Analysis of numbers of completed visits and program retention

Suggested Variables to create

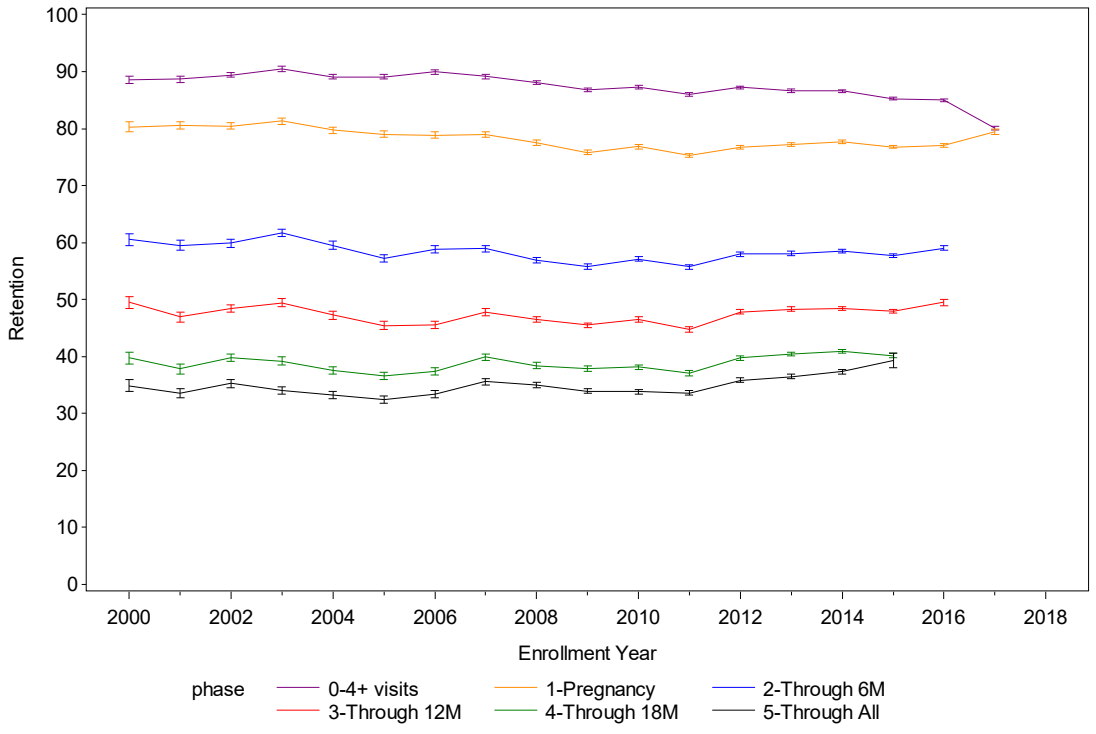
Variable	Pseudocode
Program Phase	Determine the point in the program that the mother would be in regardless of current enrollment status. Code as follows based on current date you have data collected into the system • 0: prior to child's expected delivery date (EDD) • 1: between child DOB (or EDD) and child age 6 months • 2: child age 6 months to 12 months • 3: child age 12 months to 18 months • 4: child age 18 months to 24 months • 5: child age 24+ months • (also can consider other phases for example getting through 22 months might be considered a program graduate)
Retention through each phase	Create dichotomous variables (0: dropped out, 1: continued with program through phase). Our experience in the US replication is that within 2 months of a phase ending we have a 98% assurance we can determine retention status based on the previous phase. Therefore all the retention variables should be created for mothers that have or could have reached at least 2 months past the phase. For example if determining retention through child age 6 months, take all mothers that enrolled and at the point of data collection the child is at least 8 months old. If the mother has not completed any visits after the 6 month period then we code this mother as dropped out prior to 6 months.
Number of completed visits	Create variables that count up both cumulatively (from enrollment) and within each phase the number of visits each mother completes. Note that these variables are calculated for all enrolled mothers that could have completed the phase of the program. This would therefore include mothers that did not complete any visits.
Early drop out	Create additional dichotomous variable coded 0: dropped out prior to completing 4 home visits and 1: completed 4+ visits. This variable should only be calculated for mothers that are in phase=1 or higher (see first row).

