Original Article

Prenatal Care Reduces the Impact of Illicit Drug use on Perinatal Outcomes

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OBJECTIVE:
To estimate the extent that prenatal care (PNC) retains its protective influence against prematurity, low birth weight (LBW), and small for gestational age (SGA) status in infants exposed to illicit drug use (IDU) in pregnancy.

STUDY DESIGN:
This was a prospective cohort analysis including 6673 women residents of the District of Columbia (Washington, DC, USA) delivering at four city hospitals. Women were screened in the immediate postpartum period. Levels of PNC were established according to American College of Obstetrics and Gynecology guidelines and the Kotelchuck index. PNC and IDU were compared between subgroups. Adjusted relative risks for prematurity, LBW and SGA, controlling for maternal and gestational ages, were calculated in different groups according to IDU and level of PNC.

RESULTS:
IDU was identified in 13% of mothers screened. PNC was classified as none (6%), inadequate (10%), intermediate (20%), and adequate (64%). The highest risk for prematurity, LBW, or SGA occurred in infants born to mothers with no PNC and positive IDU in pregnancy (prematurity OR = 12.05, 95% CI: 8.99 to 16.16; LBW OR = 14.76, 95% CI: 11.03 to 19.75; SGA OR = 9.20, 95% CI: 5.32 to 15.92). As PNC levels increased, significant reductions in risk for prematurity and LBW (not for SGA) in IDU-exposed infants were observed. Risk for SGA in IDU-exposed infants reduced significantly when PNC was introduced.

CONCLUSIONS:
In infants exposed to IDU, a reduction in risk for prematurity, LBW, and SGA, was consistently demonstrated with improved levels of PNC. In high-risk populations, health care should seek to reach mothers early, especially those identified at risk for IDU, and deliver PNC to them effectively.
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INTRODUCTION

Inadequate prenatal care (PNC) and illicit drug use (IDU) during pregnancy are both identifiable risk factors associated with perinatal morbidity and mortality. Birth defects, preterm labor and delivery, intrauterine growth retardation (IUGR), abruptio placentae, fetal distress, and intrauterine fetal demise, neonatal withdrawal, and other neurobehavioral abnormalities have all been documented in relation to substance abuse during pregnancy.[1,2] Inadequate PNC, as an independent predictor, is associated with compromised outcomes, namely an increased incidence of prematurity and low birth weight (LBW).[3–5]

The association of IDU and inadequate PNC creates additional risk for LBW and perinatal mortality.[6] In populations most vulnerable to poor perinatal outcomes these important risk factors overlap, making it difficult to define the more predominant association. It is unclear to what extent PNC retains its protective influence against prematurity, LBW, and IUGR in infants exposed to IDU in pregnancy.[7] We attempt to answer these questions within the context of the multicenter NIH-DC Initiative to Reduce Infant Mortality in Minority Populations in the District of Columbia. The study is designed to explore the impact of IDU and inadequate PNC, separately and together, on the incidence of prematurity, LBW, and small for gestational age (SGA) status in Washington, DC.

METHODS

Study Population

All women (13,705) delivering in four Washington, DC hospitals during the period April 1995 to April 1997 were screened in the immediate postpartum period. The hospitals included two university medical centers, one city hospital, and one private women's hospital. Delivery logs were screened to identify eligible

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postpartum women. Women were considered eligible if they were Washington, DC residents and were not incarcerated or otherwise institutionalized. DC residency was verified by using women's medical records (MRs). In total, 6140 women were ineligible because they were not DC residents, 892 women were ineligible because of missing information or other ineligibility criteria. This left a total of 6673 women to enter the analyses.

Data Collection

Screening log information was recorded for the 6673 eligible postpartum DC women. Data abstracted from delivery logs included maternal information on age, PNC initiation and number of PNC visits, history of drug abuse, and results of urine toxicology screen. No information on alcohol use or smoking was available. The infants' birth weight and gestational age were also obtained, based mainly on review of delivery room logbook and special care nursery admission log. Women were interviewed only when information was missing.

