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Nurse-Family Partnership International

Guidance on analysis of implementation data for supporting continuous quality improvement | July 2024

Guidance on Analysis of Implementation Data for Supporting Continuous Quality Improvement

This document has been prepared to create consistency across governments and sites in the way implementation data are analyzed. Its purpose is to ensure common interpretation of these data and to increase their value in guiding continuous quality improvement activities. The core data elements for this system have been used to guide nurses' implementation of the program and guide efforts to improve it since it was first implemented in the Elmira trial of NFP in 1977.

Analysis of numbers of completed visits and program retention

The table below indicates suggested variables to create and analyze. When data are extracted from the system, it is important to calculate for every family enrolled in NFP the child development phase of the index child. This variable can then help determine appropriate denominators to use for calculations. For instance, those mothers who have enrolled in the program but have not yet had their baby or reached their expected delivery date would be in the pregnancy (phase 0) of the program. In US replication we have found it hard to analyze data on retention/completed visits for clients who have not yet passed their expected delivery date; we do not recommend creating retention/completed visit outcomes for this group.

For all other child development phases, we have found it useful to create variables for the child development phases preceding the phase the child is currently in. For instance, all those clients who ever enrolled in NFP and have a child that is between 0 and 6 months old at the time of data extraction we could determine how many visits were completed during pregnancy. We recommend waiting two months into each development phase to include people in the denominator in determining whether the client completed the previous phase. For example, to determine the percentage of clients that have finished pregnancy, we include in the denominator all clients who would have a child that is at least 2 months old based upon expected or actual delivery date.

Overall program retention is useful, but sometimes it is useful to categorize different reasons for exiting the program. If the data system allows, we recommend additionally presenting different reasons for leaving the program. Sometimes it is also useful to categorize these reasons into things the program could potentially address (e.g. client too busy), things the program cannot address (e.g. miscarriage) and positive reasons for leaving the program (e.g. moving out of the service area for work or education).

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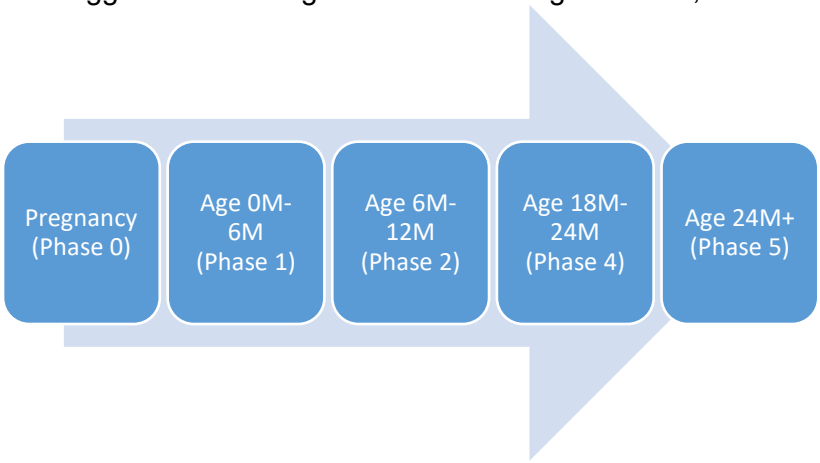
Table of Suggested Variables to create

Variable	Pseudocode
Program Phase (used for denominator determinations of other variables)	Determine the point in the program that the mother would be in regardless of current enrollment status. Calculate Child Age in Months at data extraction: (Date Data Extracted - Child DOB/EDD) / 30.4375 We suggest these categorizations of the age variable, but others can be considered: 
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 who have or could have reached at least 2 months past the phase. For example, when determining retention through child age 6 months, take all mothers who 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. We understand that occasionally we might code a mother as dropped at the time of data extraction, but that mother ends up returning to the program. These situations would be corrected the next time you extract the data.
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 who could have completed the phase of the program. This therefor would include mothers who did not complete any visits.

