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Prevalence and predictors of integrated care among teen mothers and their infants

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Abstract

Purpose: Integrated models of primary care for parenting teens, in which teens and infants are cared for by the same clinical team on the same day, are associated with reduced repeat pregnancies and increased uptake of contraception and immunization. Our purpose was to determine how frequently teen-infant dyads receive integrated care.

Methods: This study used Medicaid Analytic eXtract data to create a retrospective cohort of mothers aged 12–17 linked with infants born from 2007–2012 in 12 states. Teen-infant dyads were enrolled in Medicaid throughout the year after birth. The primary outcome was integrated care in the year after birth, defined as ≥ 1 instance when teen and infant had visits on the same day, billed to the same clinician identifier. Logistic regression assessed the relationship between integrated care and maternal demographics, dyad health, clinician specialty, and community factors.

Results: Of 20,203 dyads, 3,371 (16.7%) had integrated care in the year after birth. Dyads with integrated care had a mean of 1.2 (SD 1.3) integrated visits. Dyads with integrated care had more visits (14.9, SD 10.6 vs. 11.7, SD 8.3), including more preventive visits for teens and more acute visits for both teens and infants. In regression, integrated care was associated with maternal factors (younger age, non-Latinx white race, maternal health risks), residence in rural or high-poverty areas, and ever visiting Family Medicine clinicians.

Conclusions: Though uncommon, integrated care was associated with greater engagement in health care. Implementation of integrated care may support increased preventive care for parenting teens.

Keywords

Preventive health care; primary care; interconception care; teen pregnancy; parenting teen; teen-tot clinics; Medicaid

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INTRODUCTION

Preconception and interconception care encompass preventive health care services before or between pregnancies with a goal of promoting healthy pregnancies and long-term women's health. Because of gaps in interconception care for women of all ages, models are emerging that take advantage of infant visits to address interconception health needs.[1–3] For example, a Family Medicine consortium has implemented a model that addresses maternal tobacco use, depression, vitamin use, and contraceptive needs during all infant visits.[1] However, most infants in the US receive primary care from Pediatricians.[4] Pediatricians have endorsed maternal health needs as a component of infant care,[5,6] but face barriers to providing integrated care for mothers and infants, including issues related to training, credentialing, and payment.[6]

Integrated interconception care models for younger teen mothers and their infants are a special case that avoids these barriers to integrated teen-infant care in Pediatric settings. Since the 1980s, integrated care programs for teens and their infants have been described. These programs, often referred to as "teen-tot clinics," provide comprehensive primary care for both teen and infant with a single team at a single location, sometimes during combined visits.[7]

Teen-tot clinics were designed to address a population of mothers-infant dyads with particular health care risks and needs, including increased birth complications, increased behavioral and developmental health needs, and high rates of rapid repeat birth.[8–11] As many as 42% of teen mothers become pregnant within 2 years of their first birth, and 17% of teen births are repeat births.[12,13] Teen-tot clinics have demonstrated benefits for these high-risk dyads, including increased uptake of contraception, reduced repeat pregnancies, increased primary care visits, increased infant immunization rates, and decreased emergency department use.[7,14–17]

It remains unknown how many teen-infant dyads receive integrated health care. In this study, we aimed to describe how often teens and their infants were seen on the same day by the same physician in the year after birth. In addition, we describe individual, clinician and community level factors associated with integrated care. Understanding situations in which integrated care has been successful for teen-infant dyads may suggest strategies to improve interconception care for young mothers, and for women of all ages.

METHODS

Population

We used Medicaid Analytic eXtract (MAX) data from 2007–2012, including person- and encounter-level variables, from the Centers for Medicare and Medicaid Services to perform this retrospective cohort study. Data were provided in de-identified format. This study was reviewed by Institutional Review Board at the Children's Hospital of Philadelphia and approved as exempt. We have previously described our strategy for linking mothers and infants in this dataset and for assessing the quality of encounter-level data.[3] In brief, linkages relied on Medicaid case numbers, infant birth date, maternal delivery date, and

zip code. We included 12 states with high-quality encounter-level data and mother-infant links for at least 70% of births: Alaska, Colorado, Indiana, Michigan, New Hampshire, New York, North Dakota, Oregon, South Dakota, Tennessee, Vermont, and Wyoming. These states represent a diverse portion of the US population with regards to socioeconomic status, urbanicity, and race and ethnicity.

