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RESEARCH ARTICLE

The Impact of a Population-Based System of Care Intervention on Enhanced Prenatal Care and Service Utilization Among Medicaid-Insured Pregnant Women

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Introduction: Enhanced prenatal/postnatal care home visiting programs for Medicaid-insured women have significant positive impacts on care and health outcomes. However, enhanced prenatal care participation rates are typically low, enrolling <30% of eligible women. This study investigates the impacts of a population-based systems approach on timely enhanced prenatal care participation and other healthcare utilization.

Methods: This quasi-experimental, population-based, difference-in-differences study used linked birth certificates, Medicaid claims, and enhanced prenatal care data from complete statewide Medicaid birth cohorts (2009 to 2015), and was analyzed in 2019−2020. The population-based system intervention included cross-agency leadership and work groups, delivery system redesign with clinical−community linkages, increased enhanced prenatal care−Community Health Worker care, and patient empowerment. Outcomes included enhanced prenatal care participation and early participation, prenatal care adequacy, emergency department contact, and postpartum care.

Results: Enhanced prenatal care (7.4 percentage points, 95% CI=6.3, 8.5) and first trimester enhanced prenatal care (12.4 percentage points, 95% CI=10.2, 14.5) increased among women served by practices with established clincial-community linkages, relative to that among the comparator group. First trimester enhanced prenatal care improved in the county (17.9, 95% CI=15.7, 20.0), emergency department contact decreased in the practices (−11.1, 95% CI= −12.3, −9.9), and postpartum care improved in the county (7.1, 95% CI=6.0, 8.2). Enhanced prenatal care participation for Black women served by the practices improved (4.4, 95% CI=2.2, 6.6) as well as early enhanced prenatal care (12.3, 95% CI=9.0, 15.6) and use of postpartum care (10.4, 95% CI=8.3, 12.4).

Conclusions: A population systems approach improved selected enhanced prenatal care participation and service utilization for Medicaid-insured women in a county population, those in practices with established clinical-community linkages, and Black women.

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INTRODUCTION

Several maternal and infant health outcomes have worsened for Medicaid beneficiaries, with a disproportionate burden for Black women and infants.[1−8] Moreover, a growing number of beneficiaries enter prenatal care with pre-existing conditions,[9−11] high stress,[12] social determinant risk factors,[1] barriers to care,[13] and, for women of color, exposure to racism that influences their health and care,[14−16] leading to calls for perinatal care improvement.[17−19]

In synthesizing the best available evidence, the Centers for Medicare and Medicaid Services Expert Panel on Improving Maternal and Infant Outcomes have reiterated support for enhanced prenatal care (EPC) programs that are available in various forms in >60% of states.[20] Recommendations also included developing population-based systems of care to reach and maintain the participation of high-risk women in care, integrating systems of clinical and community-based care, and empowering women through education.

Although the Centers for Medicare and Medicaid Services defines *EPC* broadly to include multiple program models, in the context of statewide Medicaid-sponsored programs, EPC home visiting (referred to as EPC in the remaining parts of the paper) is a common model that includes care coordination, social support, health education, and connections to resources, with services often extended through the postpartum year.[21,22] Although early EPC studies reported mixed results,[23−25] rigorous evaluations of EPC programs, using quasi-experimental propensity score methods, demonstrated significant risk reduction for adverse birth outcomes and healthcare improvements.[26−29] The Michigan Maternal Infant Health Program (MIHP), a federally designated evidence-based EPC program, showed a reduced risk for adverse birth outcomes and infant mortality, especially for Black women and infants, and improved maternal and infant service use.[30−32] MIHP, primarily delivered by nurses or social workers, includes (1) comprehensive risk screening, (2) delivery of standardized interventions based on risks, and (3) care coordination.[33]

However, consistent with Michigan participation rates, statewide EPC programs typically engage <30% of eligible women, most women with clinical risk factors do not participate,[34] and little is known about how systems-based recommendations can be accomplished at the population and practice levels to improve timely participation. Addressing this gap, the objective of this study is to evaluate whether population-based system interventions in a Michigan County could improve timely EPC and other perinatal service utilization for Medicaid beneficiaries in the county, specifically for the women served by practices that integrated EPC resources and clinical care, and for Black women, a subpopulation at higher risk of morbidity, mortality, and adverse birth outcomes. This study, using propensity score difference-in-differences (DIDs) methods, shifts the research focus from EPC effectiveness to the impact of leveraging community assets and existing points of care on improving participation in an evidence-based EPC program and in perinatal care.

