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Cocaine use during pregnancy and health outcome after 10 years

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Abstract

Background

Women who used cocaine during pregnancy may become at risk for increased physical and mental health problems.

Methods

Three hundred and twenty-one (158 cocaine use during pregnancy (PC), 163 no cocaine (NC)) women were assessed using the Health Survey Questionnaire (SF-36V2) 10 years after infant birth. Factors related to mental and physical health, and co-occurring with PC, were evaluated using multiple regression.

Results

Controlling for age and education, PC women reported poorer total perceived mental health (PMH) (46.3 ± .9 vs. 50.7 ± .9, $p < .001$), more bodily pain (48.1 ± 1.0 vs. 51.5 ± 1.0, $p < .02$) and poorer health perceptions (46.8 ± .9 vs. 49.7 ± .9, $p < .03$) than NC women. PC women had lower BMI (29% vs. 32%, $p < .006$), higher current alcoholic drinks per/week (4.05 ± 15.5 vs. 1.29 ± 3.51, $p < .005$) and number of cigarettes per day (9 ± 10.6 vs. 4 ± 6.5, $p < .0001$) and greater total life strain (Family Inventory of Life Events and Changes (FILE)) (4.6 ± 4.9 vs. 3.2 ± 3.2, $p < .004$) than NC women. Regression analyses indicated that body mass index (BMI) mediated the effect of prior cocaine use on perceived physical health (PPH) and total life strain had additive effects. Current cigarette use and total life stress partially mediated the effects of cocaine use on PMH and also had additive independent effects.

Conclusions

PC use is a marker for poor health after 10 years. Mediators of these relationships (BMI, stressful life events and current tobacco use) should be considered when designing interventions to promote health.

Keywords

Prenatal; Cocaine; Mental and physical health; Women

Hide terminology links

1. Introduction

During the crack cocaine epidemic in the United States in the 1980s and early 1990s, it was estimated that up to 18% of urban women, primarily minority and poor, used cocaine while pregnant (Kandel et al., 1998 and Ostrea et al., 1992). Women who do not discontinue cocaine use while pregnant are considered regular users of the drug and consistently use larger amounts of other drugs including tobacco, alcohol and marijuana compared to pregnant women who do not use cocaine (Minnes et al., 2008a and Singer et al., 1995). As a result, many women identified as cocaine users during pregnancy may continue to suffer negative physical and mental health consequences. Additionally these minority and socioeconomically disadvantaged groups, similar to those in the sample investigated, suffer higher rates of health disparities, further compounding potential negative health effects of cocaine use; yet to date there are no reports describing the long term health effects of cocaine use in women.

Cocaine use negatively affects many organ systems, although focus has been on the central nervous (Goldstein et al., 2009) and cardiovascular systems (Schwartz et al., 2010). Cocaine produces a very powerful sympathetic nervous system effect, placing great stress on the cardiovascular system, resulting in vasoconstriction and high blood pressure which can lead to ongoing organ damage (Goldstein et al., 2009). Toxic effects of cocaine are exerted on the central nervous system (CNS) through the blockage of neurotransmitter reuptake, resulting in depletion. Particularly harmful is the depletion of dopamine which, occurring with chronic cocaine use, can result in movement disorder, decreased attention, psychosis and panic disorder (Goldstein et al., 2009).

The acute toxic effects of cocaine include seizures, hyperthermia and intra-cerebral hemorrhage arrhythmias, hypertension and myocardial infarction. Acute psychological effects include anxiety, aggression, paranoia or hallucinations (American Psychiatric Association, 1994). Many of cocaine's effects on psychological functioning occur following withdrawal between administrations and include irritability, depression, insomnia and agitation. Psychological symptoms after chronic use include somatic complaints (Johanson et al., 1999 and Watson et al., 1992), eating disorders (Ross-Durow and Boyd, 2000), anxiety, depression (Beckwith et al., 1999 and Falck et al., 2002) and overall psychological distress post-partum (Singer et al., 1997 and Singer et al., 1995) and up to six years after (Minnes et al., 2008b).