After identifying these states, we applied mother-infant dyad level exclusion criteria. We excluded dyads in which the mother's age was 18 or greater at the time of birth to ensure that age would not be a barrier to teen care in Pediatric settings. We eliminated potential bias caused by lack of insurance by excluding dyads with less than 11 of 12 months of Medicaid eligibility in the year after birth. We also excluded dyads if there was maternal or infant death in that time.

Finally, there were several visit-level exclusions. Starting with outpatient visits, we excluded emergency department visits and visits with behavioral health professionals or allied health providers such as physical therapists. We also excluded encounters with neither a National Provider Identifier (NPI) nor a state-specific Medicaid clinician identifier (0.01% of visits).

To examine patterns of care utilization, we classified all visits as preventive or acute based on CPT or ICD codes (codes used for analysis are shown in Supplemental Table 1). Preventive visits for teens included routine visits, postpartum visits, and visits for contraceptive management. For infants, preventive visits were limited to routine visits.

Outcome: Use of integrated care

We created a dichotomous variable indicating whether a teen had at least one integrated visit in the year after birth, defined as a visit for both teen and infant on the same day with the same clinician identifier. Visits were labeled as "teen" or "infant" visits based upon the person to whom the encounter was billed. Visits for teen and infant on the same date that matched on either NPI or physician identifier were considered "integrated visits."

Covariates

Covariates were selected based on the Andersen Model of Health Care Utilization, which posits that utilization is influenced by predisposing factors (such as age, race/ethnicity, and geographic region), enabling factors (such as poverty level, area of residence, insurance coverage, and type of medical clinician visited), and need factors (including health conditions).[18]

Maternal Demographics: Maternal age in years was calculated at delivery. Maternal race and ethnicity were collapsed into non-Latinx white, non-Latinx Black, Latinx, and Other, which included teens who identified as Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Multiracial, or unknown.

Health factors: Maternal and infant health risks are associated with health care utilization in the first year of life.[3] Maternal cardiovascular and mental health risks and infant prematurity or low birth weight were identified using ICD codes between beginning of pregnancy and 90 days after delivery, using a previously described procedure.[3]

Cardiovascular risk was identified using ICD codes for obesity, pre-eclampsia, chronic or pregnancy-related hypertension, and gestational or chronic diabetes. Mental health risk included codes for anxiety and depression. Infant prematurity and/or low birth weight was identified using ICD, CPT or revenue codes. These risks were coded as dichotomous variables and were not mutually exclusive.

Clinician specialty: We classified visits with Pediatricians and Family Medicine physicians as two separate dichotomous variables. Family Medicine training programs prepare clinicians to provide health care across the life course and have developed models using infant visits to deliver interconception care.[1] Therefore, Family Medicine physicians may be particularly likely to provide integrated interconception care to mother-infant dyads.

Clinician specialty was identified for 46% of visits by mapping NPI and state-specific Medicaid identifiers to standardized taxonomy codes.[19] We first classified specialties into broad groups: Pediatrics, Family Medicine, Obstetrics and Gynecology, Internal Medicine, or other specialty or subspecialty. Most taxonomy codes specified a specialty (e.g., Pediatric physician) or a site from which specialty could be inferred (e.g., ambulatory surgical center). However, some taxonomy codes referred to sites where physicians from different specialties may practice (e.g., Federally Qualified Health Center). We classified visits where taxonomy was not available or could not be inferred as unknown taxonomy. We then created dichotomous variables indicating whether the teen or infant ever had a visit classified as Family Medicine or Pediatric specialty (later referred to as Family Medicine or Pediatric exposure). In these dichotomous variables, we classified unknown taxonomy as not Family Medicine, or not Pediatrics.