The status of PNC and IDU during pregnancy was determined by MR review and by interviewing the mothers. Urine testing of mothers and/or infants was left to the judgment of the treating physician according to the guidelines of their usual practice, but the results were used to corroborate the MR information on IDU in pregnancy. Additional information was collected from the infants' MR regarding the birth weight and gestational age by menstrual history, and was confirmed by Dubowitz exam in premature infants.

In order to control for the length of gestational period in the analysis, the proportion of the actual number of PNC visits to the recommended visits was calculated. The recommended number of PNC visits was based on the number of weeks of gestation for women with an uncomplicated pregnancy, according to the current American College of Obstetricians and Gynecologists (ACOG) standards.[8] The proportion, called adequacy of received services by Kotelchuck, is considered adequate if more than 80%, intermediate if more than 50% but less than 80%, and inadequate if less than 50% of expected number of visits.[8,9]

Statistical Analysis

Statistical analysis of the data consisted of two stages. The first stage characterized and compared subgroups of the study population, according to adequacy of PNC and IDU exposure status. Contingency tables were generated, using SPSS software, to test for bivariate associations. StatXact software was used to calculate *p*-values and make reliable inferences.[10] The purpose of this step was to characterize the population with respect to various reproductive health measures and compare study subgroups.

In the second stage, logistic regression analyses were performed in order to calculate the adjusted relative risk for adverse pregnancy outcomes controlling for maternal age, gestational age, IDU, and/or PNC. Exposures to alcohol or tobacco use were not controlled for in this analysis because this information was not available. While no information was collected with respect to other background characteristics, the sample may be considered homogeneous with respect to two main covariates, that is race (mostly black subjects) and marital status (mostly never married). The purpose of this step is to control for any differences in IDU and PNC among various subpopulations.

RESULTS

Prenatal Care

For descriptive characterization purposes, the total population of postpartum women (6673) was divided into two groups: women with ''inadequate'' PNC and those with ''adequate'' PNC, using Kotelchuck's classification, as outlined above.[9] The inadequate PNC group is comprised from no, inadequate, and intermediate PNC groups.

The prevalence of no PNC during pregnancy was reported in 6.3% ($n = 418$) of the 6673 DC women. Data collected over the period of the study indicate a decline in the prevalence of no PNC among pregnant women in DC. For the first year (April 1995 to April 1996), no PNC was reported in 6.8% ($n = 254$) of 3739 women, compared to only 5.6% ($n = 164$) of 2934 women for the second year of the study (May 1996 to April 1997). These two prevalence rates are significantly different at the 5% level.

Maternal Characteristics In Table 1, maternal age and IDU are reviewed by category of PNC utilization. Mothers with adequate PNC were significantly older (about 2 years) than those with inadequate PNC. Conversely, mothers with no PNC were significantly older than those with inadequate/intermediate PNC. IDU exposure was reported in 12.4% of the study population. Mothers with adequate PNC had significantly less exposure to IDU (4.2%) than mothers with inadequate PNC (26.2%), while mothers with no PNC had the highest prevalence of IDU (55.2%) during pregnancy.

Infant Characteristics

Infant characteristics classified by category of PNC utilization are also provided in Table 1. Infants born to mothers with inadequate PNC during pregnancy had significantly lower birth weights, most significantly in the group born to mothers with no PNC. The same relation was observed for gestational age distribution.

Illicit Drug Use

Information on IDU exposure status during pregnancy was identified by self-report and/or urine screen in 796 DC mothers representing 12.4% of the population with recorded IDU exposure status (6413 out of 6673 mothers). Of the IDU-positive group, 59.4% were positive by history and urine testing, 36.3% had positive history and either negative urine testing (16.8%) or no urine testing was performed (19.5%). In addition, 4.3% were positive by urine testing but no drug history was reported. No information was available regarding classes of illegal drugs.