Existing studies of health outcomes of cocaine dependent individuals often do not focus on outcomes for women, lack a control group, or do not control for other confounding variables. For example, a community sample (n = 574) of primarily white, male cocaine and/or methamphetamine users was assessed over a two year period (Borders et al., 2009). Results indicate that drug use severity had a weak, adverse relationship with physical health status. Another community sample of 439 cocaine abusers (269 men, 170 women) was assessed five times over two years (Falck et al., 2000b). Increased frequency of crack cocaine use was associated with poorer perceived physical, social and mental health. Self-assessed cocaine addiction ratings, rather than actual frequency of use, were associated with poorer perceived health (Falck et al., 2000a). In contrast to the above, other studies indicate mixed results or no specific perceived physical health (PPH) decline among cocaine/polydrug abusers (Falck et al., 2000a, Grinman et al., 2010 and Stein et al., 1998).

Social and behavioral factors associated with cocaine use may exacerbate or mitigate health problems. Behavioral factors associated with both cocaine use and long term physical and mental health include anorexia, obesity and polydrug use, increased life stress due to a drug using lifestyle, and lack of positive social support. A constant relationship between higher body mass index (overweight and obese, BMI > 25) and increased adverse physical health outcomes, including cardiovascular mortality (Dudina

et al., 2011), chronic diseases (Hirani, 2011), obstetric complications (Manzanares Galan et al., 2012) and breast cancer in minority women (Sexton et al., 2011) has been found. Obesity has also been cited as a factor related to mental health problems such as depression (Luppino et al., 2010). However, the relationship of BMI to crack cocaine use is less clear, as cocaine use is related both to anorexia during cocaine binge phases and severe hunger and overeating during withdrawal. This eating pattern may be associated with lower BMI and therefore provide a protective component to health outcome.

The typical pattern of cocaine use includes periods of binges followed by forced abstinence and withdrawal. This usage pattern, as well as efforts at total abstinence, leads to increases in the use of other drugs including alcohol, marijuana and tobacco. These drugs are consumed in efforts to control immediate or extended withdrawal symptoms such as insomnia, anxiety, depression and/or inattentiveness (Chaves et al., 2011 and Ribeiro et al., 2010). Subsequently, the use of alcohol, marijuana and tobacco occurs at greater rates and higher amounts among women who use cocaine prenatally both during pregnancy and after (Minnes et al., 2008b). Such habitual use of these substances is also independently associated with poorer physical health outcomes (Hall and Degenhardt, 2009, Nolen-Hoeksema, 2004 and Strandberg et al., 2008) and negative mental health outcomes for tobacco (Parrott, 2006).

Psychosocial factors have been repeatedly associated with poor health (Baum and Posluszny, 1999 and Krantz and McCeney, 2002). Acute and chronic stress produces neuroendocrine, immunologic and hemodynamic responses that underlie physical and mental health problems (Baum and Posluszny, 1999). Social support has also been identified as a determinant of health (Geckova et al., 2001) and the absence of social support is associated with a range of disease processes (Krantz and McCeney, 2002). In addition to having a direct positive effect on health, social support is considered to have an interactive effect with the stress response (Krantz and McCeney, 2002) on health. These effects of stress and lack of social support on health outcome will also be evaluated.

The objectives of this study were to: (1) examine differences in perceived physical and mental health among women who used or did not use cocaine during pregnancy ten years prior to the health assessment; (2) examine cocaine use group differences in other health related factors including body mass index, current drug use and life stress; and (3) examine the relationship of health related behavioral and psychosocial factors to perceived health outcomes among women who used cocaine prenatally. It is hypothesized that women who use cocaine during pregnancy are at higher risk for poorer perceived physical and mental health after ten years compared to socio-economically matched poly-substance, non-cocaine using women. In addition, social and behavioral factors will be examined to determine whether they add to or mediate cocaine's effects on perceived health.

