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Predictors of Inadequate Prenatal Care in Methamphetamine-Using Mothers in New Zealand and the United States

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Abstract

This study compared patterns of prenatal care among mothers who used methamphetamine (MA) during pregnancy and non-using mothers in the US and New Zealand (NZ), and evaluated associations among maternal drug use, child protective services (CPS) referral, and inadequate prenatal care in both countries. The sample consisted of 182 mothers in the MA-Exposed and 196 in the Comparison groups in the US, and 107 mothers in the MA-Exposed and 112 in the Comparison groups in NZ. Positive toxicology results and/or maternal report of MA use during pregnancy were used to identify MA use. Information about sociodemographics, prenatal care and prenatal substance use was collected by maternal interview. MA-use during pregnancy is associated with lower socio-economic status, single marital status, and CPS referral in both NZ and the US. Compared to their non-using counterparts, MA-using mothers in the US had significantly higher rates of inadequate prenatal care. No association was found between inadequate care and MA-use in NZ. In the US, inadequate prenatal care was associated with CPS referral, but not in NZ. Referral to CPS for drug use only composed 40 % of all referrals in the US, but only 15 % of referrals in NZ. In our study population, prenatal MA-use and CPS referral eclipse maternal sociodemographics in explanatory power for inadequate prenatal care. The predominant effect of CPS referral in the US is especially interesting, and should encourage further research on whether the US policy of mandatory reporting discourages drug-using mothers from seeking antenatal care.

Keywords

Methamphetamine; Adequate prenatal care; New Zealand; Kessner Index; Child protective services

Introduction

Methamphetamine (MA) use is a growing worldwide public health issue [1–3], with dramatic increases in the Asia-Pacific region [4, 5]. Of particular concern is MA use during pregnancy [6]: the Infant Development, Environment, and Lifestyle (IDEAL) study estimated that 5.5 % of the pregnant women in its study sites used MA [7]. While no similar specific estimates are available in New Zealand (NZ), NZ's statistics on MA use parallel trends worldwide [8, 9], with a fivefold increase in the past 7 years amongst pregnant women in Auckland [10].

A primary worry concerning MA use during pregnancy is its association with inadequate prenatal care. Research demonstrates a clear correlation between drug use during pregnancy and inadequate prenatal care or late access to care [11, 12], both of which are linked to maternal and neonatal risks including a lack of breastfeeding, postnatal care, well-child visits, child immunizations, and an increased likelihood of loss of custody [13]. For drug-using women, prenatal care is especially beneficial as it facilitates drug-use monitoring and linkages with mental health, nutritional and educational services, while identifying psychological and social issues. Adequate prenatal care among cocaine-using women is associated with positive perinatal outcomes, including greater birthweight and head circumference [14–20], decreased prematurity [15–17] and a lower likelihood of having infants born small for gestational age [15, 16].

However, perceived and real barriers prevent drug-using women from obtaining early and consistent care throughout pregnancy, including financial and drug-related social problems. One of the most consistently reported obstacles is the belief that accessing prenatal care will lead to reports to legal or child protection agencies [21–29]. This belief among pregnant drug users in the US may be attributable to the legally-mandated requirement for health professionals to report maternal drug use to child protection services [30].

The majority of studies examining substance abuse and prenatal care have been conducted in the US, and the extent to which findings can be generalized to countries with different medical and legal systems is unknown. To date, no studies have compared use of prenatal care among drug-using women in countries with differing legal and social policies. Given its importance, it is useful to understand the correlates of adequate prenatal care and the possible impact of legal, social and/or healthcare policies on access to and usage of prenatal care.

We chose to examine patterns of prenatal care in NZ and the US: despite the cultural similarities between the two countries, there are three notable differences in the management of maternity care that potentially affect utilization of care among drug-using women. First, in NZ, no legal mandate exists to report a woman to legal or child protection services upon revealing drug use during pregnancy. Second, pre- and post-natal care is free for NZ residents under the country's Universal Healthcare system. Finally, most women receive prenatal care throughout their pregnancy, at birth and post-natally, from midwives, promoting continuity of care and stronger provider-patient relationships.