METHODS

A population-based system intervention was implemented in a Michigan county. A quasi-experimental, DID study design was used to compare all women in the intervention county and the subgroup of women served by high-volume practices that integrated EPC resources and clinical care with women in the rest of the state. Outcomes included EPC participation and early participation, prenatal care adequacy, emergency department contact, and postpartum care.

Study Sample

The county of the study is mixed urban/rural and includes the second-largest city in Michigan, Grand Rapids, with 4,594 births (2009), of which 42% were Medicaid and with 30% participation in MIHP.[35] Medicaid eligibility and claims (through 2016), vital records, and EPC data were retrieved for statewide Medicaid birth cohorts (2009−2015) from the Michigan Department of Health and Human Services (MDHHS) Health Services Data Warehouse and were analyzed in 2019−2020. Infants' and mothers' data were linked on the basis of unique MDHHS encrypted identifiers, with a linking rate of >95%. The mother−newborn observations were linked to EPC program, Medicaid claims, supplementary vital records data, and publicly available U.S. Census data. Excluding birth records with linkage issues, nonsingleton births, fetal death or congenital anomalies, and nonviable gestation age or birth weight, there were a total of 70,163 records in 2009 and 62,397 records in 2015 of mother−infant pairs in the measurement period. Baseline data for EPC participants in the practice settings were not available until 2010. The Michigan State University IRB determined that the study did not involve human subjects.

Intervention

The components of the population-based system of care intervention (Figure 1) included the following:

1. Cross-agency, physician-led administrative leadership and work groups thatdeveloped strategies and used continuous improvement methods to guide efforts.
2. Created linked information systems, elicited patient perspectives,[36] and analyzed administrative data to drive change.
3. Delivery system redesign to increase EPC early participation, including clinical−community EPC linkages within 2 practices that serve a high volume of patients with Medicaid insurance.
4. Improvement of capacity to deliver culturally sensitive EPC for Black and Hispanic women with Community Health Workers (CHWs) (EPC + CHW), similar in race−ethnicity.