2. Methods

2.1. Participants

The sample of 321 women (158 cocaine use prenatally (PC), 163 no cocaine use prenatally (NC)) was recruited from a Midwestern urban hospital at infant birth between September 1994 and June 1996. Women were participants in a prospective longitudinal study to examine the effects of cocaine use during pregnancy on child developmental outcomes (Singer et al., 2004). Women who lacked prenatal care, self-reported substance use to hospital staff, appeared intoxicated at delivery, or had prior referrals to Child Protective Services (CPS) were screened using urine toxicology. Screened women were approached by a research nurse and asked to participate in the study. Non-English speaking women, women who were HIV positive, women with severe mental or medical disorders or intellectual disabilities and women <19 years old were excluded. Women signed a consent approved by the participating hospital's Institutional Review Board and were notified that a Certificate of Confidentiality (DA 04–03) was issued by the National Institute on Drug Abuse that protects investigators from being compelled by subpoena to release research data about illegal drug use behavior. Women who used cocaine and

other drugs during pregnancy were identified by measures including infant meconium analyses, maternal urine, or maternal report of cocaine use while pregnant. Placement into the PC group was indicated after cross referencing all biologic assays and self-report data. A negative indicator of cocaine use on all biologic assays and self-report data indicated placement in the non-cocaine, but potentially other drug (alcohol, tobacco and marijuana) use, group. The majority of cocaine using women in the study reported using crack cocaine or a combination of methods including crack cocaine. Eleven of the cocaine using women opted out of the study after consenting to participate. Two additional women did not participate due to the death of their children, resulting in a sample of 404 women (210 PC and 194 NC). Of the 404 women, 11 had children who died by ten years (8 PC and 3 NC, $\chi^2 = 1.9$, $p < .7$) and no longer participated. Only those women who attended the 10 year post birth assessment, and completed the health survey, were included in the final sample ($n = 321$). Among the 52 PC women who did not attend the 10 year post birth assessment, 8 had a child who died, 4 dropped out, 38 did not attend the ten year assessment visit, and 2 were present but did not complete the Health Survey Questionnaire (SF-36V2). Of the 31 NC women who did not attend the 10 year assessment, 2 were deceased, 3 had a child who died, 9 dropped out of the study and 17 did not attend the visit.

When PC women with a SF-36V2 were compared to those without an assessment on demographic data, completers were significantly older (30.2 vs. 27.8 years, $p < .004$) but not different on other descriptive features. There were no differences on demographic data among NC women who completed vs. did not complete the SF-36V2.

2.2. Procedure

Women and their children were evaluated shortly after infant birth and 10 years after, even if child custody was terminated. Seventy-four women lost child custody by the 10 year assessment (46.8% of PC use women and 3.7% of NC use women, $p < .0001$). Prenatal and current substance use, educational, psychological and environmental data were collected by a research assistant. Women received a $50 stipend for their participation in the study at the ten year assessment.

2.2.1. Measures

Demographic data extracted from hospital records included age, race, parity, education, employment, marital status and socioeconomic status (Hollingshead, 1957). The maternal post-partum interview (within a month post-partum) and update (administered at follow-up) (Singer et al., 2004) were used to quantify maternal use of tobacco, alcohol, marijuana and cocaine both during pregnancy and 10 years later. Frequency and amount of each drug used during pregnancy and at follow-up were collected and values indicating the average amount used per week were computed. Number of tobacco cigarettes and marijuana joints smoked, and the number of drinks of beer, wine, or hard liquor per day was computed with each drink equivalent to 0.5 oz of absolute alcohol. For cocaine, the number of “rocks” or money spent per day was noted and converted to equivalent “average units” of cocaine. Estimates of receptive vocabulary and non-verbal intelligence were assessed using the Peabody Picture Vocabulary Scale-Revised (PPVT- R; Dunn and Dunn, 1981) and the Block Design and Picture Completion subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Weschler, 1989) at the post-partum visit or later if it was missed at that time. All other data were collected 10 years after infant birth.

