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Medicaid Home Visitation and Maternal and Infant Healthcare Utilization

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Background: The Michigan Maternal and Infant Health Program (MIHP) is a population-based home-visitation program providing care coordination, referrals, and visits based on a plan of care. MIHP is available to all Medicaid-eligible pregnant women and infants aged ≤1 year in Michigan.

Purpose: To assess the effects of MIHP participation on maternal and infant healthcare utilization.

Methods: Propensity-score matching methods were used to assess differences in healthcare utilization between MIHP participants and nonparticipants using 2009—2010 Medicaid claims and administrative data obtained from the Michigan Department of Community Health. Data were analyzed between October 2011 and March 2013.

Results: MIHP participants had higher odds of receiving any prenatal care compared to matched women not participating in MIHP (OR=2.94, 95% CI=2.43, 3.60) and higher odds of receiving adequate prenatal care (OR=1.06, 95% CI=1.01, 1.11). MIHP participants had higher odds of receiving an appropriately timed postnatal visit (OR=1.50, 95% CI=1.43, 1.57). Infants participating in MIHP had higher odds of receiving any well-child visits over the first year of life (OR=1.70, 95% CI=1.51, 1.93) and higher odds of receiving the appropriate number of well-child visits over their first year of life (OR=1.47, 95% CI=1.35, 1.60) compared to matched nonparticipant infants.

Conclusions: The results from Michigan provide strong evidence for the effectiveness of a Medicaid-sponsored population-based home-visitation program in improving maternal prenatal and postnatal care and infant care. This evidence is important to consider as the federal healthcare reform is implemented and states are making decisions on the expansion of the Medicaid program.
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Introduction

Home visiting is a service delivery strategy used to provide a broad set of services to families with pregnant women and young children to address issues such as access to services, maternal and child health, safe home environments, and parenting.[1] Such programs are relevant as, in general, the participants are low-income populations and other at-risk groups experiencing worse health outcomes and underutilization of services.[2,3] The federal 2010 Patient Protection Affordable Care Act recently reaffirmed the need for evidence of the effectiveness of home-visitation programs.[4,5] As a result, the DHHS launched Home Visiting Evidence of Effectiveness (HomVEE) to review home-visitation research studies and assess the evidence of effectiveness for home-visitation programs.[6]

Medicaid covers 40% of the births in the U.S. and 45% of the births in Michigan.[7,8] Medicaid-eligible women are at higher risk, including having a higher likelihood of unintended pregnancies, initiating prenatal care later than the first trimester, smoking during pregnancy, and having low–birth weight infants compared to women with private insurance.[9] The Maternal and Infant Health Program (MIHP) is a population-based home-visitation program available to all Medicaid-eligible pregnant women and infants aged ≤1 year in Michigan. MIHP is the largest program dedicated to serving all Medicaid pregnant women and infants in the state. MIHP provides support to promote healthy pregnancies, positive birth outcomes, and healthy infants. MIHP is intended to supplement medical prenatal and infant care through home-based care coordination, referrals, and interventions based on individual care plans. Similar to the

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federal call, recent Michigan legislation emphasizes the need for evidence-based home-visitation programs.[10]

Rigorous evaluation designs meeting high and moderate HomVEE study ratings consist of RCTs and quasi-experimental designs, including matched comparison group, single-case design, and regression discontinuity.[11,12] In a review of the literature, it was found that studies examining the effects of home-visitation programs on maternal and infant preventive care are scarce, not easy to generalize in racially diverse populations, and provide little evidence of the favorable effects of such programs. There were few rigorous evaluations of the effects of home-visitation programs on improving prenatal care, and all were small sample RCTs.[13–15] In an RCT evaluation of 121 pregnant adolescents, Koniak-Griffin and colleagues[14] found that participation in an early intervention program did not increase the total number of prenatal visits.[14] A Nurse Family Partnership RCT evaluation by Kitzman et al.[15] found that participation in that program did not increase the total number of standard prenatal care visits among low-income women with no previous live births.