Guidance on analysis of implementation data for supporting continuous quality improvement

Step 1: compute simple statistics (means, range, standard deviation, percent) for each variable and then array the stats by time (e.g. year mother enrolled) to see if things are constant or changing (see example below run with the USA replication data)

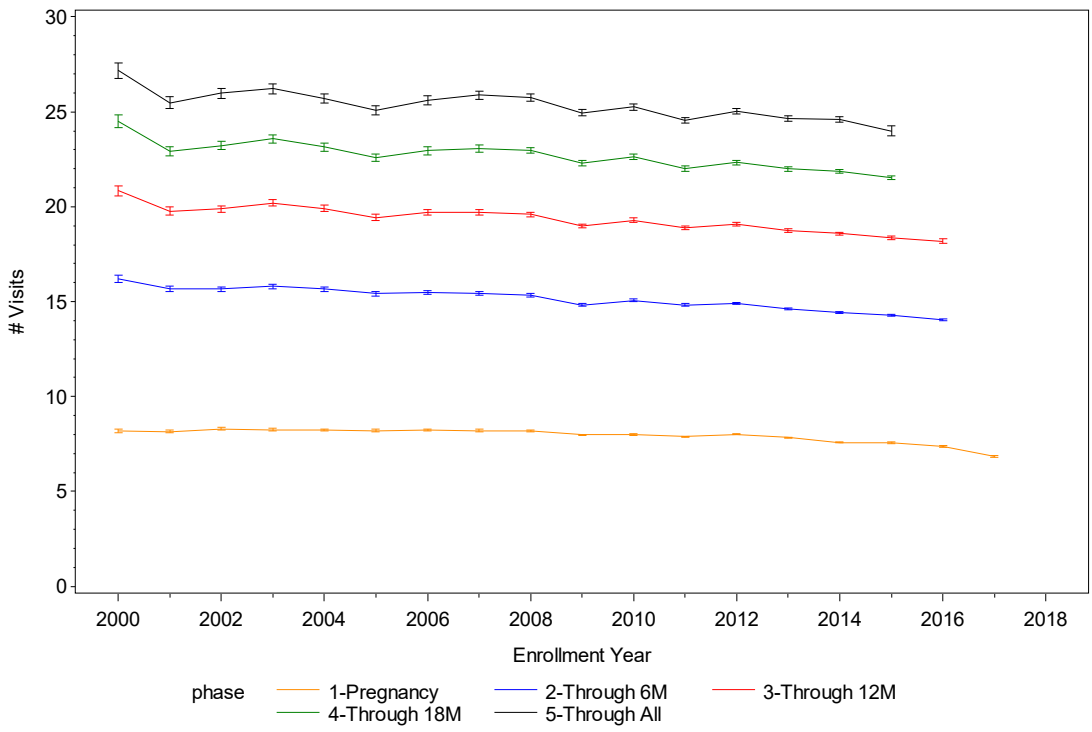
<4 visit and Retention Rates over time and by phase

EnrollYr	N Obs	N	>= 4 visits	Retained Preg	N	Retained 06 Months	N	Retained 12 Months	N	Retained 18 Months	N	Retained 22 Months
All years	192003	192003	86.7	77.5	177920	58.0	167463	47.3	157342	39.1	142082	35.0
2000	2213	2213	88.5	80.3	2213	60.5	2213	49.5	2213	39.8	2213	34.9
2001	3447	3447	88.7	80.5	3447	59.5	3447	46.9	3447	37.8	3447	33.5
2002	4999	4999	89.4	80.4	4999	59.9	4999	48.4	4999	39.8	4999	35.2
2003	4853	4853	90.5	81.3	4853	61.7	4853	49.4	4853	39.2	4853	34.0
2004	5186	5186	89.1	79.7	5186	59.5	5186	47.3	5186	37.6	5186	33.2
2005	5921	5921	89.1	79.0	5921	57.3	5921	45.4	5921	36.5	5921	32.4
2006	5974	5974	89.9	78.9	5974	58.8	5974	45.6	5974	37.4	5974	33.3
2007	7063	7063	89.2	78.9	7063	58.9	7063	47.7	7063	39.9	7063	35.6
2008	9588	9588	88.1	77.5	9588	56.9	9588	46.5	9588	38.4	9588	34.9
2009	12918	12918	86.8	75.8	12918	55.8	12918	45.5	12918	37.8	12918	33.9
2010	12617	12617	87.3	76.8	12617	57.1	12617	46.5	12617	38.1	12617	33.8
2011	13086	13086	86.1	75.3	13086	55.7	13086	44.8	13086	37.1	13086	33.6
2012	15757	15757	87.2	76.7	15757	58.0	15757	47.8	15757	39.7	15757	35.8
2013	18219	18219	86.6	77.2	18219	58.1	18219	48.3	18219	40.4	18219	36.5
2014	19426	19426	86.6	77.7	19426	58.5	19426	48.4	19426	40.9	18782	37.3
2015	19880	19880	85.3	76.8	19880	57.7	19880	47.9	15922	40.1	1459	39.3
2016	20632	20632	85.0	77.0	16615	59.0	6312	49.5	152	.	0	.
2017	10224	10224	80.1	79.4	158	.	4	.	1	.	0	.