Our study uses data from the IDEAL study, a longitudinal study of prenatal MA exposure and child outcomes, to compare patterns of prenatal care among MA-using and non-using mothers in the US and NZ. We also evaluated associations between prenatal MA use, sociodemographic status, CPS referral, and adequate prenatal care in these countries.

Methods

Overview

The IDEAL study involved four US sites (Los Angeles, CA; Des Moines, IA; Tulsa, OK; and Honolulu, HI) and one international site (Auckland, NZ). Due to differing site regulations and methods of delivering prenatal care between the two countries, recruitment procedures slightly varied.

In the US, study protocol was reviewed and approved by each site's IRB. A federal Certificate of Confidentiality (COC) was obtained to assure confidentiality regarding sensitive information about substance abuse, superseding mandatory reporting of illegal drug use but not evidence of abuse and neglect. At all four sites, staff members were responsible for monitoring hospital delivery logs and attempted to approach every mother who delivered an infant within the last 48 h, prior to discharge. The purpose and scope of the study were explained, along with assurances afforded by the COC. If the mother signed informed consent to participate, the staff member administered the Lifestyle Interview and collected infant meconium.

In NZ, approval was granted by both the Auckland and Waitemata District Health Boards (DHBs), and finalized by the NZ Ministry of Health's Northern Regional Ethics Committee. Because of the inclusion of Maori participants, the study consulted local *Iwi* and Maori health care agencies before obtaining approval from the Maori Research Committees of the Auckland and Waitemata DHBs. While mothers were again ensured confidentiality, a COC was not required because NZ has no analogous policy of mandatory reporting.

Recruitment in NZ took place during pregnancy. In NZ, prenatal care is usually provided by midwives; thus, in NZ, midwives in the Auckland region were requested to refer potential subjects. All referred mothers met with study staff and, if interested, provided written consent for participation. Staff met again with mothers immediately after delivery, and prior to discharge, administered the Lifestyle Interview and collected infant meconium.

In both countries, maternal exclusion criteria were: LSD, PCP and/or other hallucinogen use during the pregnancy; younger than 18 (US) and 17.5 (NZ) years of age; history of hospitalization for intellectual disability or emotional disorders; low cognitive functioning; overt psychotic behavior or documented psychosis; and an inability to speak English (except Maori in NZ). Infant exclusion criteria were: critical illness at birth/unlikely to survive; multiple births; major life-threatening congenital anomaly; documented chromosomal abnormality associated with mental or neurologic deficiency; overt TORCH infection; and/or sibling previously enrolled in the study.

Participants

A case–control design was used: mothers and their infants were classified into either the 'Exposed group' by maternal report of MA use during pregnancy and/or positive toxicology results from meconium screening or into the 'Comparison group' by negative maternal-report and meconium screen. The two groups were matched within site in the US and within NZ by race/ethnicity, infant birth weight category (<1,500 g, 1,500–2,500 g,>2,500 g), and educational level. In the US, mothers were matched on private versus public insurance, which was not applicable in NZ.

The direct-recruiting method in the US allowed most participants to be matched one-to-one. When characteristics were difficult to match (e.g., Asian, >2,500 g, public insurance, high school not completed), a few Comparison group participants were enrolled prior to corresponding Exposed participants, leading to uneven group sizes. In NZ, the midwife-referral method of recruiting narrowed the pool of potential participants; therefore, group level matching was conducted. The final sample sizes were 182 Exposed and 196 Comparison participants in the US, and 107 and 112 participants in NZ, respectively. Details on recruitment protocols and response rates are provided in earlier publications [1, 31].

Measures

All study instruments were administered by trained staff members. The Lifestyle Interview collected details about the pregnancy and sociodemographics: educational level, age, race/ethnicity, partner status, insurance type (US only), and socioeconomic status (SES), which was calculated using the four-factor Hollingshead Index (Group 5 = low SES). Race/ethnicity was dichotomized into 'minority' (all non-white participants) versus 'non-minority' (participants of white/European-ancestry) status.