To our knowledge, no RCTs or quasi-experimental studies have evaluated the effects of home-visitation programs on the rate of women receiving the recommended postnatal visit. Few rigorous evaluations analyzed the effects of home-visitation programs on well-child visits. RCT evaluations of the Healthy Steps program, which targets children aged 0–3 years, found that participating infants were more likely to have the 1-month and the 24-month well-child visit.[16,17] The Healthy Families San Diego program, which focuses on pregnant women and their children, increased the number of well-child visits at the third-year follow-up in a clinical trial.[18]

The purpose of the current study was to assess the effects of MIHP participation on maternal and infant healthcare utilization among Medicaid-eligible women and infants in Michigan using propensity-score matching methods. It was hypothesized that maternal prenatal and postnatal care and infant care among participants in MIHP would be improved compared to the care in a matched sample of nonparticipants.

Methods

Study Design

This cohort study used a quasi-experimental design to assess the effects of MIHP on maternal and infant healthcare utilization. Specifically, the study used the matched comparison group methodology to compare the outcomes of MIHP participants with a matched group selected from among the Medicaid beneficiaries who did not participate in MIHP. The study received approval from the Michigan State University IRB.

Study Population and Data Sources

The study population is represented by the cohort of women who delivered a Medicaid-insured singleton birth between January 1, 2010, and December 31, 2010, in Michigan and their infants (N=60,653). Infants and mothers were linked based on unique Michigan Department of Community Health master record numbers, with a linking rate of >95%. All data were available through the data warehouse from that department.

Data for this cohort of mothers and infants consisted of all Medicaid maternal medical claims during pregnancy and 12 months postpartum, monthly Medicaid eligibility from 3 months prior to conception through the first 12 months postpartum. Data also included other program participation (such as cash assistance) linked to infant birth records (including maternal demographics and reproductive history) and monthly infant Medicaid eligibility and infant medical claims for the first 12 months of life. Prenatal MIHP risk screening data was also linked to the data set. All data sources used the unique master record numbers.

Measures

Outcomes. All the outcomes were defined based on administrative data. Adequacy of prenatal care was defined based on the Adequacy of Prenatal Care Utilization (Kotelchuck) Index considering both initiation and number of visits received (Inadequate, Intermediate, Adequate, or Adequate Plus) reported on the birth certificate.[19] As women receiving Adequate Plus care tend to be medically high risk, a first analysis defined a binary outcome coded 1 if the Kotelchuck Index was "adequate" and 0 if it was "intermediate or inadequate," excluding women who received Adequate Plus care. An alternative definition, consistent with state[20] and federal reporting (mchdata.hrsa.gov/tvisreports/MeasurementData/HSCI/HsciMenu.aspx) was coded 1 if the Kotelchuck Index was "adequate or adequate plus" and 0 if it was "intermediate or inadequate."

Another outcome of interest was the presence of prenatal care (binary), coded 1 if there was any prenatal care and 0 otherwise. The postpartum visits were determined based on qualifying current procedural terminology (CPT) and ICD-9 codes on maternal Medicaid claims with a date of service between 21 and 56 days after delivery.[21] The outcome of interest (binary) was coded as 1 if the mother had any qualifying postpartum visits and 0 otherwise. Women who lose Medicaid after they give birth become eligible for Plan First! coverage for family planning services. A binary outcome was coded 1 for women who enrolled in Plan First! in the first 12 months postpartum, and 0 otherwise.

Well-child visits were identified based on CPT codes on infant Medicaid claims. An indicator for "any well-child visits" was coded 1 if the infant had any such visits during the first year of life and 0 otherwise. The American Academy of Pediatrics recommends seven well-child visits by age 1 year. A binary indicator was coded 1 if the infant had at least seven well-child visits in the first year of life and 0 otherwise.

The analyses of maternal outcomes, except Plan First!, included all women, because all retain Medicaid eligibility and MIHP (if participating) throughout pregnancy and for at least 60 days postpartum. The Plan First! outcome was analyzed for women who lost Medicaid eligibility postpartum. Infant well-child visits, derived from Medicaid claims, were analyzed for the infants who