Table 1 Maternal and Neonatal Characteristics Classified According to Adequacy of PNC

Characteristics	All DC mothers n=6673	Adequate PNC n=4241	Inadequate PNC n=2432	p-value	Inadequate/Inter-mediate PNC n=2014	No PNC (0 visits) n=418	p-value
Maternal age (years)*	27.5±0.1	28.2±0.1	26.3±0.1	<0.001	25.9±0.2	27.9±0.3	<0.001
<18 years	6.6%	4.7%	10.0%	<0.001	10.7%	6.7%	0.014
Illicit drug use (%)	12.4%	4.2%	26.2%	<0.001	20.1%	55.2%	<0.001
Number of PNC visits*	8.6±0.1	11.3±0.1	4.1±0.1	<0.001	4.9±0.1	0.0	<0.001
No PNC visits (%)	6.3%	NA	17.2%	NA	NA	100%	NA
PNC initiation (weeks)*	15.5±0.1	11.2±0.1	22.9±0.2	<0.001	20.3±0.2	—	NA
<13	50.0%	69.5%	16.1%	<0.001	19.2%	—	NA
<25	84.2%	97.6%	60.7%	<0.001	72.0%	—	NA
Birth weight (g)*	3141±8	3292±9	2879±17	<0.001	2953±17	2521±44	<0.001
<500	045%	0.1%	0.8%	<0.001	0.7%	1.7%	0.065
<1000	1.6%	0.4%	3.9%	<0.001	3.2%	7.5%	<0.001
<1500	3.4%	0.8%	8.0%	<0.001	6.3%	15.9%	<0.001
<2500	12.4%	6.7%	25.4%	<0.001	21.8%	43.0%	<0.001
Gestational age (weeks)*	38.2±0.1	38.9±0.1	37.1±0.1	<0.001	37.4±0.1	35.3±0.2	<0.001
<25	1.0%	0.2%	2.4%	<0.001	1.8%	5.3%	<0.001
<29	2.5%	0.4%	6.2%	<0.001	4.8%	13.2%	<0.001
<33	5.1%	1.3%	11.9%	<0.001	9.9%	21.6%	<0.001
<37	14.2%	7.6%	29.6%	<0.001	25.9%	46.4%	<0.001

*Mean±SEM (standard error of mean).

The prevalence of IDU among pregnant women in DC did not change significantly over the period of the study. For the first year (April 1995 to April 1996), IDU was reported in 12.9% ($n=462$) of 3581 women, compared to 11.8% (334 out of 2832 pregnant women) during the second year (May 1996 to April 1997).

Maternal Characteristics Mothers with IDU exposure in pregnancy were older ($p<0.01$) and initiated PNC later in pregnancy ($p<0.001$). These mothers had significantly fewer PNC visits ($p<0.001$) (Table 2).

Infant characteristics Infants exposed to IDU during pregnancy had significantly lower birth weights ($p<0.001$) and were born at significantly younger gestational age ($p<0.001$). Detailed distribution of birth weight and gestational age categories are provided in Table 2.

Risk for Prematurity, LBW, and SGA

Table 3 presents the logistic regression results for prematurity controlling for maternal age, while Tables 4 and 5 present the logistic regression results for LBW and SGA controlling for both maternal and gestational ages. The two marginal distributions represent the main effects of PNC adequacy (the last column) and IDU exposure (the last row) for the three dependent variables, namely, prematurity, LBW, and SGA, respectively. The PNC−IDU inside cells of the tables represents the combined effect of both risk factors on each of the three dependent variables. In all tables, the adequate PNC and negative IDU cell is the reference category. Table 6 shows the impact of increases of PNC adequacy on the three dependent variables among pregnant women with IDU exposure during pregnancy.