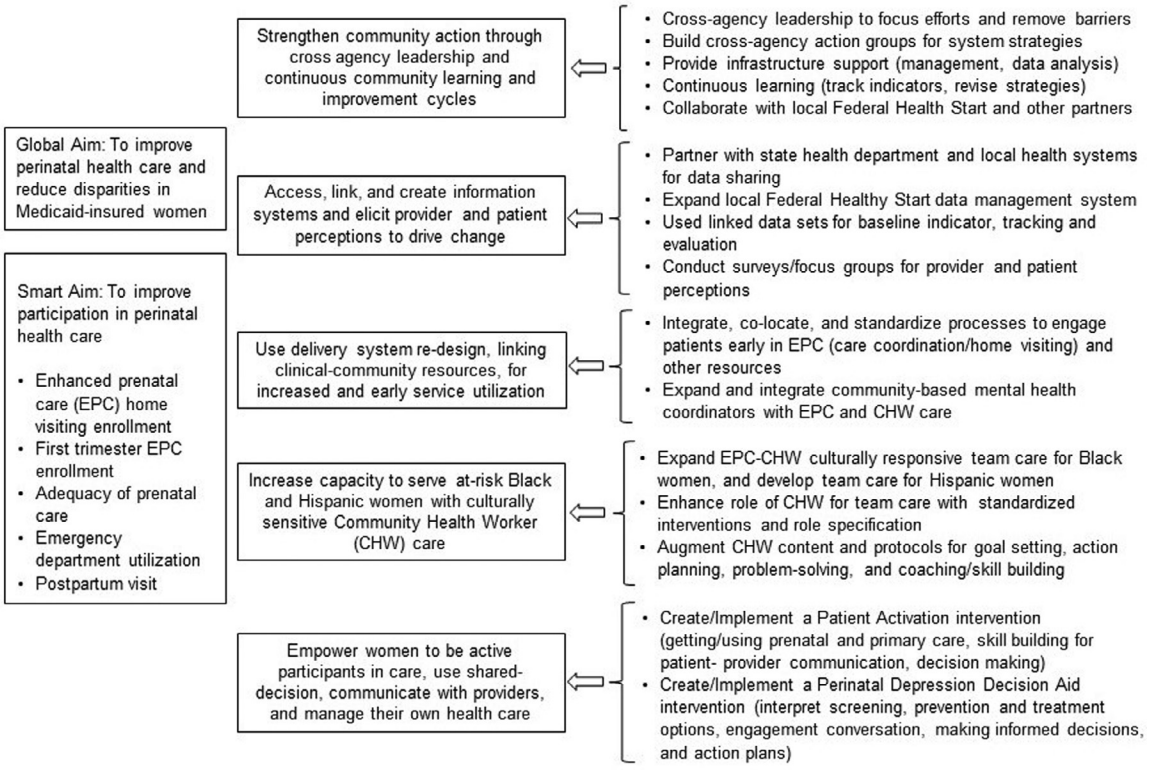

Figure 1. System of care intervention strategies to address perinatal improvement.
CHW, community health worker; EPC, enhanced prenatal care.

5. Standardized CHW care with intervention tools focused on empowering women to be active participants in their care through shared decision making and action planning.[37]

Briefly, the integrated clinical–community practices tailored strategies to engage women, such as changing patient flow to initiate early EPC engagement, on-site EPC providers, physician endorsement and scripting, and the use of EMR communication and case conferencing.[38] Partnering with the federal Healthy Start program,[39] Strong Beginnings, and working with 5 EPC programs, the community chose to expand the use of CHWs to encourage EPC participation, provide relationship-based support, address social determinants, and improve the cultural competence of service delivery. MDHHS advised on strategies, supported data access, and informed policy implications. Information about the community process and detailed system interventions are included in an online Perinatal System of Care Toolkit.[38]

Measures

This study defined *EPC participation* as a binary indicator of any MIHP Medicaid claim or screening participation records during pregnancy. *Early EPC participation* was defined as a binary indicator of EPC participation within the first trimester of pregnancy. Service utilization indicators from birth certificates and claims included (1) Kotelchuck adequacy of prenatal care (adequate or adequate plus versus intermediate or inadequate), (2) any prenatal emergency department (ED) use (any ED Medicaid claims during pregnancy versus none), and (3) completion of postpartum care in the first 60 days after birth (any postpartum care Medicaid claims versus none). Postpartum care measurement was based on American College of Obstetricians and Gynecologists recommendations,[40] availability of Medicaid claims, and a statewide study that reported that a third of Medicaid-insured women completed a visit in the first 21 postpartum days.[41]

Informed by the authors' previous work,[30–32] covariates were chosen to reflect the factors that are associated with pregnancy health and healthcare indicators, including sociodemographic factors, behavioral health, pregnancy and chronic health risks for adverse outcomes, Medicaid insurance, and census variables and indices. Covariates included age; education; marital status; father identified on the birth record; maternal and paternal race/ethnicity; maternal alcohol use; tobacco use; previous preterm birth; a previous birth within 18 months of conception; and Special Supplemental Nutrition Program for Women, Infants, and Children participation, all from birth records. Medicaid eligibility and claims were used to create a binary indicator for having Medicaid coverage 3 months before pregnancy. A total of 3 indicators for maternal chronic conditions were crated: asthma (International Classification of Diseases, Ninth Revision [ICD-9]; 491–493), diabetes (ICD-9, 250), and hypertension (ICD-9; 401–405). Multiple census variables, at the block group and census tract level, were used to adjust for poverty and family household characteristics as well as indexes for community material and social deprivation, including Townsend et al.,[42] Jarman,[43] and Messer and colleagues[44] indexes.