Community Factors – Area Poverty Level, Rural Residence, and State: Rural areas are more likely to have low health care access.[20] Maternal residential zip codes were classified as rural using Federal Office of Rural Health Policy data, which defined a zip code as rural if 50% or more of its population resided in a Non-Metro County or a rural Census Tract.[21]

Low-income areas also have low availability of health care and long appointment wait times, compared to high-income area, so we controlled for area poverty level.[20] To do this, we linked zip code to county using the U.S. Census County Cross Reference File, and then used 2010 census data to calculate the percentage of the population below the federal poverty line. For zip codes that linked to more than one county, the county with the highest poverty level was used, because teen mothers tend to have high rates of poverty.[22] We then created a categorical variable using previously defined county-level poverty groups: low poverty (<10% below poverty line), medium poverty (10–19% below poverty line), or high poverty (>20% below poverty line).[23]

We adjusted for maternal state of residence at infant's birth to account for differences in policy and service at the state level.

Analysis

Chi-Square analyses and t-tests were used to compare characteristics of dyads with any integrated visits versus those without. We assessed timing of visits by calculating the medians and interquartile ranges (IQR) of days between birth and visits for those with and without integrated visits. We compared medians between groups using Wilcoxon rank sum tests. We compared teen and infant utilization between dyads with any integrated visits and those without. We calculated the proportion of teens and infants in each group who had no preventive visits.

We could not determine whether visits occurred in dedicated teen-tot clinics. However, we did assess the number of integrated visits billed to independent clinician identifiers to assess whether integrated visits clustered in certain identifiers.

Logistic regression examined the association between use of any integrated visits as the dependent variable and maternal factors (age, race/ethnicity, cardiovascular risk, and mental health risk), infant prematurity or low birthweight, Family Medicine exposure, Pediatrics exposure, poverty level, rural residence, and state.

We conducted sensitivity analyses to address two issues. First, because integrated visits were associated with preventive visits for teens, we wanted to assess whether our model was predicting integrated visits without this potential confounding. To do this, we performed the same logistic regression among the subgroup of dyads in which all teens had at least 1 preventive visit. Second, sensitivity analyses explored potential misclassification of clinician type due to missing clinician taxonomy codes. To do this, we first performed a subgroup analysis of dyads for whom clinician type could be identified for all visits. Next, we conducted sensitivity analyses that varied our definitions of exposure to Family Medicine or Pediatrics. The main analysis classification of Family Medicine and Pediatrics exposure was conservative (i.e., unknown taxonomy was classified as no Family Medicine or Pediatrics exposure). In this sensitivity analysis we assessed regression models with the full cohort where we first classified all visits with unknown taxonomy as Family Medicine and then, in a separate regression, classified all visits with unknown taxonomy as Pediatrics.

RESULTS

Descriptive and Bivariate Analyses

Of the 20,203 teen-infant dyads included in the sample, 3,371 (16.7%) had at least one integrated visit in the year after birth (Table 1). Compared to those with no integrated visits, teens who had integrated visits were more likely to identify as Non-Latinx white (45.7% vs. 40.2%), live in rural (31.0% vs. 22.9%) or high poverty areas (41.4% vs. 37.1%) and have Family Medicine exposure (37.5% vs. 29.2%). Dyads who had integrated visits were less likely to have visits with Pediatricians compared to those with no integrated visits (38.0% vs. 48.1%). Integrated visits were less likely following pre-term birth (9.1% vs. 10.9%), but more likely in the presence of maternal cardiovascular risk (17.8% vs. 15.5%) or maternal mental health risks (14.6% vs. 9.2%).

We classified clinician types for 113,518 (46.9%) visits, of which 59,842 (52.7%) were classified as Pediatrics, 27,482 (24.2%) as Family Medicine, 7,295 (6.4%) as Obstetrics and Gynecology, 3,370 (3.0%) as Internal Medicine, and 15,529 (13.7%) as other specialties or subspecialties. Integrated visits were completed by 2,568 distinct clinician identifiers, with a mean of 3.7 integrated visits per identifier (range 1 – 69). Of integrated visits, we classified clinician type for 2,331 (43.0%) visits. Among these integrated visits with classified clinicians, 951 (40.8%) were classified as Pediatrics and 971 (41.7%) were classified as Family Medicine.