Table 1. CPT, ICD, and HCPCS codes used in variable definitions

Variable	Codes
Postpartum visit	CPT: 57170, 58300, 59400, 59410, 59430, 59510*, 59515, 59610, 59614, 59618, 59622, 88141-88143, 88147, 88148, 88150, 88152-88155, 88164-88167, 88174, 88175, 99501
	HCPCS: G0101, G0123, G0124, G0141, G0143, G0144, G0145, G0147, G0148, P3000, P3001, Q0091
	ICD-9: 89.26, 91.46, V24.1, V24.2, V25.1, V72.3, V76.2
Well-child visit	CPT: 99381—99385, 99391—99395, 99432, 99461
	ICD-9: V20.2, V20.3, V70.0, V70.3, V70.5, V70.6, V70.8, V70.9
MIHP participation	Maternal CPT or HCPCS: 99402, A0100, A0110, A0170, H1000, H2000, S0215, S9442, T1023.
	Infant CPT or HCPCS: 96154, 99402, A0100, A0110, A0170, H2000, S0215, S9444.
Asthma[a]	ICD-9: 491—493
Diabetes[a]	ICD-9: 250
Hypertension[a]	ICD-9: 401—405

[a]For asthma, diabetes, and hypertension, qualifying diagnostics were considered only if they were present in the primary or secondary diagnostic fields.
CPT, Current Procedural Terminology; HCPCS, Healthcare Common Procedure Coding System; MIHP, (Michigan) Maternal and Infant Health Program

retained Medicaid eligibility for the entire 12 months postpartum (>80%) in order to observe the outcomes consistently for the entire analytic sample.

Michigan Maternal and Infant Health Program participation. If at least one maternal claim with MIHP CPT or Healthcare Common Procedure Coding System codes submitted by an MIHP provider was present during pregnancy, or an MIHP prenatal risk screening record was identified, the maternal MIHP indicator was coded "yes"; otherwise, it was coded "no." Infant MIHP participation was similarly defined based on Medicaid claims. If at least one infant MIHP claim was submitted by an MIHP provider during the infant's first 12 months of life, or the mother participated in MIHP during pregnancy, or she had an MIHP claim in the first 12 months postpartum, then the infant MIHP indicator was coded "yes"; otherwise, it was coded "no."

Matching maternal baseline characteristics. Maternal age, marital status, race/ethnicity, smoking status during pregnancy, first-time pregnancy, and repeat pregnancy within 18 months were assessed. Two SES measures were also included. The first (yes/no) identified pregnant women with income at ≤33% of the federal poverty level (FPL) based on their participation in the Low-Income Family Program and receipt of cash assistance. The second indicator distinguished between (1) Medicaid-eligible pregnant women who had Medicaid before pregnancy (qualifying income ≤63% FPL if aged >19 years, the majority in the present study; and ≤150% FPL if aged ≤19 years) and (2) higher-income women who became eligible after confirming the pregnancy, with qualifying income of ≤185% FPL regardless of age.[7]

The baseline characteristics also included three binary indicators for maternal chronic conditions not specific to pregnancy. The presence of related claims during pregnancy, based on diagnostics and procedure codes, was considered evidence of maternal chronic disease. To minimize the likelihood of measurement error, including the potential for disease onset after MIHP enrollment during pregnancy, some of the most prevalent conditions were selected: asthma (including chronic bronchitis and emphysema); diabetes; and hypertension (excluding gestational diabetes and hypertension). Table 1 identifies all relevant codes used in the definitions above.

Analytic Approach

The propensity-score matching method was used to account for potential differences between MIHP participants and nonparticipants. First, comparability between the MIHP participants and all nonparticipants was assessed (Table 2). Then, the expected probability of MIHP participation (the propensity score) was estimated for the entire population as a function of all the above baseline characteristics using logistic regression.[22,23] Estimations were performed separately for black women and women of other races and ethnicities. Next, 1:1 random-sort nearest-neighbor matching without replacement on a Mahalanobis distance with a caliper of 0.2 SD was used within the same race (black versus others) to select a matched group from among the nonparticipants.[24] Further, bivariate conditional logistic regressions were used to assess baseline equivalence across all covariates between the MIHP participants and the matched comparison group (Table 2).