Statistical Analysis

A quasi-experimental pre−post design with a comparison group was used to identify the impact of the community system of care intervention. Medicaid-insured women in the county formed the intervention group, and those in the rest of the state formed the comparison group. Analyses were limited to those with singleton births of valid weight and gestational age (≥500 grams and ≥20 weeks) on the birth record. Data were analyzed using DID methodology with period-specific propensity score kernel weighting that accounted for missing covariate data.[45−47] The propensity score in the intervention group was estimated before and after the periods separately, balancing for individual- and geographic-level variables. The DID method ameliorates potential selection biases by subtracting the difference in outcomes between intervention and comparison groups at the baseline period from the difference in outcomes between intervention and comparison groups after the intervention. The method relies on the assumption that the groups do not systematically change over time (i.e., they would experience the same trend over time had there been no intervention). However, this assumption would be violated if the women served in the intervention group changed composition, which was likely because the county and intervention sites increased the identification of high-risk women. To minimize measurement bias, a propensity score−weighted DID method was used that balances the intervention group at baseline and at follow-up, so the comparison group had similar demographic, geographic, and medical background as the intervention group before and after the implementation of strategies. The DID estimation model was specified as follows:

$$Y = \beta 0 + \beta 1 * (\text{time}) + \beta 2 * (\text{intervention}) + \beta 3 * (\text{time} * \text{intervention}) + \beta 4 * (\text{PS}, \text{covariates}) + \varepsilon.$$

Time took values 0 (preintervention) and 1 (postintervention). Intervention was 0 for women outside the intervention group and 1 for women in the intervention group. The model used propensity score weighting and adjusted for some unbalanced census covariates. $\beta 3$ estimates the DID effects, as reported in Table 3. Outcomes were reported for all women and separately for Black women at higher risk of morbidity, mortality, and adverse birth outcomes than women of other races. For ease of interpretation, the DID method used a linear probability model in the estimation of the coefficients of interest. To take into account that the conditional variances of the outcomes are heteroscedastic, investigators used the sandwich-type robust SEs in all DID models. The absolute standardized differences of the key covariates before and after the propensity score weighting were used to assess the impact of the method on balancing the baseline characteristics between the groups. The standardized differences for the vast majority of individual-level covariates were <10% after weighting, meeting the typical criterion for balancing. Some census tract variables were not well balanced, and these variables were included as additional residual confounding adjustment variables. Sensitivity analyses were conducted, and results were qualitatively and quantitatively similar to the main results (results are available from the authors). Stata, version 15, was used for all analyses.

RESULTS

Table 1 summarizes the characteristics of all Medicaid beneficiaries in the county, the practices, and the state; Table 2 reports the characteristics of women who are Black (characteristics of women of other races are in Appendix Table 1, available online). Women served by the practices at baseline (n=826) were more likely to be Black (33.9%) or Hispanic (30.0%) than those served by the county (n=4,594; 20.5% and 22.7%) and the state of Michigan (n=65,566; 26.9% and 8.3%). They were more likely to have not completed high school (36.7% vs 29.5% vs 23%); to be enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (74.1% vs 65.3% vs 69.9%); and to have had a previous preterm birth (6.7% vs 2.3% vs 1.7%) and less likely to be married (21.8% vs 39.9% vs 38.2%). Overall, Black women were more likely to have full Medicaid before conception, related to family income disparities and marital status. Furthermore, they were more likely to have chronic health conditions and a previous preterm birth.

In the unadjusted pre−post intervention comparison (Table 3), there were larger improvements in first trimester EPC participation in the county (17.5 percentage points [PPs]) than statewide (3.4 PPs). Black women had larger pre−post intervention improvements in first trimester EPC participation in the county (18 PPs) than statewide (4.2 PPs). However, the statewide comparator group had modest increases in EPC participation statewide versus the county (−1.6 PPs). Propensity score −weighted DID findings (Table 3, adjusted DID) showed large increases in first trimester EPC participation among all women served in the county (17.9 PPs, 95% CI=15.7, 20.0) and among Black women in the county (12.3 PPs, 95% CI=9.0, 15.6).

Table 3 reports larger unadjusted pre−post improvements in the share of pregnancies with adequate prenatal care among all women in the county (3.4 PPs) than among the statewide comparison group (1.2 PPs). There were pre−post increases in the county in the share of women with postpartum care within 60 days after birth (9.8 PPs) versus statewide (4.5 PPs). Black women also experienced larger pre−post improvements in the likelihood of receiving postpartum care in the first 60 days after birth in the county (15.5 PPs) than statewide (6.8 PPs).