Dyads with at least 1 integrated visit had more visits for both teens (4.9 vs. 3.0) and infants (10.0 vs. 8.8) (Table 2). This included more preventive visits for teens (1.6 vs. 1.2) and more acute visits for both teens (3.3 vs. 1.8) and infants (5.3 vs. 4.1). For dyads with integrated care, 44.0% had at least one teen preventive visit, compared to only 22% among dyads without integrated care.

The median days after birth at which teen visits occurred for women with at least 1 integrated visit was greater than the median for those with no integrated visits (median 165 days, IQR 78 – 261 vs. median 154 days, IQR 63 – 257). Similarly, infants with 1 or more integrated visit had a greater median age at infant visits than those without (median 150 days, IQR 62 – 250 vs. median 144 days, IQR 61 – 243). The median age of infants at dyad visits was 146 days (IQR 60 – 245).

Regression Analysis

In multivariate regression (Table 3), integrated visits were associated with younger maternal age (OR 0.86, CI 0.82, 0.90) and maternal non-Latinx white race and ethnicity (compared to non-Latinx white: non-Latinx Black OR 0.72, CI 0.65, 0.81; Latinx OR 0.82, CI 0.74, 0.92). Maternal health risks were associated with increased odds of an integrated visit (cardiovascular risk OR 1.22, CI 1.10, 1.35; mental health OR 1.52, CI 1.37, 1.70), but infant prematurity or low birth weight was associated with decreased odds of an integrated visit (OR 0.82, CI 0.71, 0.92). Family Medicine exposure was associated with increased odds of an integrated visit (OR 1.53, CI 1.41, 1.67), while Pediatric exposure was associated with decreased odds of an integrated visit (OR 0.74, CI 0.68, 0.81).

Community factors were also associated with integrated care. Dyads who lived in rural areas were more likely to have integrated visits (OR 1.32, CI 1.20, 1.45) as did those in high poverty areas (OR 1.21, CI 1.00, 1.46). The relationship between area poverty and integrated care was the only relationship that reversed direction between bivariate and multivariate analysis.

In sensitivity analysis including the subgroup of dyads with at least 1 teen preventive visit (n = 12,040) the direction of associations between covariates and integrated care was the same as in the full regression analysis. The associations were also unchanged in sensitivity analysis including only the subgroup of dyads who had clinician specialty classified for all visits (n=5,060). In analysis for the full cohort in which all unclassified visits were assumed to be Family Medicine visits, Family Medicine continued to be associated with increased odds of an integrated visit (OR 1.29, CI 1.13, 1.48) and other relationships were stable.

In analysis for the full cohort in which all unclassified visits were assumed to be Pediatric visits, Pediatrics was still associated with decreased odds of an integrated visit (OR 0.69, CI 0.61, 0.78) and all other relationships were stable.

DISCUSSION

We found low rates of integrated care among teen-infant dyads in the year after birth. Dyads with integrated care engaged in more outpatient visits overall, including more visits for both teen and infant. This could be because, in our cohort, teens with health risks were more likely to have integrated visits, and these teens may require more health care than teens without health risks. Consistent with prior work on dedicated teen-tot clinics, we found more preventive visits among teens who received integrated care.[14,16] We also found that the median time after birth of teen visits was shifted slightly later for teens with integrated care, suggesting that teens with integrated care may remained engaged in care longer after birth than their counterparts with no integrated care. This suggests that teen-infant health care integration, even in the absence of a dedicated teen-tot clinic, may be an underutilized strategy to improve interconception preventive care for teens.

Integrated care was more common among dyads living in communities that typically face barriers to health care access, including high poverty and rural areas. Physicians in these areas may be more likely to offer integrated care in recognition of local barriers to health care. We also found racial and ethnic differences in utilization of integrated care. Black and Latinx teens were less likely to have integrated visits. This may be due to interactions between race, ethnicity, and rural residence among Medicaid-insured teens. However, due to increased maternal morbidity and mortality among Black women, understanding strategies for preventive care delivery that are feasible for these teens may be particularly consequential.[24]