Propensity-score models were adjusted, with consideration given to interactions, higher-order terms, and multiple matches to ensure maximum balance on baseline covariates.[22,25] Using the residence county as a baseline covariate (versus state regions) minimized the number of duplicate propensity scores, at the cost of not accomplishing balance on the individual counties. MIHP enrolled 18,798 pregnant clients who delivered a singleton birth in 2010. The reported propensity-score analysis matched, one-to-one, >85% of the MIHP clients with nonparticipants. The other 15% were excluded because of missing relevant baseline data or

Table 2. Baseline comparisons: MIHP participants, all nonparticipants, and the matched comparison group

	2010 Medicaid birth cohort		
Characteristic (covariates)	**MIHP clients** *n*=18,798	**All not in MIHP** *n*=41,855	**Matched controls**[a] *n*=16,044
Age (years)	**25.3**	26.7	25.5
Smoked during pregnancy	**30.64**	28.42	30.74
Race			
White	**51.22**	65.91	50.38
Black	**38.04**	23.38	39.38
Hispanic	**7.71**	5.97	7.25
Other	**3.02**	4.74	2.99
Rapid repeat pregnancy			
<18 months from prior pregnancy	**24.69**	26.57	25.62
≥18 months from prior pregnancy	**31.70**	37.23	33.35
First pregnancy	**39.32**	31.53	36.38
Unknown	**4.62**	4.65	4.59
Income ≤33% FPL[b]	**17.89**	10.66	17.06
Medicaid before pregnancy (income ≤63%–150% FPL)[c]	**65.57**	53.17	63.84
Marital status			
Married	**33.17**	21.88	33.23
Mother only on birth certificate	**24.13**	38.45	24.71
Not married, paternity acknowledged	**42.70**	39.67	42.07
Asthma	**15.34**	9.65	13.09
Diabetes	**4.61**	3.33	3.92
Hypertension	**5.45**	3.70	4.96

Note: Boldface indicates significant differences ($p<0.05$) between MIHP prenatal participants and all Medicaid-eligible pregnant women not in MIHP. There were no significant differences between MIHP prenatal participants and the matched controls.
[a]The comparisons were made in the matched sample (*n*=16,044 program–control pairs).
[b]Binary indicator: a pregnant woman living at ≤33% federal poverty level (FPL) based on her participation in the Low-Income Family Program and receipt of cash assistance
[c]Binary indicator: a Medicaid-eligible pregnant woman who had Medicaid before the pregnancy (qualifying income ≤63% FPL if aged >19 years [which describes the majority of participants in the current study] and ≤150% FPL if aged ≤19 years)
FPL, Federal Poverty Level; MIHP, (Michigan) Maternal and Infant Health Program

because a match was not found within the caliper. The matching process yielded a >99% propensity-score overlap between the MIHP group and the matched comparison group.

Finally, to test the hypothesis that MIHP has favorable effects on maternal and infant outcomes, comparisons were made between the MIHP participants and the matched comparison group, adjusting for the county of residence, using conditional logistic regressions (Table 3). To determine the sensitivity of the results to the fact that there were duplicate propensity scores in the MIHP group and the matched group, the MIHP effects were re-estimated five times, with the propensity scores being randomly sorted in each iteration. The results were essentially unchanged, suggesting that the identical scores did not affect the evaluation.

The MIHP effect unbiased estimations relied on the assumption that the probability of MIHP participation based on the observed covariates is the same in the participant group and the matched comparison group. Estimated program effects may be biased if relevant unobserved variables are not included in the propensity-scores estimation. To assess the robustness of the results to hidden bias, the potential effects of unobserved variables causing differences in the odds of treatment assignment between the MIHP and the matched comparison group were calculated. The larger the required hidden bias needed to invalidate the MIHP effects, the more likely the findings were to be robust (Table 4). SAS, version 9.1.3, and Stata, version 11, were used to perform the analyses between 2011 and 2013.

Table 3. MIHP effects on maternal and infant health care: propensity-score matching analyses

	2010 Medicaid birth cohort		
	MIHP clients (%)	Matched controls (%)	OR (95% CI)
Maternal prenatal and postnatal care			
Any prenatal care	99.17	97.44	**2.94** (2.43, 3.60)
Adequate prenatal care (adequate vs intermediate/inadequate)	39.60	38.16	**1.06** (1.01, 1.11)
Adequate prenatal care (adequate/adequate-plus vs intermediate/inadequate)	64.75	63.46	**1.06** (1.01, 1.11)
Appropriate postnatal visit	50.14	41.14	**1.50** (1.43, 1.57)
Enrolled in postnatal Plan First! family planning	12.19	11.13	1.14 (0.99, 1.29)
Infant care			
Any well-child visits	97.02	94.54	**1.70** (1.51, 1.93)
Appropriate number of well-child visits	92.18	89.67	**1.47** (1.35, 1.60)