Prematurity Table 3 shows that the risk of prematurity increases significantly among pregnant women as level of PNC decreases and when IDU is present. Women with no or with inadequate PNC are 10.72 or 7.03 times as likely to have premature babies as compared to those with adequate PNC. Pregnant women with illicit drug use are 3.40 times as likely to have premature babies as nonusers. The adjusted odds ratios, stated above, were highly significant. This means that the overall risk for prematurity was greater in association with no PNC than with IDU exposure (10.72 vs 3.40). IDU exposure did not increase the risk for prematurity in mothers receiving no, inadequate or intermediate PNC, but did significantly in mothers receiving adequate PNC (data not shown).

Considering both risk factors together, the highest risk for prematurity occurred in infants born to mothers with no PNC and IDU exposure in pregnancy. These infants are about 12 times as likely to be born premature. There was a significant reduction in risk for prematurity in infants born to IDU-exposed mothers as the level of PNC utilization increased (Table 6).

LBW (< 2500 g) Table 4 indicates that the risk of LBW increases significantly as level of PNC decreases and when IDU is present. Adjusted odds ratios for LBW are significantly higher and increase in magnitude systematically as levels of PNC utilization decreases. Pregnant women with no PNC are 10.73 times as likely to have babies with LBW as those with adequate PNC. Women using drugs during pregnancy are 4.35 times as likely to have babies with LBW

Table 2 Maternal and Neonatal Characteristics Classified According to IDU in Pregnancy

Characteristic	Positive IDU $n=796$	Negative IDU $n=5617$	p-value
Maternal age (years)*	29.2±0.2	27.2±0.1	<0.001
<18 years	4.1%	7.1%	0.001
Number of PNC visits*	4.4±0.1	9.1±0.1	<0.001
Inadequate PNC (%)	78.6%	31.5%	<0.001
No PNC visits (%)	28.8%	3.3%	<0.001
PNC initiation (weeks)*	23.9±0.4	14.5±0.1	<0.001
<13	16.7%	53.5%	<0.001
<25	54.3%	88.0%	<0.001
Birth weight (g)*	2690±26	3197±9	<0.001
<500	0.9%	0.5%	0.122
<1000	4.1%	1.8%	<0.001
<1500	9.7%	3.2%	<0.001
<2500	35.8%	11.3%	<0.001
Gestational age (weeks)*	36.7±0.1	38.4±0.1	<0.001
<25	2.4%	0.8%	<0.001
<29	6.2%	2.1%	<0.001
<33	13.1%	4.2%	<0.001
<37	32.6%	12.0%	<0.001

*mean±SEM (standard error of mean).

Table 3 Risk for Prematurity Analyzed by IDU Exposure and PNC Level in a Logistical Regression Model

PNC adequacy	Adjusted odds ratios (95% CI)		Total
	Positive IDU	Negative IDU	
No PNC	12.05	9.72**	10.72**
	(8.99, 16.16)	(7.03, 13.42)	(8.52, 13.50)
	$n=229$	$n=186$	$n=415$
Inadequate PNC	9.70*	6.17**	7.03**
	(7.06, 13.32)	(4.81, 7.93)	(5.70,8.67)
	$n=195$	$n=464$	$n=659$
Intermediate PNC	4.11**	3.32**	3.40**
	(2.89, 5.84)	(2.71, 4.07)	(2.82, 4.09)
	$n=202$	$n=1117$	$n=1319$
Adequate PNC	1.72*	1.00	1.00
	(1.04, 2.87)	—	—
	$n=170$	$n=3850$	$n=4020$
Total	3.40**	1.00	
	(2.88, 4.01)	—	
	$n=796$	$n=5617$	$n=6413$

Odds ratios are adjusted for maternal age. Adequate PNC and negative IDU cell is the reference category for each PNC/IDU combination.
*$p \leq 0.05$; **$p<0.001$.

as nonusers. Infants born to women with no PNC are at higher risk for LBW than infants born to women with IDU exposure. However, adherence to PNC may be a proxy for other maternal characteristics that are not easily identifiable, such as a more structured lifestyle and stronger resiliency.