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<table>
<tr><td>Early drop out</td><td>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 who have surpassed their expected due date (phase 1 or higher).</td></tr>
<tr><td>Reasons for Drop</td><td>Present every known reason and possibly categorize, where possible, into groupings such as the table below:
<table>
<tr><th>Addressable Reasons</th><th>Un-addressable reasons</th><th>Positive reasons</th></tr>
<tr>
<td>Client is receiving services from another program
Client refused NFP continuation following report to Child Welfare Services
Client returned to work but remains in service area
Client returned to school but remains in service area
Client received what she needs from the program
Dissatisfied with program
Excessive missed appointments/attempted visits
Nurse resigned and no room in remaining nurses' caseloads
Pressure from family
Refused new nurse
Unable to accommodate requested schedule
Unable to contact
Unable to locate</td>
<td>Child no longer in family's custody[a]
Client incarcerated[a]
Infant death[a]
Maternal death[a]
Miscarried/fetal death
Moved out of service area for non-education/work reasons
[a] We will need to gain consensus on this classification</td>
<td>Moved out of service area for education
Moved out of service area for employment</td>
</tr>
</table></td></tr>
</table>

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	In US replication, we often found that reasons for drop were not always recorded, so need to caution if these data are not reliable Retention, number of completed visits, and early drop out can all be created separately for each reason category
Cohort	Determine useful cohorts to separate out data. Some examples might include: • All clients that enrolled in Year XXXX • All clients that enrolled at site X • All clients that enrolled at site X in Year XXXX • Excluding clients that left for un-addressable reasons

Below we show an example report from the United States showing retention rates through various phases and numbers of completed visits through various phases. The first two pages show the data across all sites implementing the program while the 3rd page shows data from a specific site compared to state or national rates.

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

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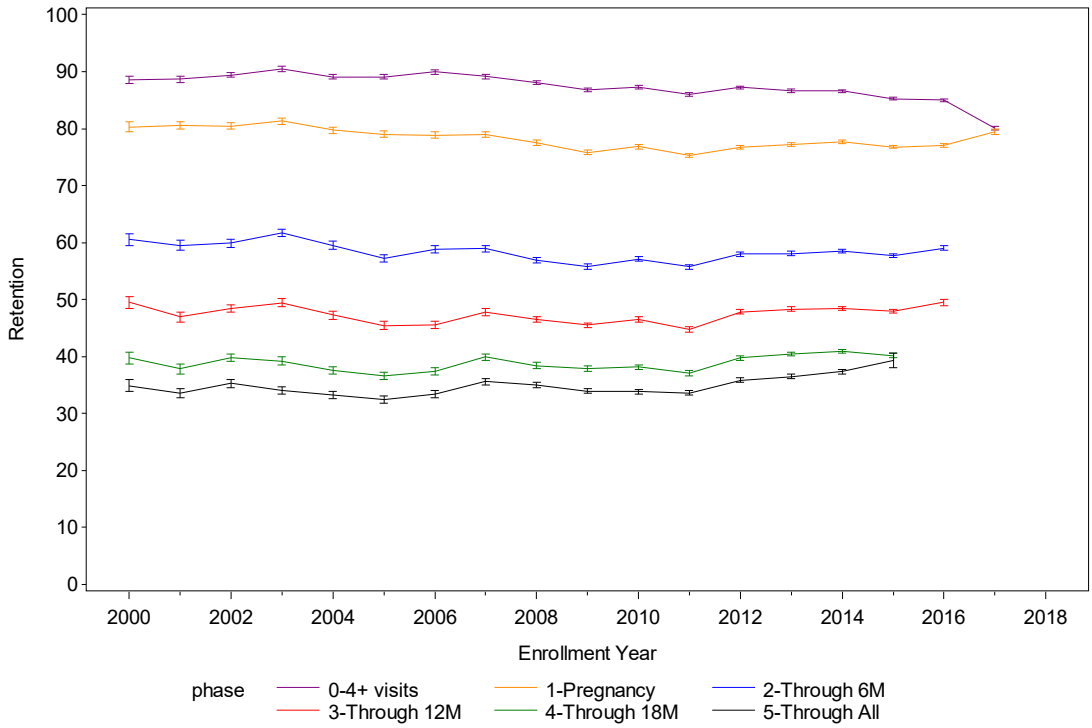
2016	20632	20632	85.0	77.0	16615	59.0	6312	49.5	152	.	0	.
2017	10224	10224	80.1	79.4	158	.	4	.	1	.	0	.