Note: Boldface indicates significantly different than zero at the $p<0.05$ level, two-tailed test.
MIHP, (Michigan) Maternal and Infant Health Program

Results

Baseline Equivalence

Statewide, pregnant women participating in MIHP, compared to the Medicaid-insured pregnant women not participating in MIHP, were more likely to be younger (mean age 25.3 vs 26.7 years); smoke during pregnancy (30.6% vs 28.4%); be black (38% vs 23.4%); carry a first pregnancy (39.3% vs 31.5%); have family income below 33% FPL (17.9% vs 10.7%); be married (33.2% vs 21.9%); and have chronic disease. All differences were significant ($p<0.05$). The results (Table 2) also show that using propensity scoring to select a matched group of the nonparticipants established baseline equivalence on all the characteristics included in the analyses (except on individual county of residence: results not shown).

Maternal and Infant Healthcare Utilization

The MIHP participants had higher odds of receiving any prenatal care compared to matched nonparticipants (OR=2.94, $p<0.05$; Table 3). Women enrolled in MIHP during pregnancy had higher odds of scoring "adequate" on the Kotelchuck Index (OR=1.06, $p<0.05$). MIHP participants had higher odds of receiving an appropriately timed postnatal visit (OR=1.50, $p<0.05$). The odds of eligible women who participated in MIHP during pregnancy enrolling in Plan First! postpartum were not different from those of matched women not participating in MIHP. Infants participating in MIHP had higher odds of receiving any well-child visits over the first year of life compared to matched nonparticipant infants (OR=1.70, $p<0.05$; Table 3). They also had higher odds of receiving the appropriate number of well-child visits over their first year of life (OR=1.47, $p<0.05$).

Sensitivity Analysis

Unobserved characteristics would have to cause differences in the odds of treatment assignment between the MIHP group and the control group as high as OR=2.7 to invalidate the findings on MIHP and receipt of prenatal care (Table 4). The required hidden bias OR values to invalidate the findings on the MIHP effects on postnatal visits, any infant well-child visits, and appropriate number of well-child visits were 1.55, 1.5, and 1.4, respectively. A hidden bias of as low as OR=1.02 would invalidate the findings on the MIHP effects on adequacy of prenatal care.

Discussion

This quasi-experimental evaluation of MIHP revealed several important findings. Participation in Michigan's Medicaid Maternal and Infant Health Program (MIHP) increased the odds of receiving any prenatal care, the adequacy of prenatal care, and the odds of new mothers receiving appropriate postnatal visits. Prior RCTs of other home-visitation programs did not find positive effects on the use of prenatal care.[13,15]

To our knowledge, there are no prior RCT or quasi-experimental evaluations of the effects of home-visitation programs on the receipt of appropriate postnatal care. Positive MIHP effects on infant use of

Table 4. Sensitivity analyses for selected MIHP favorable effects

Maternal and infant healthcare outcomes	2010 Medicaid birth cohort required hidden bias[a] (OR)
Any prenatal care	2.7
Adequate prenatal care (Kotelchuck Index: adequate)	1.02
Adequate prenatal care (Kotelchuck Index: adequate or adequate-plus)	1.02
Mother had appropriate postnatal visit	1.55
Any well-child visits	1.5
Appropriate number of well-child visits	1.4

[a]For MIHP effects to lose significance; OR=threshold ORs of difference in MIHP assignment between the MIHP and the matched control group in order for MIHP favorable results to lose significance. Higher OR implies robustness of results to potential hidden bias.
MIHP, (Michigan) Maternal and Infant Health Program

preventive health services were found. These included increased odds of ever presenting for well-child visits and of receiving the appropriate number of such visits over the first year of life. The findings of improved infant use of preventive services were in line with RCT evaluations of other home-visitation programs.[16,18] The favorable MIHP effects are consistent with the roles of the MIHP case manager coordinating care with the medical care provider and Medicaid Health Plan and removing barriers to participation in care. Most of the favorable MIHP effects were robust to potential unobserved confounders.