There were modest propensity score−weighted DID effects (Table 3, adjusted DID) of the intervention increasing the share of women with adequate or better prenatal care for all women in the county (2.2 PPs, 95% CI=1.2, 3.2). There were relatively large DID effects of the intervention in the county increasing the share of

Table 1. Characteristics of Medicaid-Insured Women in Clinical—Community Integrated Practices, County, and Michigan, 2009 and 2015

Characteristics	Clinical—community-integrated practices in intervention county[a]		Intervention county		Michigan population of Medicaid births for comparison group	
	2010 *n*=826	2015 *n*=881	2009 *n*=4,594	2015 *n*=3,937	2009 *n*=65,566	2015 *n*=58,457
All women (individual-level variable)						
Mother's age at birth, years, mean±SD	24.4±5.6	25.7±6.0	25.1±5.4	26.2±5.6	25.1±5.2	26.1±5.2
Prepregnancy BMI, mean±SD	27.1±7.2	28.5±7.7	27.0±6.9	28.0±7.2	27.1±6.5	27.8±7.0
Black, *n* (%)	280 (33.9)	304 (34.5)	940 (20.5)	952 (24.2)	15,797 (26.9)	15,122 (28.4)
Hispanic/Latina, *n* (%)	248 (30.0)	287 (32.6)	1,042 (22.7)	829 (21.1)	4,862 (8.3)	4,373 (8.2)
< High-school diploma, n (%)	302 (36.7)	299 (34.0)	1,355 (29.5)	899 (22.9)	13,390 (23.0)	9,781 (18.5)
Married at birth or conception, *n* (%)	180 (21.8)	226 (25.7)	1,832 (39.9)	1,393 (35.4)	22,455 (38.2)	18,355 (34.4)
Father is black, *n* (%)	146 (26.8)	195 (30.2)	628 (17.5)	696 (22.2)	8,948 (20.3)	9,553 (23.2)
Father with < high-school diploma, *n* (%)	195 (36.4)	214 (33.4)	920 (25.9)	630 (20.2)	8,529 (19.5)	6,713 (16.5)
Enrolled in WIC, *n* (%)	612 (74.1)	633 (72.3)	2,996 (65.3)	2,551 (65.6)	39,001 (69.9)	36,325 (69.1)
Has full Medicaid before conception, *n* (%)	391 (47.3)	522 (59.3)	1,400 (30.5)	1,929 (49.0)	18,454 (31.4)	28,588 (53.6)
Smoking, *n* (%)	177 (21.4)	200 (22.7)	905 (19.7)	773 (19.6)	17,267 (29.6)	15,391 (29.0)
Diabetes before/during pregnancy, *n* (%)	45 (5.4)	50 (5.7)	216 (4.7)	210 (5.3)	2,533 (4.3)	2,478 (4.6)
Hypertension before/during pregnancy, *n* (%)	79 (9.6)	76 (8.6)	254 (5.5)	301 (7.6)	4,704 (8.0)	4,916 (9.2)
Asthma before/during pregnancy, *n* (%)	31 (3.8)	31 (3.5)	133 (2.9)	89 (2.3)	1,809 (3.1)	1,640 (3.1)
Previous preterm birth, *n* (%)	55 (6.7)	56 (6.4)	105 (2.3)	183 (4.7)	1,010 (1.7)	1,710 (3.2)
Short interpregnancy interval,[b] *n* (%)	191 (23.1)	225 (25.5)	1,137 (24.7)	969 (24.6)	13,845 (23.6)	13,440 (25.2)
All women (census tract level variable), mean±SD						
% families < FPL	21.1±12.9	22.8±14.9	15.4±11.2	18.2±13.8	16.0±13.4	20.0±15.3
% Female head of household	29.4±14.2	32.1±14.3	24.5±12.2	28.2±13.7	25.6±17.5	28.2±17.6
% Families with some college, associate degree	32.7±7.4	33.4±10.2	32.4±8.1	34.5±9.2	34.1±8.7	36.9±8.8
Townsend index	1.8±2.9	2.4±2.7	0.8±2.7	1.4±2.9	1.0±2.8	1.2±2.9
Jarman index	4.3±5.3	4.7±5.3	2.9±5.0	3.3±5.1	1.7±4.0	1.9±4.1