Completed Visit Means and Standard Deviations over time and by phase

EnrollYr	N	# visits Preg	N	# visits 06 Months	N	# visits 12 Months	N	# visits 18 Months	N	# visits all
All years	192003	7.8 (4.17)	181187	14.8 (8.43)	171032	19.0 (12.00)	160420	22.4 (15.37)	145282	25.1 (18.44)
2000	2213	8.2 (4.17)	2213	16.2 (8.68)	2213	20.8 (12.54)	2213	24.5 (16.21)	2213	27.2 (19.25)
2001	3447	8.2 (4.24)	3447	15.7 (8.49)	3447	19.8 (11.91)	3447	22.9 (15.05)	3447	25.5 (17.98)
2002	4999	8.3 (4.24)	4999	15.7 (8.46)	4999	19.9 (11.92)	4999	23.2 (15.29)	4999	26.0 (18.44)
2003	4853	8.3 (4.19)	4853	15.8 (8.35)	4853	20.2 (11.82)	4853	23.6 (15.14)	4853	26.2 (18.10)
2004	5186	8.2 (4.27)	5186	15.7 (8.56)	5186	19.9 (12.08)	5186	23.2 (15.34)	5186	25.7 (18.30)
2005	5921	8.2 (4.25)	5921	15.4 (8.47)	5921	19.4 (11.91)	5921	22.6 (15.21)	5921	25.1 (18.12)
2006	5974	8.2 (4.11)	5974	15.5 (8.31)	5974	19.7 (11.85)	5974	22.9 (15.23)	5974	25.6 (18.37)
2007	7063	8.2 (4.07)	7063	15.4 (8.33)	7063	19.7 (11.92)	7063	23.1 (15.34)	7063	25.9 (18.52)
2008	9588	8.2 (4.13)	9588	15.3 (8.50)	9588	19.6 (12.16)	9588	23.0 (15.63)	9588	25.8 (18.86)
2009	12918	8.0 (4.20)	12918	14.8 (8.58)	12918	19.0 (12.26)	12918	22.3 (15.73)	12918	25.0 (18.86)
2010	12617	8.0 (4.16)	12617	15.1 (8.50)	12617	19.3 (12.16)	12617	22.6 (15.60)	12617	25.3 (18.67)
2011	13086	7.9 (4.21)	13086	14.8 (8.57)	13086	18.9 (12.17)	13086	22.0 (15.50)	13086	24.6 (18.57)
2012	15757	8.0 (4.17)	15757	14.9 (8.36)	15757	19.1 (11.94)	15757	22.3 (15.28)	15757	25.0 (18.35)
2013	18219	7.8 (4.18)	18219	14.6 (8.34)	18219	18.7 (11.88)	18219	22.0 (15.22)	18219	24.7 (18.24)
2014	19426	7.6 (4.13)	19426	14.4 (8.28)	19426	18.6 (11.84)	19426	21.9 (15.18)	19407	24.6 (18.27)
2015	19880	7.6 (4.15)	19880	14.3 (8.42)	19880	18.4 (12.00)	18390	21.5 (15.31)	4034	24.0 (17.68)
2016	20632	7.4 (4.15)	19150	14.0 (8.32)	9875	18.2 (11.70)	762		0	
2017	10224	6.8 (3.89)	890		10		1		0	



Guidance on analysis of implementation data for supporting continuous quality improvement

Step 2: Array these stats by location/site to examine differences in implementation across different locations (see example from a site in the USA replication)