Table 4 Risk for LBW Analyzed by IDU Exposure and PNC Level in a Logistical Regression Model

PNC adequacy	Adjusted odds ratios (95% CI)		Total
	Positive IDU	Negative IDU	
No PNC	14.76**	6.95**	10.73**
	(11.03, 19.75)	(4.96, 9.73)	(8.52, 13.51)
	$n=229$	$n=186$	$n=415$
Inadequate PNC	9.98**	5.77**	6.89**
	(7.30, 13.65)	(4.51, 7.39)	(5.60, 8.47)
	$n=195$	$n=464$	$n=659$
Intermediate PNC	5.10**	2.60**	2.99**
	(3.64, 7.15)	(2.11, 3.22)	(2.47, 3.61)
	$n=202$	$n=1117$	$n=1319$
Adequate PNC	1.80*	1.00	1.00
	(1.10, 2.96)	—	—
	$n=170$	$n=3850$	$n=4020$
Total	4.35**	1.00	
	(3.70, 5.12)	—	
	$n=796$	$n=5617$	$n=6413$

Odds ratios are adjusted for both maternal and gestational ages. Adequate PNC and negative IDU cell is the reference category for each PNC/IDU combination.
*$p=0.02$; **$p<0.001$.

If one considers both risk factors simultaneously, the highest risk for LBW was observed in infants born to mothers with no PNC and IDU exposure (OR = 14.76, 95% CI: 11.03 to 19.75) as compared to babies born to mothers with adequate PNC and no drug use during pregnancy. Increases in PNC adequacy level have reduced the risk for LBW in babies born to IDU-exposed mothers (Table 6).

SGA status in term newborns Table 5 shows the impact of PNC adequacy and IDU exposure on SGA. In this analysis, premature cases with gestational age less than 37 weeks were excluded. The results reflect LBW secondary to IUGR and not prematurity. Contrary to the previous results for prematurity and LBW, the risk for SGA was similar for infants born to mothers with no PNC and for those born to mothers with IDU exposure (OR = 5.54, 95% CI: 3.41 to 9.02, vs OR = 4.63, 95% CI: 3.29 to 6.52). Neither inadequate nor intermediate PNC categories were associated with increased risk for SGA unless they included infants exposed to IDU. Among infants born to mothers with adequate PNC, IDU exposure doubled the risk for SGA (not significant) in comparison with those with negative IDU exposure. There was a gradual decline in the risk for SGA in IDU-exposed infants as the level of PNC improved. This decline was only significant when comparing no PNC to inadequate PNC, but lost significance for higher levels of PNC. For mothers with no IDU exposure, changes in PNC levels have no significant impact on SGA (Table 6).

Table 5 Risk for SGA Status for Term Infants Analyzed by IDU Exposure and PNC Level in a Logistical Regression Model

PNC adequacy	Adjusted Odds Ratios (95% CI)		Total
	Positive IDU	Negative IDU	
No PNC	9.20*	0.97	5.54*
	(5.32, 15.92)	(0.23, 4.01)	(3.41, 9.02)
	n=117	n=108	n=225
Inadequate PNC	4.30*	1.65	2.36*
	(2.09, 8.85)	(0.83, 3.26)	(1.41, 3.97)
	n=111	n=332	n=443
Intermediate PNC	3.72*	0.92	1.39
	(1.93, 7.18)	(0.53, 1.60)	(0.89, 2.15)
	n=154	n=911	n=1065
Adequate PNC	2.07	1.00	1.00
	(0.88, 4.84)	—	—
	n=151	n=3579	n=3730
Total	4.63*	1.00	
	(3.29, 6.52)	—	
	n=533	n=4930	n=5463

Odds ratios are adjusted for both maternal and gestational ages. Adequate PNC and negative IDU cell is the reference category for each PNC/IDU combination.
*$p \leq 0.001$.

