **duration**.



Recall Bias

ITFPS-2 relies heavily on **self-reported** telephone interviews.

If mother **overreports positive behaviors**, this could cause duration predictor coefficient estimates to rise.

Suggestions for Further Research

Expand the Dataset

Include later years of ITFPS-2 to capture breastfeeding **beyond 1 year**.

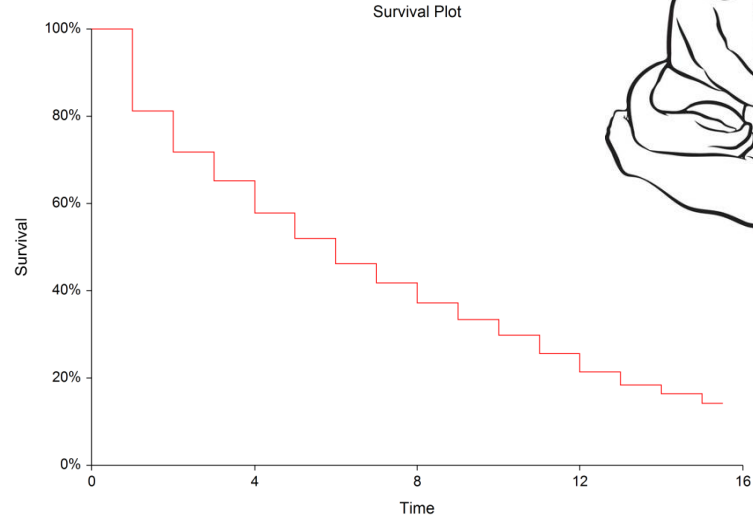
Use Survival Analysis Framework

“**Event**” = breastfeeding cessation

“**Time**” = weeks postpartum until cessation

Advantages of Survival Models

- Show when mothers are **most likely to stop** breastfeeding, not just how long they continue.
- Maintain survey weighting for **national representativeness**.



References

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Comments or Questions?