Though our study focused on younger teens who could be cared for by Pediatricians, the most significant predictor of integrated care was Family Medicine exposure, and Pediatric exposure was associated with less integrated care. Physician specialty was subject to both missing and potential misclassification in our data. The associations between clinician specialty and integrated care were robust to sensitivity analyses but warrant further exploration in datasets that better classify physician specialty. If confirmed, these findings suggests that modifiable factors such as physician training, regardless of specialty, and practice characteristics may be opportunities to improve implementation of integrated interconception care. The increased likelihood of integrated visits among those with Family Medicine exposure may partially explain our finding that teens whose infants were premature or low birthweight were less likely to utilize integrated care, as these teens may choose to seek infant care from a Pediatrician. In contrast to our findings related to clinician specialty, most prior reports of dedicated “teen-tot” clinics come from pediatric centers.[16,17]

Even absent pregnancy, teens have low rates of preventive care utilization[25] and strategies are lacking to engage teens in care or ensure optimal transitions to adult preventive health care. Teens who are transitioned to adult care without proper preparation may experience

significant gaps in care for chronic conditions.[26] Pregnancy may prompt a transition from pediatric to adult care.[27,28] Because over 75% of teenage pregnancies in the US are unplanned,[29] this transition can be sudden and disorganized. Though some teens may prefer care in adult settings,[30] the option to continue care with a known clinician who is also providing infant care may appeal to some parenting teens. Pediatric investment in strategies to increase integration of care for teen mothers and their infants could support both high-quality interconception care for teens and promote effective transitions to adult care.

This study had several limitations. First, some infant visits may have been billed to the teen in the early postpartum period, leading to misclassification as maternal visits. This could have led to an underestimate of integrated visits. Furthermore, clinician identifiers were not recorded for every visit in the MAX dataset. While this represented a small proportion of our data, excluding these visits may have introduced selection bias. More consequentially, we could only identify a clinician specialty for about half of visits. This may have biased our assessment of which clinicians were more likely to provide integrated care, though findings remained unchanged across several sensitivity analyses designed to explore potential bias in clinician specialty classification. In addition, because some clinician numbers referred to groups practicing at a particular location or health system, while some refer to single clinicians, integrated visits may have been visits at the same day in the same clinic, rather than with the same clinician.

Finally, our data only extend through 2012. This is the most recent data available to our team, and the best dataset of which we are aware to explore out study question. However subsequent policies that influence patterns of interconception care, such as increased interest in Fourth Trimester care,[31] may have changed patterns of integrated care since our data were collected. Because we only included teen mothers with continuous Medicaid in the year after birth, our findings may not be generalizable to teens who experience gaps in insurance coverage.

In conclusion, we found low rates of integrated teen-infant care in the year after birth. Integrated care was associated with greater engagement in health care and, particularly, increased preventive care for teens. Characteristics of teens, clinicians, and communities were associated with integrated care. Increased implementation of integrated care principals for teens, even in the absence of dedicated teen-tot clinics, may lead to improved interconception care, reduce rapid repeat pregnancies and improve outcomes for parenting teens and their infants.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations:

MAX	Medicaid Analytic eXtract
NPI	National Provider Identifier
CPT	Current Procedural Terminology
ICD	International Classification of Diseases and Related Health Problems
OR	Odds Ratio

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Implications and Contribution: Integrated care models are associated with improved outcomes for parenting teens and their infants. In this cohort of teen-infant dyads, use of integrated care, defined as visits on the same day with the same clinical team, was low. Increased implementation of integrated care may improve health outcomes for this population.

Table 1:

Characteristics of teens with and without integrated visits

Characteristic	All (N=20,203)	No Integrated Visits (N=16,832)	1+ Integrated Visit (N=3,371)
Maternal age, mean (SD) (y)	16.4 (0.8)	16.4 (0.8)	16.4 (0.8)
Race/ethnicity, n (%)			
Non-Latinx White	8,310 (41.1%)	6,768 (40.2%)	1,542 (45.7%)
Non-Latinx Black	5,915 (29.3%)	5,227 (31.1%)	688 (20.4%)
Latinx	4,389 (21.7%)	3,627 (21.6%)	762 (22.6%)
Other	1,589 (7.9%)	1,210 (7.2%)	379 (11.2%)
Health factors, n (%)			
Pre-term birth or low birthweight	2,139 (10.6%)	1,834 (10.9%)	305 (9.1%)
Maternal cardiovascular risk	3,215 (15.9%)	2,616 (15.5%)	599 (17.8%)
Maternal mental health	2,049 (10.1%)	1,558 (9.2%)	491 (14.6%)
Ever saw Family Medicine, n (%)	6,178 (30.6%)	4,914 (29.2%)	1,264 (37.5%)
Ever saw Pediatrician, n (%)	9,732 (46.4%)	8,091 (48.1%)	1,281 (38.0%)
Area poverty level, n (%)			
Low poverty	1,031 (5.1%)	844 (5.0%)	187 (5.6%)
Medium poverty	11,002 (54.5%)	9,068 (53.9%)	1,934 (57.4%)
High poverty	8,170 (40.4%)	6,920 (41.4%)	1,250 (37.1%)
Rural area of residence, n (%)	4,895 (24.2%)	3,850 (22.9%)	1,045 (31.0%)