The Health Survey Questionnaire Short Form (36) Version 2 (SF-36V2) (Ware et al., 1993 and Ware, 2000) assesses 8 self-reported health attributes (physical functioning, role limitation-physical, bodily pain, general health, vitality, social functioning, role limitation-emotional, and mental health) and yields two summary scores, perceived physical health (PPH) and perceived mental health (PMH). Research indicates that the SF-36V2 is reliable, with summary score estimates exceeding .90 (Ware et al., 1993). The SF-36V2 scores reflect a population mean of 50 and standard deviation *SD* of 10.

Higher scores indicate better health. Poor perceived mental and physical functioning were defined as 1*SD* below the standardized mean.

The Diagnostic Interview Schedule – Computer version (DIS-C) (Robins et al., 1981) and a medical checklist were administered. The DIS-C is an assessment of mental health diagnostic categories based on the Diagnostic and Statistical Manual-IV (American Psychiatric Association, 1994). Lifetime diagnostic categories assessed were alcohol, cocaine and marijuana dependence, dysthymia, generalized anxiety disorder, major depressive episode, mania, hypomania, post-traumatic stress disorder (PTSD) and dual disorders. Dual disorders were identified by the presence of at least one type of substance dependence and mental health disorder. The medical condition checklist contains five summary variables (any chronic condition, cancer, cardiovascular disease, stroke, and infectious disease).

The Family Inventory of Life Events and Changes (FILE; McCubbin et al., 1991) measures family stress (intrafamily strains, marital strains, pregnancy and childbearing strains, work-family transitions and strains, illness and family care strains and losses) in the past 12 months (proximal) and any time prior (distal) through self-report. To assess perceived social support the multidimensional scale of Perceived Social Support (MSPSS) (Zimet et al., 1988) was used. The MSPSS consists of 12 questions assessing support received from family, friends and a special person.

Maternal weight (pounds) and height (inches) were collected via self-report at the 10 year assessment and converted to kilograms (kg) and meters (m). BMI was computed using combined maternal height and weight (BMI = kg/m^2). BMI as also categorized by applying the overweight (BMI = 25–29.9) and obesity (BMI > 30) guidelines recommended by the Centers for Disease Control (CDC).

2.3. Statistical analyses

Data that were positively skewed were normalized using the natural logarithm transformation. Means and distribution are reported based on the original distribution, while the test statistics are based on normalized data. For continuous variables, *t*-tests and the Wilcoxon–Mann–Whitney tests were used to compare the PC and NC groups. Pearson chi-square (χ^2) test or Fisher's Exact test were used for categorical demographic variables, dichotomized SF-36V2 data, DIS-C and health questionnaire data.

2.3.1. Selection of covariates, intervening variables and independent predictors

Control variables including maternal age, education and race were identified for evaluation of SF-36V2 group differences as they are regularly associated with health outcomes. If these variables were different by cocaine status at $p < .10$ they were retained as control variables for additional bivariate and multivariate analyses of health outcome.

Other variables were assessed as intervening or predictive variables (BMI, current drug use, social support and life stress) if they were both different by cocaine status at $p < .10$, after controlling for maternal age and education, and correlated with PPH or PMH at $p < .10$. Their association with health outcome was evaluated using multivariate data analyses.

2.3.2. Assessing the relationship of potential intervening variables or independent predictors

Associations were tested, if the above conditions were met, using the approach proposed by Baron and Kenny (1986). A series of regression models were run to demonstrate how the introduction of each potential variable affected the relationship between cocaine and health outcomes (PPH and PMH). A mediator is considered on the causal pathway to the outcome if it increases or decreases the relationship between the predictor and the outcome. To be considered a mediator, or partial mediator in the context of this data analyses, prenatal cocaine status should be significantly related to the health

outcome (PPH and PMH) and to the potential mediator after controlling for covariates. Further, the mediator should be significantly related to the health outcome after controlling for cocaine status and covariates. In a final model, the confounders and significant mediators of cocaine's effect were evaluated simultaneously to demonstrate the overall contribution of variables and cocaine use status to health outcome. R^2 and R^2 change (ΔR^2) from Model 1 (cocaine and covariates) are reported at each step with significant change at each step indicated at $p < .05$.