The Lifestyle Interview asked about referrals made to Child, Youth, and Family Services (CYFS; NZ) and Child Protective Services (CPS; US). Referrals to CPS were also obtained from the participants' medical charts. Hospital records included a section on the social conditions of the infant's discharge. Reasons for CPS referral included: (1) In utero drug exposure and/or maternal drug or alcohol use; (2) Abandonment by mother; (3) Mother thought to be incapable of caring for child; (4) Evidence of neglect; (5) Evidence of physical and/or sexual abuse; (6) Mother's social or economic circumstances; (7) Mother's physical or mental condition; (8) Mother already known to CYFS; (9) Mother incarcerated; and (10) Mother deceased. The information was coded as either a yes or no 'CPS referral'. Because it was possible to be simultaneously referred for both drug-related (#1) and non-drug/other related (#2–10) reasons, CPS referral reasons were categorized as 'Drug Only', 'Both Drug/

Other' and 'Other Only'. There were too few cases of 'Other Only' (N = 3 [1.6 %] in the US, N = 1 [0.9 %] in NZ) to analyze as a distinct group.

Inadequate prenatal care, measured using the Kessner Index [32], was derived from questions in the Lifestyle Interview, specifically the number of prenatal visits and the GA at first prenatal visit. The Kessner Index ranks the adequacy of prenatal care into three categories: adequate, intermediate, and inadequate. We created a binary measure of either 'inadequate' or 'intermediate/adequate' prenatal care. All cases with no prenatal visits (N = 12 in the US, N = 0 in NZ) were classified as inadequate care. This modified Kessner scale does not take into consideration prenatal service quality.

The Substance Use Inventory (SUI) assessed maternal substance use during pregnancy. Two variables were measured: (1) a dichotomous variable denoting 'any' use of tobacco, alcohol, marijuana, methamphetamine; and (2) continuous measures of drug use quantity per day: tobacco in number of cigarettes; alcohol in ounces; and marijuana in joints. For alcohol, standard drinks were converted to absolute alcohol ounces based on each country's conventions.

Statistical Analysis

All statistical analyses were conducted using SPSS version 17.0. Analysis of variance (ANOVA) and Chi-square statistics were used to compare groups within and across each country on maternal demographic characteristics, prenatal use of tobacco, alcohol and marijuana, prenatal care and its components (Table 1), and patterns of CPS/CYFS referral (Table 3). Mann–Whitney tests were used to compare tobacco, alcohol, and marijuana use quantities within and across country and exposure groups (Table 1).

All variables in Table 1 were examined for possible inclusion as potential factors related to inadequate prenatal care. Factors were selected based on conceptual reasons, previous literature, and characteristics that differed between exposure groups in either country. The final chosen variables were: MA-exposure, quantities of tobacco, alcohol, and marijuana use, minority status, SES, maternal age, partner status, and CPS referral. Maternal education was highly correlated with SES and excluded. Tobacco, alcohol, and marijuana quantities, maternal age and SES were analyzed as continuous measures while minority status, partner status, and CPS referral were analyzed as binary variables.

For each country, two logistic regressions were conducted, testing the effects of (1) MA-exposure and tobacco, alcohol, and marijuana quantities; and (2) MA-exposure, tobacco, alcohol, and marijuana quantities, minority status, SES, maternal age, partner status, and CPS referral (Table 2) on inadequate care in each country. Because the US cohort was matched, the 4-level site effect was not tested. Statistical significance was accepted at $P < 0.05$.

Results

Maternal Demographics

In both the US and NZ, the Exposed group was significantly less likely to have a partner, more likely to be of lower SES and have a referral to CPS compared to the Comparison group (Table 1). A greater percentage of MA-using mothers in the US (US-MA) were minorities and had a referral to CPS compared to MA-using mothers in NZ (NZ-MA). The NZ-MA cohort was more likely to be of lower SES and educational attainment than the US-MA cohort (Table 1).