 # visits / retention through Pregnancy

	Site A Outcomes				State Level Outcomes				National Outcomes			
Enroll Year(s)	N	# Visits	% drop<4 vis	% drop Preg	N	# Visits	% drop<4 vis	% drop Preg	N	# Visits	% drop<4 vis	% drop Preg
All Years	2895	7.2 (4.24)	10.6%	16.8%	24329	7.5 (4.56)	11.7%	18.6%	193411	7.8 (4.17)	13.3%	22.4%
Before 2011	1289	8.0 (4.16)	9.9%	20.6%	12768	8.3 (4.48)	10.3%	19.5%	76186	8.1 (4.17)	11.5%	21.6%
2011+	1606	6.6 (4.19)	11.1%	13.7%	11561	6.7 (4.50)	13.3%	17.7%	117225	7.6 (4.15)	14.5%	23.0%
2011	170	7.8 (3.89)	10.6%	20.0%	1504	7.7 (4.50)	12.0%	21.5%	13086	7.9 (4.21)	13.9%	24.7%
2012	192	7.8 (4.11)	8.9%	20.8%	1488	7.2 (4.41)	12.7%	20.5%	15757	8.0 (4.17)	12.8%	23.3%
2013	167	7.9 (4.36)	7.8%	19.8%	1766	7.1 (4.60)	13.6%	19.3%	18219	7.8 (4.18)	13.4%	22.8%
2014	361	6.8 (4.40)	10.8%	11.6%	2117	6.8 (4.67)	11.9%	16.8%	19426	7.6 (4.13)	13.4%	22.3%
2015	261	5.9 (3.87)	8.0%	12.6%	1859	6.4 (4.36)	13.7%	17.9%	19880	7.6 (4.15)	14.7%	23.2%
2016	256	5.6 (4.09)	8.2%	9.0%	1840	6.1 (4.41)	11.0%	13.8%	20632	7.4 (4.15)	15.0%	23.0%
2017	199	4.8 (3.45)	24.6%	5.5%	987	5.3 (3.92)	21.7%	11.7%	10225	6.8 (3.89)	19.9%	20.6%

 # visits / retention through infancy

	Site A Outcomes			State Level Outcomes			National Outcomes		
Enroll Year(s)	N	# Visits	% drop	N	# Visits	% drop	N	# Visits	% drop
All Years	2603	19.6 (11.24)	49.8%	22559	20.1 (11.98)	49.6%	172440	19.1 (12.01)	52.6%
Before 2011	1289	19.7 (11.63)	53.1%	12768	20.9 (12.17)	50.6%	76186	19.6 (12.08)	53.1%
2011+	1314	19.5 (10.85)	46.4%	9791	19.2 (11.66)	48.4%	96254	18.6 (11.93)	52.3%
2011	170	18.8 (11.21)	61.2%	1504	20.1 (12.11)	51.7%	13086	18.9 (12.17)	55.2%
2012	192	19.7 (10.96)	49.5%	1488	19.3 (11.64)	49.1%	15757	19.1 (11.94)	52.2%
2013	167	18.8 (11.15)	53.9%	1766	19.6 (11.88)	47.1%	18219	18.7 (11.88)	51.7%
2014	361	20.4 (11.07)	42.1%	2117	19.2 (11.70)	48.4%	19426	18.6 (11.84)	51.6%
2015	261	19.3 (10.63)	37.9%	1859	18.7 (11.55)	47.3%	19880	18.4 (12.00)	52.1%
2016	163	18.8 (9.86)	41.1%	1057	17.9 (10.55)	46.4%	9875	18.2 (11.70)	50.5%

 # visits / retention through program completion

	Site A Outcomes			State Level Outcomes			National Outcomes		
Enroll Year(s)	N	# Visits	% drop	N	# Visits	% drop	N	# Visits	% drop
All Years	2279	25.5 (17.34)	63.6%	20190	27.1 (18.87)	62.3%	146689	25.2 (18.45)	65.0%
Before 2011	1289	25.3 (17.59)	66.8%	12768	27.7 (19.10)	63.1%	76186	25.6 (18.58)	65.8%
2011+	990	25.8 (17.01)	59.1%	7422	26.1 (18.44)	60.9%	70503	24.7 (18.31)	63.9%
2011	170	23.6 (17.19)	68.8%	1504	26.6 (18.86)	62.5%	13086	24.6 (18.57)	66.4%
2012	192	25.0 (16.18)	63.0%	1488	25.9 (18.36)	62.2%	15757	25.0 (18.35)	64.2%
2013	167	24.2 (17.08)	62.3%	1766	26.5 (18.56)	60.0%	18219	24.7 (18.24)	63.5%
2014	361	27.7 (17.37)	51.4%	2111	26.0 (18.43)	59.2%	19407	24.6 (18.27)	62.7%
2015	100	26.7 (16.36)	54.9%	553	24.6 (17.08)	62.8%	4034	24.0 (17.68)	60.7%

Guidance on analysis of implementation data for supporting continuous quality improvement

Step 3: Determine factors related to retention/number of completed visits. These could be characteristics Anaof the mother, local site or the nurse visiting the mother. The table below shows some factors examined with these outcomes in the USA replication.