The current study has application to the national debate over healthcare reform, in particular the decision at the state level on expanding Medicaid in conjunction with the federal changes in health care. In addition, the findings are relevant as states and the federal government reaffirm evidence-based programs for pregnant women and children as priorities.[4,5] The results lend support to the Medicaid MIHP in Michigan as an evidence-based home-visitation program with a population-management approach. Other state-sponsored enhanced prenatal services programs are similar to MIHP in eligibility, service content, and increase in coverage with state Medicaid expansion.[26—31] This may suggest improvements in maternal prenatal and postnatal care and infant care as states expand Medicaid coverage as a result of the federal 2010 Patient Protection Affordable Care Act and, implicitly, enhanced prenatal service coverage.

Strengths and Limitations

This quasi-experimental evaluation of MIHP had several distinct strengths. First, the propensity-score matching study design was rigorous, contrasting with most of the prior statewide evaluations of state-sponsored home-visitation programs.[26—31] The design accounts for potential bias by matching on observed selection factors and assesses the robustness of the findings to potential hidden bias. Second, the study population was a complete statewide birth cohort of Medicaid-insured infants and their mothers. The findings are generalizable to all participants in MIHP in Michigan, a racially and ethnically heterogeneous population. Third, by linking and observing mothers and infants from preconception through the first 12 postbirth months, and using multiple sources of data, program effects characterize an extensive period of time.

Although the analysis was balanced on factors likely to influence participation in MIHP, matching was limited to observable characteristics, with other potential selection factors unmeasured. However, it is reassuring that the hidden bias analyses suggest that, for most of the favorable MIHP effects, the extent of bias induced by unobserved selection factors needs to be large to invalidate the findings. Another limitation was that timing and dosage of the MIHP was not assessed in this study; these should be explored in future research, along with additional health outcomes. However, this lack of assessment may reinforce the results, as it is possible that the findings of MIHP favorable effects are conservatively estimated.

Infants with continuous Medicaid eligibility for 12 months, although a majority, represent a select sample. Future research should include infant outcomes that are more generally applicable. Additional limitations characteristic to using administrative data include potential inaccuracies due to the inability to validate diagnostics by reference to medical records, potential underdiagnosing of some diseases, and somewhat limited sociodemographic characteristics.

Conclusion

The results from Michigan provide strong evidence for the effectiveness of a Medicaid-sponsored population-based home-visitation program in improving maternal prenatal and postnatal care and infant care. The findings

are especially relevant as Medicaid covers a large proportion of pregnancies and births in the U.S. and Medicaid-insured mothers and infants represent a disadvantaged group. These factors are important to consider as the federal healthcare reform is implemented and states undertake decisions on the expansion of the Medicaid program.