Prenatal Care

In the US, the Exposed group had significantly fewer prenatal visits, attended their first prenatal appointment later, and had a higher rate of inadequate prenatal care compared to the Comparison group. In contrast, in NZ, the only significant difference between the two groups was the relative lateness of the first prenatal visit for the Exposed group (Table 1).

A comparison of the US-MA and NZ-MA groups revealed that the US-MA cohort had fewer prenatal visits and were more likely to receive inadequate prenatal care. No significant difference existed in the GA at first prenatal visit (Table 1).

Prenatal Substance Use

In the US, the MA group was more likely than their nonusing counterparts to use tobacco, alcohol and marijuana and to use these substances in greater quantities. Identical trends were found in NZ, except that no significant differences existed between the NZ Exposed and Comparison groups in terms of prevalence or quantity of alcohol use during pregnancy (Table 1).

Comparing the NZ-MA and US-MA groups directly, a larger percentage of NZ-MA participants used alcohol and marijuana and consumed greater amounts of tobacco, alcohol, and marijuana than the US-MA group. Tobacco use was not significantly different between the groups (Table 1).

Correlates of Inadequate Care

MA-exposure was significantly associated with inadequate prenatal care in the US ($P < 0.001$), with mothers in the Exposed group being 4.63 times more likely to receive inadequate care than their matched Comparisons. In contrast, this association was not found in the NZ cohort (Table 2). Interestingly, after accounting for demographic characteristics and prenatal drug use, the only significant correlate of inadequate prenatal care in the US was CPS referral ($P < 0.001$), with referred mothers being 7.15 times as likely to receive inadequate care. In the NZ cohort, none of the variables were significantly associated with inadequate prenatal care (Table 2).

Reasons for CPS Referral

A significantly larger rate of CPS referral and subsequent out-of-home placements were observed in the US-MA group compared to the NZ-MA group, consistent with the US legal mandate to report drug use during pregnancy (Table 3). While the US-MA cohort has a significantly higher percentage of Drug Only CPS referrals relative to the NZ-MA cohort, a Chi-square test comparing the NZ-MA and US-MA groups found no significant difference in the percentage of ‘Both Drug/Other’ CPS referrals between the two cohorts (Table 3).

Focusing on MA-using mothers who were reported to CPS (hereby designated NZ-MA-CPS and US-MA-CPS), we found that patterns of CPS referral were consistent with the reporting practices of each country (Fig. 1). A significantly greater proportion ($P < 0.001$) of the US-MA-CPS group (39.3 %) were reported for ‘Drug Only’ reasons compared to the NZ-MA-CPS group (15.4 %), again reflecting the American policy of mandatory reporting of prenatal drug use to CPS by state statutes. All four US sites have active reporting statutes to CPS or other agencies. NZ has no such policy. A significantly greater proportion ($P = 0.007$) of the NZ-MA-CPS group (82.1 %) were reported for ‘Both Drug/Other’ reasons compared to the US-MA-CPS group (58.0 %). We hypothesize that this disparity is due again to the differing reporting practices in the two countries: in NZ, CPS referrals are made only with the co-occurence of other adverse environmental conditions.

Discussion

This study found that MA use during pregnancy is associated with lower SES, single marital status, and referral to CPS in both NZ and the US, as reported by earlier studies. Compared to their non-using counterparts, the US-MA group had significantly higher rates of inadequate prenatal care, corroborating the results of previous studies [11, 12, 33–41]; no association was found between inadequate prenatal care and MA use in NZ. The only variable associated with inadequate prenatal care in the US that retained statistical significance was CPS referral. In NZ, none of the studied variables were significantly correlated with inadequate care.

Comparing MA users between countries, the NZ-MA group was more likely to have lower SES and educational attainment, while the US-MA group was more likely to be of minority status and have a CPS referral. There was also a much higher rate of CPS referral and subsequent out-of-home placement in the US-MA group. Further analysis revealed that a much larger percentage of the US-MA-CPS cohort was reported for ‘Drug Only’ reasons in contrast to the more predominant ‘Both Drug/Other’ reasons for CPS referral in the NZ-MA-CPS cohort. These results are consistent with the current US policy of mandatory reporting.