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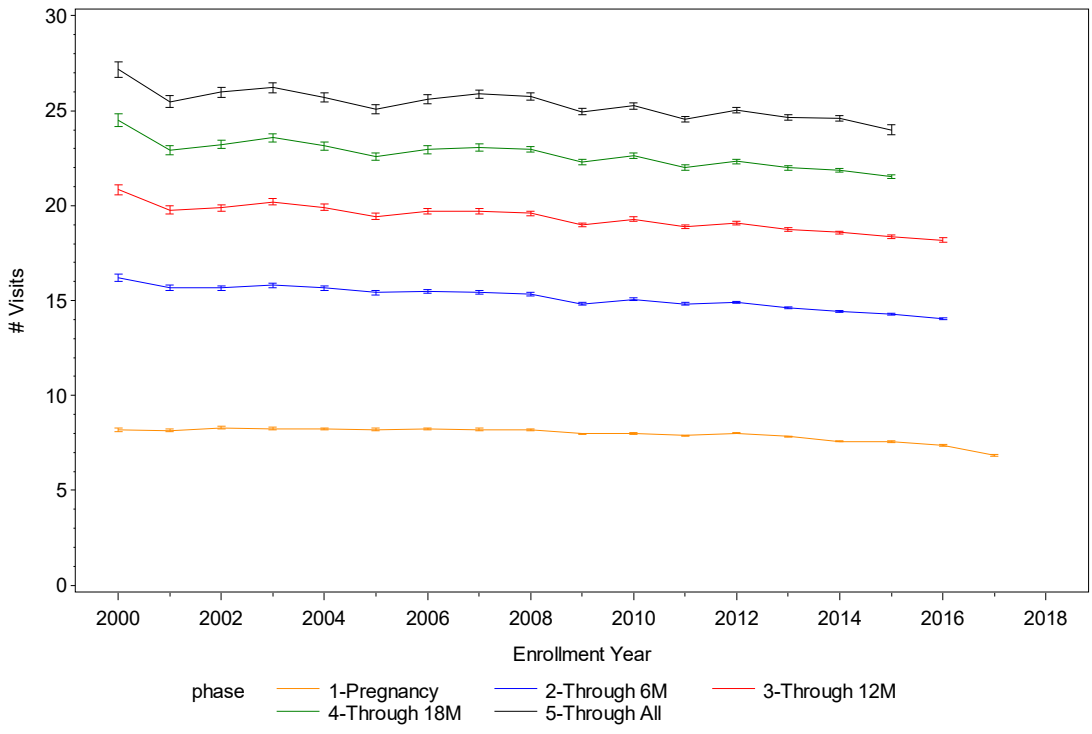
Completed Visit Means and Standard Deviations over time and by phase

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	



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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%

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	Site A Outcomes			State Level Outcomes			National Outcomes		
Enroll Year(s)	N	# Visits	% drop	N	# Visits	% drop	N	# Visits	% drop
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%

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Step 3: Determine factors related to retention/number of completed visits. These could be characteristics of the mother, local site or the nurse visiting the mother. The table below shows an example of some factors examined with these outcomes in the US replication. Each individual country should carefully consider their own list of variables as some of the US replication variables will not be relevant in other contexts.

Variable	Notes
Maternal Characteristics at Enrollment	
Age	Continuous and broken into categories (16 and under, 17-18, 19+)
Race/Ethnicity	
Household composition	Homeless, 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 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	

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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.

Our 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 the 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.

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Analysis of other program outcomes

Below is an example of outcomes that can be derived from the data collection system in the United States. Each individual country may have other outcomes of interest. The main point here is that it is important to understand these outcomes in context with what you have learned about participant retention in the steps above because in most circumstances we only obtain these outcomes from families that remain in the program.

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 who 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 who 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 who 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 who have data available are different from those who do not, you have selection working that needs to be considered in evaluating these outcomes.

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 those not missing each outcome.

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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).

Finally, when at all possible, consider quasi-experimental design studies to obtain data from outside sources (e.g. hospital discharge records) that you could obtain from everyone who enrolls in NFP to a comparable group that does not receive NFP.