All P-values < 0.01 for χ^2 tests comparing categorical characteristics between groups

Table 2.

Patterns of Care Utilization

Mean (SD) or No. (%)	All (N=20,203)	No Integrated Visits (N=16,832)	1+ Integrated Visit (N=3,371)	P-value*
Teen visits				
Preventive visits	1.2 (1.6)	1.2 (1.6)	1.6 (1.8)	<0.001
Acute visits	2.0 (5.5)	1.8 (5.0)	3.3 (7.5)	<0.001
Teens with no preventive visits	8494 (40.6%)	7409 (44.0%)	769 (22.8%)	<0.001
Days after birth, Median (IQR)	157 (67–258)	154 (63–257)	165 (78–261)	<0.001
Infant Visits				
Infant preventive visits	4.7 (3.2)	4.7 (3.1)	4.7 (3.4)	0.99
Infant acute visits	4.3 (4.2)	4.1 (4.1)	5.3 (4.6)	<0.001
Infants with no preventive visits	763 (3.8%)	647 (4.0%)	89 (2.6%)	<0.001
Days after birth, Median (IQR)	145 (161–245)	144 (61–243)	150 (62–250)	<0.001
Visits at dyad level				
Total preventive visits**	5.0 (3.8)	5.8 (3.7)	6.3 (4.1)	<0.001
Integrated preventive visits***	0.1 (0.3)	—	0.4 (0.7)	<0.001
Total acute visits	6.3 (7.4)	5.9 (6.9)	8.6 (9.2)	<0.001
Integrated acute visits	0.2 (0.7)	—	1.2 (1.3)	<0.001
Days after birth, Median (IQR)	—	—	146 (60–245)	—

*P-values represent results of t-tests for continuous variables, chi-squared tests for categorical variables, and Wilcoxon rank sum test for median days after birth.

**Total preventive visits at the dyad level sums infant preventive visits with teen preventive visits. In some cases, because of rounding, teen and infant visits do not always sum to total visits in this table.

An integrated preventive visit is a visit that occurred on the same day and with the same clinician identifier as a visit for the other member of the dyad, regardless of whether the other member of the dyad had an acute visit or a preventive visit. For example, a day where a teen had a preventive visit and an infant had an acute visit with the same clinician identifier would be counted as one integrated preventive visit and one integrated acute visit. In this table integrated preventive visits are a subset of total preventive visits.

Table 3.

Characteristics associated with use of integrated care in logistic regression

Characteristic	OR	95% CI
Maternal age (years)	***0.86***	0.82, 0.90
Race/ethnicity		
Non-Latinx white	—	—
Non-Latinx Black	***0.72***	0.65, 0.81
Latinx	*0.82*	0.74, 0.92
Other	0.93	0.79, 1.08
Health factors		
Pre-term birth or low birthweight	*0.82*	0.72, 0.93
Maternal cardiovascular risk	***1.22***	1.10, 1.35
Maternal mental health risk	***1.52***	1.37, 1.70
Ever had Family Medicine visit	***1.53***	1.41, 1.67
Ever had Pediatric visit	***0.74***	0.68, 0.81
Area poverty level		
Low poverty	—	—
Medium poverty	1.03	0.86, 1.23
High poverty	*1.21*	1.00, 1.46
Rural area of residence	***1.32***	1.20, 1.45

Analyses also controlled for state. Italics P < 0.05. Bold italics P < 0.001