[a]2010–2015 owing to incomplete data in 2009.
[b]Less than 18 months from previous birth to conception.
FPL, federal poverty level; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 2. Characteristics of Black Medicaid-Insured Women in Clinical–Community Integrated Practices, County, and Michigan, 2009 and 2015

Characteristics	Clinical–community-integrated practices in intervention county[a]		Intervention county		Michigan population of Medicaid births for comparison group	
	2010 *n*=280	2015 *n*=304	2009 *n*=940	2015 *n*=952	2009 *n*=15,797	2015 *n*=15,122
All women (individual-level variable)						
Mother's age at birth, years, mean±SD	23.8±5.3	24.9±5.7	24.1±5.6	25.5±5.5	24.3±5.7	25.4±5.4
Prepregnancy BMI, mean±SD	27.9±7.7	29.2±8.1	28.3±7.7	29.4±8.1	27.9±7.2	28.8±7.8
Hispanic/Latina, *n* (%)	10 (3.6)	12 (3.9)	24 (2.6)	28 (2.9)	230 (1.5)	246 (1.6)
< High-school diploma, n (%)	100 (35.8)	81 (26.7)	290 (30.9)	232 (24.4)	4,367 (28.1)	3,043 (20.4)
Married at birth or conception, *n* (%)	34 (12.1)	36 (11.8)	163 (17.3)	151 (15.9)	2,248 (14.2)	2,035 (13.5)
Father is black, *n* (%)	110 (85.9)	155 (87.1)	447 (88.5)	493 (85.6)	7,226 (94.3)	7,748 (92.8)
Father with < high-school diploma, *n* (%)	31 (24.4)	34 (19.2)	111 (22.6)	90 (15.7)	1,384 (18.5)	1,265 (15.5)
Enrolled in WIC, *n* (%)	206 (73.6)	232 (76.6)	703 (74.9)	713 (75.4)	10,791 (75.3)	11,044 (74.3)
Has full Medicaid before conception, *n* (%)	187 (66.8)	207 (68.1)	511 (54.4)	625 (65.7)	7,377 (46.7)	10,054 (66.5)
Smoking, *n* (%)	57 (20.4)	64 (21.1)	171 (18.2)	164 (17.2)	2,912 (18.6)	2,942 (19.6)
Diabetes before/during pregnancy, *n* (%)	14 (5.0)	13 (4.3)	54 (5.7)	47 (4.9)	684 (4.3)	762 (5.0)
Hypertension before/during pregnancy, *n* (%)	32 (11.4)	45 (14.8)	89 (9.5)	114 (12.0)	1,586 (10.0)	1,779 (11.8)
Asthma before/during pregnancy, *n* (%)	12 (4.3)	12 (3.9)	43 (4.6)	30 (3.2)	651 (4.1)	647 (4.3)
Previous preterm birth, *n* (%)	25 (8.9)	35 (11.5)	38 (4.0)	77 (8.1)	255 (1.7)	546 (3.6)
Short interpregnancy interval,[b] *n* (%)	74 (26.4)	85 (28.0)	243 (25.9)	247 (25.9)	3,688 (23.3)	4,023 (26.6)
All women (census tract level variable), mean±SD						
% families < FPL	23.9±11.9	24.4±14.9	20.3±10.5	22.3±14.2	26.0±15.5	30.8±16.1
% Female head of household	35.9±14.1	36.7±14.6	32.6±12.2	34.7±14.1	44.0±18.1	45.9±16.9
% Families with some college, associate degree	32.7±7.3	34.5±10.3	32.1±7.8	34.9±9.8	35.1±9.6	38.0±9.5
Townsend index	2.7±2.7	2.8±2.4	2.1±2.4	2.5±2.5	3.1±2.6	3.3±2.5
Jarman index	4.9±4.9	4.8±4.7	4.5±4.5	4.7±4.6	3.8±3.7	3.9±3.5