3. Results

3.1. Demographic characteristics

Women in the sample were primarily African American (84.8%) and of low socioeconomic status (97.8% Hollingshead level IV and V; Hollingshead, 1957) (see Table 1). Women who used cocaine while pregnant were older (years) (40.7 ± 4.8 vs. 36.2 ± 4.8, $p < .0001$), had fewer years of education (11.53 ± 1.6 vs. 12.04 ± 1.4, $p < .003$), more children (3.6 ± 2 vs. 2.7 ± 2, $p < .0001$), lower PPVT-R standard scores (72.8 ± 16 vs. 78.4 ± 15, $p < .001$), and poorer performance on measures of non-verbal intelligence (Picture Completion scaled score (6.5 ± 2 vs. 7.1 ± 2, $p < .02$) and Block Design scaled score (6.7 ± 2 vs. 7.3 ± 2, $p < .02$)) than women who did not use cocaine during pregnancy. PC women used significantly more alcohol (10.82 ± 20 drinks per week vs. .92 ± 3, $p < .0001$), marijuana (1.27 ± 3 joints per week vs. .66 ± 4, $p < .0002$) and tobacco (11.17 ± 10 cigarettes per day vs. 3.72 + 7.2, $p < .0001$) during pregnancy then NC women. Women who used cocaine during pregnancy also used alcohol, tobacco and marijuana at greater rates (p's < .0001), and were more likely to lose child custody (74% vs. 6%, $p < .0001$) than women who did not use cocaine during pregnancy. Ten years after pregnancy PC use women self-reported higher average cocaine, alcohol and tobacco, but not marijuana, than NPC use women.

Table 1.
Sample characteristics at infant birth and after 10 years by cocaine status.

	Cocaine (n = 158)		Non-cocaine (n = 163)		χ^2	t/z	p
	M	SD	M	SD			
Postpartum							
African-American, n (%)	136	86.08	136	83.44	0.43		.51
Low SES, n (%)	154	98.09	159	97.55	0.11		.74
Marital status, married, n (%)	31	19.62	42	25.77	1.73		.19
Education (years)	11.53	1.59	12.04	1.42		3.04	.003
Parity	3.60	2.00	2.70	1.87		−4.17	<.0001
PPVT Standard Score	72.76	15.50	78.44	14.87		3.30	.001
Block Design scale	6.71	2.12	7.26	2.03		2.34	.02
Picture Completion Scale	6.47	2.09	7.06	2.35		2.35	.02
Average substance use during pregnancy*							
Cocaine	22.78	45.47	–	–		–	–
Alcohol	10.82	20.37	0.92	3.09		−10.33	<.0001
Marijuana	1.27	3.32	0.66	3.71		−3.79	.0002
Cigarettes	11.17	10.01	3.72	7.20		−10.44	<.0001

Number and average (for subgroup) substance use during pregnancy[a,*], n (M, SD)								
Cocaine	158	22.78	45.47	–	–	–	–	–
Alcohol	123	13.46	21.94	65	2.21	4.49	47.67	<.0001
Marijuana	64	3.04	4.59	13	7.95	10.72	46.57	<.0001
Cigarettes	135	12.66	9.72	60	9.68	8.82	79.58	<.0001

10 Years after infant birth								
Maternal Age (years)	40.68	4.88	36.16	4.82			−8.32	<.0001
Average current substance use*								
Cocaine	1.17	5.95	0	0			−3.11	.002
Alcohol	4.05	15.45	1.29	3.51			−2.84	.005
Marijuana	0.71	3.19	0.40	2.17			−1.52	.13