Table 6 Effect of Level of PNC on Risk for Prematurity, LBW, and SGA in Infants Born to Mothers Exposed to IDU in Pregnancy

PNC adequacy	Adjusted odds ratios (95% CI) for all infants born to mothers exposed to IDU		
	Prematurity	LBW	SGA (for GA > 36)
No PNC	7.06**	7.93**	4.24*
	(4.03, 12.37)	(4.59, 13.71)	(1.62, 11.13)
	n=229	n=229	n=117
Inadequate PNC	5.66**	5.44**	2.03
	(3.19, 10.03)	(3.11, 9.51)	(0.70, 5.91)
	n=195	n=195	n=111
Intermediate PNC	2.40*	2.76**	1.74
	(1.33, 4.34)	(1.56, 4.89)	(0.623, 4.86)
	n=202	n=202	n=154
Adequate PNC	1.00	1.00	1.00
	n=170	n=170	n=151
Total	n=796	n=796	n=533

Adequate PNC cell is the reference category.
*p<0.01; **p< 0.001.

DISCUSSION

In 1996, when this study was initiated, the infant and neonatal mortality rates for DC were 14.2 per 1000 and 9.8 per 1000, respectively; double the national averages (7.2 per 1000 and 4.7 per 1000).[11,12] Prematurity and LBW have been defined as the most important causal associations for neonatal mortality.[13] In this study, we report an overall rate of 14.2% for prematurity, and 13.4% for LBW in a population of 6673 DC women screened in the postpartum period. These rates are almost double those reported nationally for LBW (7.4%) in 1996.[12] Many economic, psychosocial, behavioral, biological, and health services factors have been implicated in these adverse perinatal outcomes.[14,15] Among them are two that seem to be inextricably associated, namely low levels of PNC utilization and exposure to IDU in pregnancy.[16–21] The overlap between these factors is evident in the population we studied, with a prevalence of 4.2% IDU in mothers with adequate PNC, 26.2% in women with inadequate PNC, and 55.2% in mothers with no PNC.

In the present study, the prevalence of no PNC (6.3%) was based upon MR review, and was verified by interviewing the mothers and the health-care providers if a discrepancy was found between the MR and the information given by the mothers. This is an exceptionally high rate. National statistics report a rate of only 4.1% for mothers receiving no PNC or initiating PNC in the third trimester.[13] Prevalence of IDU in mothers recruited to this study (12.4%) was based on history from the mothers, and urine testing of mothers and/or infants when obtained by the treating physicians. This rate was similar to an earlier report from National Institute on Drug Abuse (NIDA) on a Washington, DC population comparing prevalence of IDU by history (14.7%) to a prevalence based on random urine testing (13.7%) in the postpartum period.[22]

The adequacy of PNC and exposure to IDU during pregnancy are difficult to quantify because of the questioned reliability of verbal history obtained from the highest risk group of mothers.[19–21] More recent reports in the literature show a difference between the accuracy of reporting on substance use during pregnancy, and retrospectively after pregnancy has ended.[23] The accuracy of reporting by history retrospectively seems much higher since the effect of stigma may be mitigated. This limitation is not overcome by urine testing since the urine metabolites only reflect recent use and do not reflect utilization patterns throughout pregnancy. Other testing methods, such as meconium testing, are still not in routine use.

Another limitation of this study, as a result of relying on screening logs for information, is the lack of information regarding other characteristics such as education, SES, and other background variables for the population covered in this study. While, in fact, one can claim the homogeneity of this cohort of women at least with respect to race and marital status, other characteristics associated with poor pregnancy outcomes might explain the differences among various PNC–IDU groups. Furthermore, the data are difficult to compare across studies because of differences in source and methods of data collection.[17,19,22,24]

In addition, the inability to distinguish between various classes of, and exposure levels to illegal drugs is another limitation of this study. Other studies have shown, for example, that a protective effect of PNC ($\geq$ three visits) was observed among 91 neonates of cocaine-exposed women during pregnancy but not women exposed to marijuana or multiple drugs.[27] However, PNC did not reduce the incidence of LBW.