[a]2010–2015 owing to incomplete data in 2009.
[b]Less than 18 months from previous birth to conception.
FPL, federal poverty level; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 3. Propensity Score—Weighted DID Estimates on EPC and Health Service Outcomes Among Medicaid-Insured Women

Variables	Clinical—community-integrated practices in intervention county[a]		Intervention county		Michigan population of Medicaid births for comparison group		Clinical—community-integrated practices versus state comparators DID, adjusted PP	Intervention county versus state comparators DID, adjustedPP
	2010, unadjusted%	2015, unadjusted%	2009, unadjusted%	2015, unadjusted%	2009, unadjusted%	2015, unadjusted%		
All women	*n*=826	*n*=881	*n*=4,594	*n*=3,937	*n*=65,566	*n*=58,457		
EPC participation	58.0	66.3	32.1	34.2	23.9	27.5	**7.4**** (6.3, 8.5)	−**1.6**** (−2.6, −0.6)
First trimester EPC[b]	54.5	67.8	35.1	52.6	33.9	37.3	**12.4**** (10.2, 14.5)	**17.9**** (15.7, 20.0)
Adequate prenatal care	67.4	77.1	74.0	77.4	75.0	76.2	**3.2**** (2.1, 4.3)	**2.2**** (1.2, 3.2)
Any ED use during pregnancy	56.1	54.6	29.7	41.2	37.9	49.3	−**11.1**** (−12.3, −9.9)	−0.6 (−1.7, 0.5)
Postpartum care within 60 days	82.2	81.6	59.1	68.9	54.2	58.7	0.4 (−0.6, 1.4)	**7.1**** (6.0, 8.2)
Black women	*n*=280	*n*=304	*n*=940	*n*=952	*n*=15,797	*n*=15,122		
EPC participation	63.9	68.4	44.0	48.5	32.4	43.1	**4.4**** (2.2, 6.6)	−0.1 (−2.2, 2.0)
First trimester EPC	48.0	56.3	30.9	48.9	25.2	29.4	3.3 (−0.1, 6.7)	**12.3**** (9.0, 15.6)
Adequate prenatal care	67.6	71.1	74.7	76.0	74.8	76.3	−**10.0**** (−12.1, −7.9)	−0.7 (−2.6, 1.2)
Any ED use during pregnancy	67.9	66.8	49.4	60.9	53.8	68.3	−**6.5**** (−8.6, −4.3)	**2.5*** (0.3, 4.6)
Postpartum care within 60 days	77.5	81.9	64.0	79.5	52.0	58.8	1.8 (−0.2, 3.8)	**10.4**** (8.3, 12.4)

Note: Boldface indicates statistical significance (*$p<0.05$; **$p<0.01$).
[a]2010 data used as preintervention period owing to incomplete data in 2009.
[b]Among EPC participants.
DID, difference-in-difference; ED, emergency department; EPC, enhanced prenatal care; PP, percentage points.

women with appropriate postpartum care (7.1 PPs, 95% CI=6.0, 8.2) and among Black women (10.4 PPs, 95% CI=8.3, 12.4).

In the unadjusted pre−post intervention comparison (Table 3), there were larger PP improvements between 2010 and 2015 in EPC participation among all women served in the integrated practices (8.3 PPs) than among the statewide comparison group (3.6 PPs) and larger improvements in first trimester EPC participation in the integrated practices (13.3 PPs) than statewide (3.4 PPs). Black women had larger pre−post intervention improvements in first trimester EPC participation when served by the integrated practices (8.3 PPs) than statewide (4.2 PPs).

Propensity score−weighted DID findings (Table 3, adjusted DID) indicated that intervention effects increased EPC participation among all women served in the integrated practices (7.4 PPs, 95% CI=6.3, 8.5) and for Black women (4.4 PPs, 95% CI=2.2, 6.6). There were large increases in first trimester EPC participation among all women served by the practices (12.4 PPs, 95% CI=10.2, 14.5).