Variable	Notes
Maternal Characteristics at Enrollment	
Age	Continuous and broken into categories (16 and under, 17-18, 19+)
Race/Ethnicity	
Household composition	Lives alone, lives with extended family, lives with husband/boyfriend, lives with mother
Household income	
Education	Continuous (# years) and dichotomized as less than high school or high school graduate
Marital status	
Employment status	
Public benefit programs	e.g. Medicaid
Alcohol use	
Cigarette smoking	
Mental health	E.g. Pearlin Mastery score, depression/anxiety screening
Gestational age	
Levels of risk	Assessed with the STAR framework
Features of program implementation	
Time spent in program domains	Compute averages across all visits and within each program phase (pregnancy, infancy, toddler) the % time spent in each program domain (personal health, life course, environmental health, maternal role, personal network relationships)
Who was present for visits	Compute count variables for number of visits each person (e.g. child, grandmother, father of child) present at the visit. Also might want to calculate separately by program phase (pregnancy, infancy, toddler)
Mother engaged in visits	Compute averages across all visits and within each program phase (pregnancy, infancy, toddler) the level of engagement (involvement, conflict with material, understanding of materials)
Referrals to other services	Create yes/no variables for whether or not the nurse ever made a referral for a service at any visit (e.g. financial assistance, mental health)
Nurse Characteristics	
Months employed	
Nurse attrition	E.g. nurse stops working for NFP while mother enrolled
Nurse race/ethnicity	
Site characteristics	
# years implementing	
Referral structure	
Rural/urban	
# nurses	
Avg caseload size	
Flexibility in visit scheduling	E.g. allow for visits outside of normal business hours such as evenings and weekends.

Suggestion is to run each variable in the table above individually in linear or logistic regression models and then move into multivariate mixed effect modelling. In the multivariate mixed models specify sites

and nurses nested within sites as levels of random effects. Consider stepwise regression techniques to arrive at a final model.

Once final model is chosen, produce “adjusted” estimates for each outcome and rerun analyses shown in steps 1 and 2 above. Visually examine to see whether variation is reduced from site to site. If significant variation still exists it might be necessary to investigate other factors not considered above and perform additional qualitative work.

Analysis of other program outcomes

Outcomes Variables below are derived from data collected in the field

Outcome	Notes
Changes in smoking status during pregnancy	Measured on changes in number of cigarettes smoked at intake vs 36 weeks pregnancy. Sample size based on those mothers that engaged in smoking at intake and have data available at both time points
Changes in use of other substances (alcohol, other drugs)	Measured on changes in number of drinks, (times used) at intake vs 36 weeks pregnancy. Sample size based on those mothers that engaged in substance use at intake and have data available at both time points
Premature births	Defined as gestational age < 37 weeks. Sample size based on live births only.
Low birth weight	Defined as < 2500 grams at birth. Sample size based on live births only.
Breastfeeding initiation	
Child's immunizations	
Subsequent pregnancies/births	
Workforce participation over time	Create outcome at each time point measured (e.g. birth, 6, 12, 18, 24 months). Consider only including mothers that are at least 18 years at intake.
Breastfeeding continuation at 6 and 12 months	
Ages and Stages Questionnaire screening and referrals	
Hospitalizations due to injury and ingestions	

Step 1: Evaluate differences in mothers that have and do not have data available for each outcome. Due to attrition a large percentage of mothers may not have data available to measure the outcome (e.g. 50% of mothers do not have subsequent pregnancy information at child age 2 due to dropping out of the program prior to obtaining the data). If the mothers that have data available are different against those that do not you have selection working that needs to be considered.

Our suggestion is to take the variables in the table under step 3 above from the analysis of retention and completed visits section and compare those missing to not missing each outcome.

Step 2: Run statistics in all sites and then by site similar to the descriptions in the section above (steps 1-3 in the analysis of retention and completed visits). Interpret the findings in context of what you learned in step 1 above.

It also is worthwhile to examine separately the other features of program implementation (see table in preceding section for specific variables).