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References

1. Avellar S, Paulsell D. Lessons learned from the Home Visiting Evidence of Effectiveness Review. Washington DC: Office of Planning, Research and Evaluation, Administration for Children and Families, DHHS, 2011.
2. Agency for Healthcare Research and Quality. 2011 national healthcare disparities report. 2012. www.ahrq.gov/research/findings/nhqrdr/nhdr11/index.html.
3. Blumenshine P, Egerter S, Barclay CJ, Cubbin C, Braveman PA. Socioeconomic disparities in adverse birth outcomes: a systematic review. Am J Prev Med 2010;39(3):263–72.
4. Health Care and Education Affordability Reconciliation Act of 2010. H.R. 4872. (111th).
5. Iglehart JK. Historic passage—reform at last. N Engl J Med 2010;362(14):e48.
6. Paulsell D, Avellar S, Sama Martin E, Del Grosso P. Home Visiting Evidence of Effectiveness Review: executive summary. Washington DC: Office of Planning, Research and Evaluation, Administration for Children and Families, DHHS, 2010.
7. The Henry Kaiser J. Family Foundation. Medicaid matters: understanding Medicaid's role in our health care system. 2011. www.kff.org/medicaid/upload/8165.pdf.
8. The Annie E. Casey Foundation. Data center, Kids Count, Michigan. 2013. datacenter.kidscount.org/data/bystate/Rankings.aspx?state=MI&ind=1716.
9. Michigan Department of Community Health. PRAMS report, 2008. Larder CM, Grigorescu V, eds. 2010. www.michigan.gov/documents/mdch/MI_PRAMS_2008_Annual_Repot_9_28_2010_340775_7.pdf.
10. House Bill 5572 of 2012. State of Michigan.
11. Kratochwill TR, Hitchcock J, Horner RH, et al. Single-case designs technical documentation. 2010. ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf.
12. Schochet P, Cook T, Deke J, et al. Standards for regression discontinuity designs. 2010. ies.ed.gov/ncee/wwc/pdf/wwc_rd.pdf.
13. Koniak-Griffin D, Anderson NLR, Brecht M-L, Verzemnieks I, Lesser J, Kim S. Public health nursing care for adolescent mothers: impact on infant health and selected maternal outcomes at 1 year postbirth. J Adolesc Health 2002;30(1):44–54.
14. Koniak-Griffin D, Anderson NLR, Verzemnieks I, Brecht M-L. A public health nursing early intervention program for adolescent mothers: outcomes from pregnancy through 6 weeks postpartum. Nurs Res 2000;49(3):130–8.
15. Kitzman H, Olds DL, Henderson CR Jr, et al. Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing. A randomized controlled trial. JAMA 1997;278(8):644–52.
16. Guyer B. Healthy Steps: the first three years. Hughart N Genevro J, eds. Baltimore MD: Women's and Children's Health Policy Center, Department of Population and Family Health Sciences, Johns Hopkins Bloomberg School of Public Health, 2003.
17. Johnston BD, Huebner CE, Tyll LT, Barlow WE, Thompson RS. Expanding developmental and behavioral services for newborns in primary care: effects on parental well-being, practice, and satisfaction. Am J Prev Med 2004;26(4):356–66.
18. Landsverk J, Carrilio T, Connelly CD, et al. Healthy Families San Diego clinical trial: technical report. San Diego CA: The Stuart Foundation, California Wellness Foundation, State of California Department of Social Services: Office of Child Abuse Prevention, 2002.
19. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed adequacy of prenatal care utilization index. Am J Public Health 1994;84(9):1414–20.
20. Michigan Maternal and Child Health County Profiles, 2000 to 2009. www.michigan.gov/documents/mdch/MCH_databook_final_361031_7.pdf.
21. Reed DE, Ramsini W, Hughes KF. Postpartum visits: Ohio Medicaid population, 2003-2005. Columbus: Ohio Department of Health, 2007. www.odh.ohio.gov/～/media/ODH/ASSETS/Files/data%20statistics/maternal%20and%20child%20health/postpartumvisits-medicaidpopulation.ashx.
22. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. Biometrika 1983;70(1):41–55.
23. Rubin DB. Estimating causal effects from large data sets using propensity scores. Ann Intern Med 1997;127(8 Pt 2):757–63.
24. Rosenbaum PR, Rubin DB. Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. Am Stat 1985;39(1):33–8.
25. Dehejia RH, Wahba S. Propensity score matching methods for non-experimental causal studies. Rev Econ Stat 2002;84(1):151–61.
26. Ricketts SA, Murray EK, Schwalberg R. Reducing low birthweight by resolving risks: results from Colorado's Prenatal Plus Program. Am J Public Health 2005;95(11):1952–7.
27. Slaughter J, Issel LM, Handler A, Rosenberg D, Kane D, Stayner L. Measuring dosage: a key factor when assessing the relationship between prenatal case management and birth outcomes. Matern Child Health J 2012. Epub ahead of print.
28. Reichman N, Teitler J. Timing of enhanced prenatal care and birth outcomes in New Jersey's HealthStart program. Matern Child Health J 2005;9(2):151–8.
29. Carabin H, Cowan LD, Beebe LA, Skaggs VJ, Thompson D, Agbangla C. Does participation in a nurse visitation programme reduce the frequency of adverse perinatal outcomes in first-time mothers? Paediatr Perinat Epidemiol 2005;19(3):194–205.
30. Arima Y, Guthrie BL, Rhew IC, De Roos AJ. The impact of the First Steps prenatal care program on birth outcomes among women receiving Medicaid in Washington State. Health Policy 2009;92(1):49–54.
31. Willems Van Dijk J, Anderko L, Stetzer F. The impact of prenatal care coordination on birth outcomes. J Obstet Gynecol Neonatal Nurs 2011;40(1):98–108.