The major findings of this study are the country-dependent disparity in rates of adequate care among MA-using mothers and the correlates of inadequate care in both NZ and the US. While previous studies based in the US have identified maternal drug use as a significant barrier for prenatal care [11, 12, 34–41], to date, no studies have directly compared the impact of maternal drug use on adequacy of prenatal care in two different countries. This study is unique in that it not only examines the role of MA-exposure in prenatal care in the context of two countries with dissimilar medical and legal systems, but also examines a variety of socioeconomic and demographic factors as potential correlates of inadequate care.

Of immediate interest, given the higher incidence of inadequate prenatal care among the MA-using mothers in the US, is the potential role of health insurance: previous studies in the US have emphasized the importance of health insurance as a determinant of adequate prenatal care, with lack of insurance presenting a severe financial deterrent to prenatal care utilization [26, 33, 36, 37, 39, 42–50]. Comparative studies of the US and European countries have suggested that the greater inaccessibility of American prenatal healthcare is due, to a large degree, to the incomplete financial coverage provided by the US’s private insurance systems [51–57].

We examined whether the difference in adequate care between the two countries was attributable to structural healthcare system differences, with NZ’s Universal Healthcare removing financial barriers to improve access to prenatal care. We hypothesized that a greater proportion of MA-using mothers in the US might not have been able to access adequate care due to a lack of health insurance coverage and subsequent financial impediments.

However, statistical tests revealed no difference in insurance coverage between the Exposed and Comparison groups in the US, invalidating it as an explanatory factor for the differing rates of adequate care between the cohorts. In fact, the vast majority of the US cohort had health insurance, regardless of MA-exposure status, with only 6 (1.6 %) of the total 378 participants lacking coverage. Therefore, insurance coverage does not seem to explain the disparity in adequate care.

Our findings confirm previous conclusions: surveys examining perceived barriers to prenatal care among low-income women found that financial factors, including insurance coverage,

were not identified as major barriers [29, 58]. These and other detailed examinations of Med-icaid and other government health plans [59–64] in the US have found that insurance coverage does not in and of itself ensure early, regular, or adequate prenatal care, and that other environmental factors play a substantial role in determining access to care [49, 65]. Similarly, we conclude that the disparities in adequate prenatal care between NZ and the US cannot be wholly explained by a gross structural difference in the healthcare systems.

Other commonly associated maternal sociodemographic factors such as racial/ethnic minority status [11, 36, 38, 39, 48, 66–68], maternal age [11, 48, 59, 68], education level [39, 46, 48, 50, 59, 66, 68], socioeconomic status [34, 39, 42, 45, 59, 66–68], partner status [35, 42, 45, 48, 59, 68] and referral to CPS were examined along with MA-exposure and other prenatal substance use as factors related to inadequate prenatal care in both countries. Interestingly, none of these variables were significantly associated with inadequate prenatal care in either country except for CPS referral in the US, with referral increasing the odds of inadequate prenatal care 7.15 times.

Previous studies have suggested that the more interventionist mandatory reporting practices in the US [69, 70]—reflected here in increased frequency of ‘Drug Only’ CPS referrals and the significantly higher rates of subsequent out-of-home placement in the US—act as a severe disincentive for substance-using mothers seeking prenatal care. Qualitative studies have emphasized that drug-using women actively avoid or delay prenatal care out of fear of report and legal reprisal [21–29]. Medical [21, 71, 72] and legal professionals [73–76] alike have argued that these punitive legislative policies promote a ‘flight from care’ of vulnerable drug-using mothers.

However, because our study did not enquire about maternal attitudes towards CPS or reasons for delayed and/ or missed prenatal appointments, and especially because our current measure of CPS referral occurs *after* the period of prenatal care, it is impossible to directly test whether a fear of CPS referral prevented mothers in the US from seeking prenatal care.