Cigarettes	9.00	10.62	3.99	6.53			−7.13	<.0001
FILE distal (total)	4.57	4.94	3.19	3.24			−2.94	.004
MSPSS social support	60.91	18.08	63.56	17.34			1.32	.19
Lost custody, *n* (%)	74	46.84	6	3.68		79.85		<.0001
Life diagnosis (Diagnostic Interview Schedule), *n* (%)								
Alcohol dependence	61	40.94	14	9.33		39.74		<.0001
Cocaine dependence	97	65.54	9	6.00		115.24		<.0001
Marijuana dependence	35	23.65	9	6.00		18.44		<.0001
Dysthymia	2	1.34	0	0		2.03		.15
Generalized anxiety	20	13.42	13	8.67		1.72		.19
Major depression	10	6.58	19	12.18		2.83		.09
Mania	14	9.46	14	9.33		0.001		.97
Hypomania	8	5.37	8	5.33		0.0002		.99
Diagnosis of PTSD	48	32.43	32	21.33		4.67		.03
Dual diagnosis (drug and MH)	59	38.82	19	12.18		28.88		<.0001

* Cocaine (average units of cocaine per week), alcohol (average drinks per week, each equivalent to .5 mL absolute alcohol), marijuana (average joints per week), and cigarettes (average number of cigarettes smoked per day).

a Use of substance (yes/no) at any time during pregnancy.

Table options

3.2. Physical health (medical condition checklist) and mental health (diagnostic interview schedule) by cocaine group status

The medical condition checklist indicated higher levels of reported chronic conditions (66.6% vs. 54.8%) among PC women compared to NC women, although this difference was not statistically significant ($p < .33$). The rate of congestive heart failure was greater for PC women (2.7% vs. 0%, $p < .05$) than NC women. Non-significant trends for higher rates of osteoarthritis (17.3% vs. 10.7%, $p < .09$), pain (29.8% vs. 21.5%, $p < .09$) and hepatitis C (4% vs. < 1%, $p < .06$) were found among PC compared to NC women. Summary variables including cardiovascular disease, any cancer, pulmonary disease, endocrine problems, gastrointestinal problems and pain syndromes indicated no significant group differences except for greater endorsement of pain syndromes among PC women (38.6% vs. 27.6%; p < .04). Table 1 indicates that lifetime occurrence of psychiatric disorders was higher for PC compared to NC women for alcohol dependence (40.9% vs. 9.3%, $p < .0001$), marijuana dependence (23.7% vs. 6%, $p < .0001$), cocaine dependence (65.4% vs. 6%, $p < .0001$), post-traumatic stress disorder (32.4% vs. 21.3%, $p < .03$) and dual diagnoses (38.8% vs. 12.2%, $p < .0001$).

3.3. Adjusted health outcomes

Table 2 shows SF-36V2 perceived physical health total (PPH), the component subscales of the SF-36V2 PPH, categorization of poorer physical health using the total PPH, and BMI adjusted for age and education by cocaine use group status. Results indicate that two subscales of PPH, bodily pain (48.1 ± 1 vs. 51.5 ± 1, $p < .02$) and general health perception (46.8 ± 1 vs. 49.7 ± 1, $p < .03$) were lower for PC women compared to NC women. Overall mean PPH and percentage of reported poor health were not different by group. Average body mass index was lower for PC women (29.6 ± .7) then NC women (32.7 ± .7, $p < .006$). Comparing those with average body mass index (average BMI) to those who qualify as overweight and obese (not adjusted for age and race) indicated that 69.3% of women who used cocaine prenatally were overweight/obese compared to 80.8% of women who did not use cocaine prenatally ($\chi^2 = 5.28$, $p = .02$).

Table 2.
Adjusted means of SF36 perceived physical health, perceived mental health and BMI.[a]

	Cocaine (*n* = 158)		Non-cocaine (*n* = 163)		F/χ^2	*p*
	M	se	*M*	se		
BMI[a]	29.60	0.76	32.68	0.73	7.71	.006
Underweight, *n* (%)[b]	5	3.27	2	1.23	6.54[d]	.01