Table 3 also reports larger unadjusted pre−post improvements in the share of pregnancies with adequate prenatal care among all women in the integrated practices (9.7 PPs) than among the statewide comparison group (1.2 PPs). There were modest propensity score −weighted DID effects (Table 3, adjusted DID) of the intervention increasing the share of women with adequate or better prenatal care for all women served by the integrated practices (3.2 PPs, 95% CI=2.1, 4.3). There were relatively large DID effects of the intervention reducing the share of all women with an ED visit during pregnancy when served by the integrated practices (−11.1 PPs, 95% CI= −12.3, −9.9) and for Black women (−6.5 PP, 95% CI= −8.6, −4.3).

DISCUSSION

In the context of persistent disparities and underutilization of services, implementation of a population-based system intervention improved overall EPC participation for all Medicaid-insured women and Black women served by practices with clinical−community EPC linkages but not for all women in the county. Large impacts were seen in first trimester EPC participation in the county population, among the women served by the integrated practices, and for Black women. Improvements were noted for adequacy of prenatal care in the county population and in the practice group; ED utilization in the practice group; and postpartum care countywide and for Black women.

To put improvements in perspective, the increases in first trimester EPC participation represent >50% relative improvement from the baseline level for the county, with early participation of more than half of all the EPC participants. Early participation findings are important for first-trimester risk assessment, connections to community resources, and initiation of EPC interventions.[48] EPC participation in the linked practices reached 66% for all and 68% for Black women; however, the lack of improvements in county EPC participation was not entirely unexpected. After an increase in EPC participation (32%−39%), a loss of funding support for the EPC + CHW model temporarily reduced capacity, with a rebuilding of caseloads during 2014−2015.

For Black women living in the county, the 40% relative increase in first trimester EPC screening and participation resulting in 48.9% of all Black women enrolling early is notable. There was a significant improvement for Black women served by the integrated practices for overall EPC participation (7%). For postpartum care, the relative county improvements were larger for Black women (16%) than for women of other races (11%).

Although there are several studies focused on system of care approaches, some targeting geographic populations,[49−51] comparative studies of system of care and EPC participation and service utilization using DID propensity score methods over extended periods were not available. The results of this study are novel because findings inform the calls for population systems change to improve health care and reduce socioeconomic and racial/ethnic disparities in Medicaid- insured populations.[52−57] For clinicians directed to address social determinants, EPC and CHW providers can be important sources of preventive health education, health monitoring, connections to resources, and support during pregnancy through the transition to well-woman primary care. The postpartum care results for Black women in the overall county are important given the 2019 Medicaid Expert Panel improvement recommendations to address inequities in maternal mortality and morbidity through the use of and quality of postpartum care visits.[58,59]

However, the intervention underscored the challenge of increasing overall community EPC and CHW program capacity, with reported uncompensated EPC program costs of up to 40% and unstable funding mechanisms for CHW providers.[60] Policymakers, health plans, public health, health systems, and clinicians need innovative delivery system redesign and payment models to reduce maternal socioeconomic and racial/ethnic disparities.[61−63] For example, MDHHS policymakers and the local federal Healthy Start program are engaged in a 5-year demonstration of a Pay-for-Success financial

model for the EPC + CHW team intervention.[64] The Healthy Start program is also a pilot site for the national Alliance for Innovation on Maternal Health—Community Care Initiative to adapt maternal safety bundles for community settings and for another study (RO1MD016003) that includes testing EPC telehealth approaches to address women's preferences for care.[65,66]

Limitations

The strength of this study was the sustained engagement of community stakeholders who delivered multiple interventions, with potentially synergistic effects, over time. The main limitation was the lack of implementation data and analysis to better understand the processes of how the community interventions were implemented. Research is also needed to isolate the most relevant components of the system of care interventions on care and health outcomes. Creating equivalent comparison groups within the Medicaid population through randomization is generally not possible because, in this case, EPC home visiting cannot be withheld because all Medicaid-insured pregnant women are eligible for services. As a result, the authors relied on a quasi-experimental design and covariates that were only available from administrative and publicly available data, potentially limiting the ability to establish equivalent comparison groups.

CONCLUSIONS

A population-based system intervention improved selected participation in an evidence-based, community-delivered EPC program and other perinatal service utilization relevant for the maternal and child health of Medicaid beneficiaries. Clinical—community EPC linkages in high-volume practices were especially effective in increasing participation for all patients and for Black women.

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SUPPLEMENTAL MATERIAL

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