Despite many frequently associated confounders, including poor nutrition, smoking, stress, perinatal infections and others,[3,14,25,26] it is important to clarify the relation between adequacy of PNC and IDU as risk associations involved in perinatal outcomes. PNC has been suggested to modify the impact of IDU on perinatal outcomes. We demonstrate in this study that the impact of IDU on LBW and prematurity is reduced as the level of PNC utilization is improved. This result is similar to findings of other studies.[27] A large retrospective study conducted by Broekhuizen (1983 to 1990) showed pregnant drug users with poor PNC ($\leq$ five visits) to have two-fold increase in the incidence of LBW when compared to those receiving more than five PNC visits.[7] Chazotte et al.[28] reported in a population of 145 women with a history of IDU in pregnancy that PNC significantly decreased the incidence of LBW and very LBW (VLBW) regardless of the content of PNC. No such effect was demonstrated in the incidence of prematurity, however. A similar effect had been previously shown by MacGregor et al.[29] and Mastrogiannis et al.[30] both on small numbers of mothers, 120 and 86, respectively. Using New York City birth certificate data, Racine et al.[31] report the largest study in the literature. In their study, adequacy of PNC was based solely on the number of visits and not on time of initiating care. Among black New Yorkers with a history of IDU in pregnancy, they showed that one to three PNC and 4+ PNC visits significantly reduced the incidence of LBW. In the current study, adequacy of PNC is more accurately defined by number of visits, time of initiation, and percentage of expected visits as determined by gestational age at birth. The results confirm previous findings related to reduction in LBW by improved PNC in IDU-exposed pregnancies.[17] This study also demonstrates a similar effect, for the first time, on the incidence of prematurity.

The interesting finding in this study is the unique effect of the relation between IDU and PNC on the risk for SGA in term infants. This relation is distinct from LBW and prematurity since it best reflects the risk for long-term uteroplacental insufficiency associated with SGA, and excludes the risk for acute uteroplacental vascular accidents associated with premature births. In this case only the total lack of PNC increases the risk for SGA in IDU-exposed infants. Gradual improvement in the level of PNC does not retain any significant beneficial effect.

The exact mechanism by which improved PNC is associated with improved pregnancy outcomes in a population of IDU-exposed pregnant mothers is unclear. The distinct differences in the relation between PNC, IDU, and LBW/prematurity, and between PNC, IDU, and SGA, seem to suggest existing biological differences. PNC may be directly responsible for such differences through improvement in nutrition and general health, decrease in IDU exposure, or decrease in other substance use including tobacco and alcohol. A limitation of the study is the lack of informations on women's alcohol and tobacco use. It would be difficult to determine the contribution of each risk factor to the outcome without a detailed exposure history, which is not generally available in the PNC record. The literature suggests that a degree of overlap in exposure between IDU, smoking, and alcohol would be high.[32,33] The other limitation is a nonstandardized approach in obtaining urine toxicology screens on the study subjects by physicians. It can be assumed that some women who were not tested and denied IDU during pregnancy would have tested positive by urine screen. It is reassuring that the percentage of IDU reported in the study is similar to earlier reports in the literature. Nonetheless these differences could be inherent to the mothers with IDU who choose to use PNC. Women exposed to IDU in pregnancy are represented by a wide spectrum of personal skills, control over life circumstances, and degrees of autonomy and resilience. All these factors are not easy to measure, but may play a significant role in pregnancy outcomes.

In conclusion, it is important to emphasize the significant percentage of mothers using illicit drugs who present to PNC early. This should be an incentive for health-care providers to diagnose this problem and offer treatment whenever possible. Offering PNC services to pregnant women exposed to IDU irrespective of other risk associations, and even in the absence of addiction targeted services, appears to influence outcomes in this high-risk population significantly and should be emphasized. These findings may be generalizable to other populations with similar risks.

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