Furthermore, our findings do not wholly negate the role of maternal sociodemographic factors in the receipt of inadequate prenatal care in the general population. Our focus is primarily on exploring inadequate care in the *specific* context of MA-exposure: namely, explaining why a disparity in adequate care among MA-using and non-using mothers exists in the US but not in NZ. Consequently, our results indicate that in this context and in our study population, *other* variables, such as MA-exposure and CPS referral, eclipse maternal sociodemographics in explanatory power for inadequate prenatal care. Without these factors, we may see the same demographic-dependent disparities in prenatal care reported in previous literature. Additionally, due to our recruitment methods, the mothers in the US Exposed cohort may not be nationally representative of MA-using mothers, especially regarding insurance coverage. Because the study specifically matched the Exposed and Comparison groups by insurance type, it is possible that the reported equity in coverage does not exist in the general population.

These limitations notwithstanding, our findings should encourage further research to investigate whether the US policy of mandatory report provokes a ‘flight from care’ among drug-using mothers and unintentionally exacerbates disparities in prenatal care use. Furthermore, strategies should be developed to increase access to and utilization of proper prenatal care for all women, especially those who use substances during pregnancy. Prenatal care should be seen as a potential intervention opportunity to reduce drug use.

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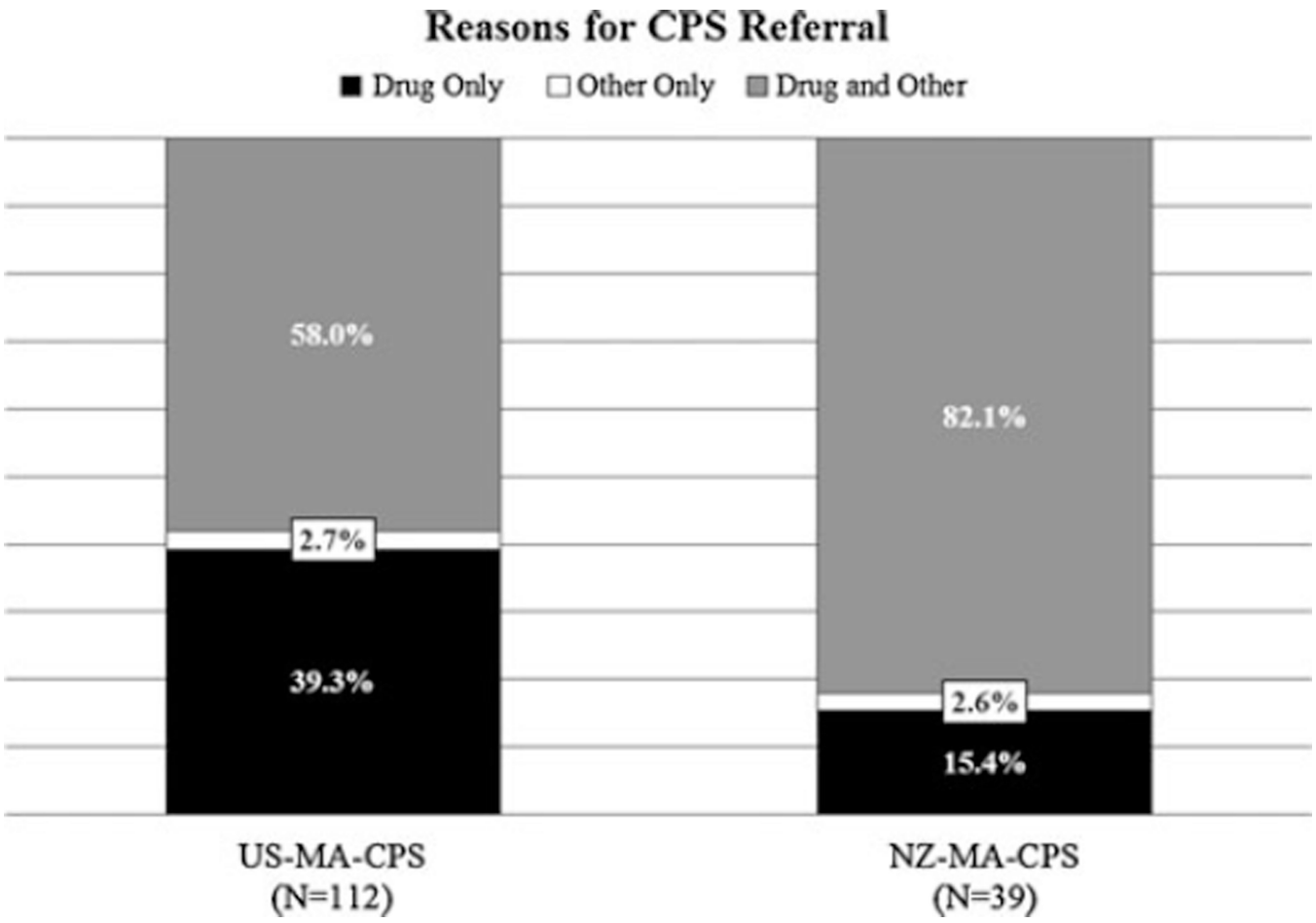