	Cocaine (n = 158)		Non-cocaine (n = 163)		F/X^2	p
	M	se	M	se		
Normal, n (%)[b]	42	27.45	30	18.52		
Overweight, n (%)[b]	44	28.76	45	27.78		
Obesity, n (%)[b]	62	40.52	85	52.47		
Physical health (PPH)[a]	47.37	0.85	49.03	0.82	1.76	.19
Physical functioning	45.99	0.97	47.74	0.94	1.49	.22
Physical health problems	46.40	0.88	48.25	0.86	2.00	.16
Bodily pain	48.08	1.00	51.52	0.98	5.37	.02
General health perceptions	46.81	0.89	49.73	0.87	4.93	.03
Poor physical health (% yes)[c]	23.14		13.72		0.15	.70
Mental health (PMH)[a]	46.28	0.90	50.71	0.88	11.02	.001
Energy/fatigue	50.04	0.83	52.95	0.81	5.57	.02
Social functioning	44.28	0.90	48.70	0.88	10.90	.001
Emotional health problems	44.45	0.99	48.41	0.97	7.18	.008
Emotional well-being	47.15	0.91	50.97	0.89	7.93	.005
Poor mental health (% yes)[c]	27.42		13.66		4.17	.04

a Adjusted for age and years of education.

b Unadjusted BMI categorical outcomes.

c 1 standard deviation below the mean.

d Mantel–Haenszel.

Table options

Mean SF-36V2 PMH total, the component subscales and poor mental health by cocaine group, adjusted for age and education, are presented in Table 2. Results indicate that total PMH (46.3 ± 1 vs. 50.7 ± 1, $p < .001$) and all of the subscales (energy/fatigue (50.0 ± 1 vs. 53.0 ± 1, $p < .02$), social functioning (44.3 ± 1 vs. 48.7 ± 1, $p < .001$), emotional health problems (44.5 ± 1 vs. 48.4 ± 1, $p < .008$) and emotional well-being (47.2 ± 1 vs. 51.0 ± 1, $p < .005$) were lower for women who used cocaine during pregnancy, with 27.4% of PC women and 13.6% of NC women reporting poor mental health ($p < .04$, OR = 1.9, CI 1.0–3.6).

3.4. Current substance use, stressful life events and social support (potential intervening variables) by cocaine status

Table 1 indicates that, when evaluated by cocaine use group, PC women continued to use more average cocaine units per week (1.17 ± 6 vs. 0, $p < .002$), average alcohol drinks per week (4.05 ± 16 vs. 1.29 ± 4, $p < .005$), and cigarettes per day (9.00 ± 11 vs. 3.99 ± 7, $p < .0001$), but not more marijuana (average joints per week) compared to NC women 10 years after target birth. The FILE and MSPSS totals by cocaine group status are also reported in Table 1. Distal total stressful life events were greater for PC women (4.57 ± 4.9 vs. 3.19 ± 3.2, $p < .004$) compared to NC women. Distal FILE subscales, illness and family care (.77 ± 1.3 vs. .45 ± 1.0, $p < .01$) and losses (.60 ± .9 vs. .35 ± .7, $p < .04$) were also greater among PC women compared to NC women. There were no significant differences in the level of total social support between groups.

3.5. Evaluation of intervening variables

After controlling for maternal age and education level, BMI (cocaine $b = -3.10$(se = 1.12), $\beta = -.18$, $p < .006$), current cigarette (cocaine $b = 77$(se = .15), $\beta = .31$, $p < .0001$) and alcohol use (cocaine $b = .23$(se = .11), $\beta = .13$, $p < .04$), and life stress (cocaine $b = 1.64$(se = .19), $\beta = .19$, $p < .002$) were associated with prenatal cocaine use during pregnancy. These potential mediators were correlated with both PPH and PMH. Significant correlations were found for BMI ($r = -.25$, $p < .0001$), current cigarette ($r = -.16$, $p < .003$) and alcohol use ($r = -.10$, $p < .07$), and for life stress ($r = -.13$, $p < .0008$) and PPH. Cigarette ($r = -.22$, $p < .0001$) and alcohol ($r = -.10$, $p < .07$) use and life stress ($r = -.19$, $p < .0008$) were correlated with PMH but BMI was not ($r = .006$,

$p < .92$). Table 3 shows the intercorrelations of the potential intervening variables and SF-36V2 outcomes.