Fig. 1.

Comparison of reasons for referral to Child Protective Services among the MA Exposed cohorts in the US and NZ. For each country, the percentages are taken out of the total population of MA-using mothers with a history of CPS referral (designated as US-MA-CPS and NZ-MA-CPS). Compared to NZ, the US-MA-CPS cohort had a significantly higher proportion of 'Drug Only' referrals (39.3 vs. 15.4 %, $P < 0.001$). Similarly, relative to its US comparison cohort, the NZ-MA-CPS group had a significantly higher proportion of 'Both Drug/Other' referrals. (82.1 vs. 58.0 %, $P = 0.007$; data not shown). These patterns reflect the stricter policies regarding maternal substance use and CPS involvement of the US

Table 1

A comparison of maternal sociodemographic factors, prenatal care utilization, and maternal prenatal drug use in the Methamphetamine (MA) Exposed and Comparison groups in the US and NZ, and a direct comparison of the MA Exposed cohorts in the US (US-MA) and NZ (NZ-MA)

	US		NZ		*P* values		
	Exposed (N=182)	Comparison (N=196)	Exposed (N = 107)	Comparison (N = 112)	US Exposed vs. comparison	NZ Exposed vs. comparison	US-MA vs. NZ-MA
	N (%) or Mean (SD)				*P*	*P*	*P*
Sociodemographics							
Race/ethnicity (% minority)	116 (63.7 %)	119 (60.7 %)	47 (43.9 %)	60 (53.6 %)	0.545	0.153	0.001
SES	24.9 (9.2)[a]	30.4 (9.6)[b]	21.9 (9.8)[c]	29.6 (13.0)	**<0.001**	**<0.001**	**0.010**
Uninsured	4 (2.2 %)	2 (1.0 %)	n/a	n/a	0.434	–	–
No partner	99 (54.4 %)	67 (34.2 %)	55 (51.4)	29 (25.9)	**<0.001**	**<0.001**	0.622
Educational level (<high school/<5th form)	84 (46.4 %)[a]	77 (39.5 %)[b]	66 (62.9 %)[d]	56 (50.0 %)	0.175	0.056	**0.007**
Maternal age (years)	25.9 (5.7)	24.22 (5.3)	26.61 (6.1)	25.31 (6.7)	**0.003**	0.137	0.317
Child protective services referral	112 (61.5 %)	8 (4.1 %)	39 (36.4 %)	3 (2.7 %)	**<0.001**	**<0.001**	**<0.001**
Prenatal care							
Number of prenatal visits	11.4 (7.4)[e]	14.35 (5.4)[f]	15.79 (7.0)	17.02 (5.8)	**<0.001**	0.156	**<0.001**
Gestational age at 1st prenatal visit (weeks)	14.75 (8.1)[g]	9.48 (5.6)[h]	15.94 (6.8)d	13.28 (5.6)c	**<0.001**	0.002	0.206
Inadequate prenatal care	42 (23.1 %)	9 (4.6 %)	9 (8.4 %)	4 (3.6 %)	**<0.001**	0.130	**0.002**
Prenatal drug use							
Tobacco	145 (79.7 %)	52 (26.5 %)	93 (87.0 %)	60 (53.6 %)	**<0.001**	**<0.001**	0.119
Alcohol	71 (39.0 %)	25 (12.8 %)	68 (63.6 %)	63 (56.3 %)	**<0.001**	0.271	**<0.001**
Marijuana	64 (35.2 %)	7 (3.6 %)	67 (62.6 %)	24 (21.4 %)	**<0.001**	**<0.001**	**<0.001**
Cigarettes/day	7.00 (8.3)[a]	1.62 (4.5)	8.37 (7.3)	3.36 (5.5)	**<0.001**	**<0.001**	**0.018**
Ounces alcohol/day	0.13 (0.5)[a]	0.003 (0.02)	0.32 (0.8)	0.12 (0.3)	**<0.001**	0.171	**<0.001**
Joints/day	0.10 (0.3)[i]	0.01 (0.09)	0.46 (1.0)	0.18 (0.7)	**<0.001**	**<0.001**	**<0.001**

[a] Sample sizes vary slightly due to missing data N = 181

[b] N = 195

[c] N = 106

[d] $N = 105$

[e] $N = 174$

[f] $N = 192$

[g] $N = 173$

[h] $N = 188$

[i] $N = 180$

Bold values indicate significant findings ($P < 0.05$)

Table 2

Two logistic regressions modeling predictors of inadequate prenatal care, entering MA exposure and continuous measures of other drug use (model 1) and MA exposure, continuous measures of additional substance use, and maternal sociodemographic factors as predictors (model 2)

Predictors	US			NZ		
	***P* value**	**Odds ratio**	**95th C.I.**	***P* value**	**Odds ratio**	**95th C.I.**
Model 1: substance use variables						
Methamphetamine exposure	**<0.001**	**4.63**	**2.08–10.32**	0.345	1.87	0.51–6.87
# Of cigarettes per day-renatal	0.064	1.04	0.10–1.08	0.637	1.02	0.94–1.11
oz. Of absolute alcohol per day-prenatal	0.157	2.00	0.77–5.25	0.529	0.69	0.22–2.18
# Of joints per day- prenatal	0.820	0.85	0.22–3.37	0.191	1.48	0.82–2.65
Model 2: substance use variables and maternal sociodemographics						
Methamphetamine exposure	0.600	1.31	0.48–3.60	0.521	1.65	0.36–7.55
# Of cigarettes per day-prenatal	0.390	1.02	0.98–1.07	0.860	0.99	0.90–1.09
oz. Of absolute alcohol per day-prenatal	0.277	1.69	0.66–4.37	0.424	0.64	0.21–1.93
# Of joints per day-prenatal	0.501	1.70	0.36–7.90	0.413	1.30	0.69–2.45
Minority status	0.944	0.97	0.44–2.17	0.166	2.73	0.66–11.31
SES	0.339	0.98	0.94–1.02	0.062	0.90	0.81–1.01
Maternal age (years)	0.472	0.98	0.92–1.04	0.453	1.04	0.94–1.14
No partner	0.195	1.60	0.79–3.18	0.871	1.12	0.28–4.43
Child protective services referral	**<0.001**	**7.15**	**2.75–18.60**	0.311	0.40	0.07–2.37

Bold values indicate significant findings ($P<0.05$)

Table 3

Patterns of CPS referral and out-of-home foster placement in only the MA exposed groups in the US and NZ

	US-MA (N = 182) N (%)	**NZ-MA (N = 107) N (%)**	***P* value**
CPS referrals	112 (61.50 %)	39 (36.40 %)	**<0.001**
Out of home placement	57 (31.8 %)[a]	6 (5.6 %)	**<0.001**
Drug only referrals	44 (24.2 %)	6 (5.6 %)	**<0.001**
Both drug/other referrals	65 (35.7 %)	32 (29.9 %)	0.313

[a] N = 179

Bold values indicate significant findings ($P < 0.05$)