Table 3.
Pearson correlation of covariates and outcomes.

	Education		BMI		Cigarette[a]		Alcohol[a]		FILE[b]		Physical health		
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*
Age	.05	.36	−.07	.22	.20	.0004	.03	.57	−.03	.63	−.21	.0002	-
Education	–	–	.03	.57	−.19	.0008	−.18	.002	−.10	.09	.12	.03	.
BMI	–	–	–	–	−.08	.16	−.03	.56	−.005	.93	−.25	<.0001	.
Cigarette[a]	–	–	–	–	–	–	.26	<.0001	.10	.07	−.16	.003	-
Alcohol[a]	–	–	–	–	–	–	–	–	.23	<.0001	−.10	.07	-
FILE[b]	–	–	–	–	–	–	–	–	–	–	−.13	.02	-
Physical Health	–	–	–	–	–	–	–	–	–	–	–	–	.

a Mean current drug use alcohol (average drinks per week, each equivalent to .5 mL absolute alcohol), cigarettes (average number of cigarettes smoked per day).

b Distal (any time prior to the past twelve months).

Table options

The regression models found in Table 4 and Table 5 demonstrate whether the entry of qualifying variables had a mediating or additive effect to that of prior cocaine use on health outcome (BMI, cigarettes, alcohol and distal life stress were evaluated for PPH; cigarettes, alcohol and distal life stress were evaluated for PMH). Table 4, Model 1, indicates that cocaine was not a significant predictor of PPH after control for education and age. However, including BMI in Model 2 revealed the effects of cocaine use on physical health. Higher BMI predicted poorer PPH ($\beta = -.29$, $p < .0001$) and PC became a predictor of negative health outcome ($\beta = -.14$, $p < .02$), indicating BMI suppressed cocaine's effects on physical health (MacKinnon et al., 2000). Current cigarette and alcohol use in Models 3 and 4 did not mediate cocaine's effect on PPH. When distal total life stress was added in Model 5, its additive and potential mediating effect is demonstrated ($\beta = -.12$, $p < .05$). Model 6 shows the effect of prenatal cocaine use and all mediators added simultaneously. This model indicates a 9% increase in accounting for variance over Model 1.

Table 4.
Hierarchical regression on perceived physical health (PPH).

	Model 1		Model 2		Model 3		Model 4		Mod
	b(se)	*β*	*b*(se)	*β*	*b*(se)	*B*	*b*(se)	*β*	*b*(se
Cocaine	−1.88(1.29)	−.09	−2.91(1.25)	−.14*	−1.33(1.35)	−.06	−1.72(1.30)	−.08	−1.3
Age	−0.35(0.12)	−.18*	−0.34(0.11)	−.18*	−0.34(0.12)	−.17*	−0.35(0.12)	−.18*	−0.3
Education	1.04(0.40)	.15*	1.04(0.38)	.15*	0.96(0.40)	.14*	0.97(0.41)	.14*	0.99
BMI			−0.34(0.06)	−.29*					
Cigarette[a]					−0.69(0.50)	−.08			
Alcohol[a]							−0.63(0.65)	−.05	
FILE[b]									−0.2
	$R^2 = .08$		$R^2 = .16$		$R^2 = .08$		$R^2 = .08$		
			$\Delta R^2 = .08$[c]		$\Delta R^2 = 0$		$\Delta R^2 = 0$		

a Mean current drug use alcohol (average drinks per week, each equivalent to .5 mL absolute alcohol), cigarettes (average number of cigarettes smoked per day).

b Distal (any time prior to the past twelve months).

c There was a significant change from previous model, $p < .05$.

* Statistically significant, $p < .05$.

Table options

Table 5.
Hierarchical Regression on perceived mental health (PMH).

	Model 1		Model 2		Model 3		Model 4		Mod
	b(se)	*β*	*b*(se)	*β*	*b*(se)	*β*	*b*(se)	*β*	*b*(se
Cocaine	−4.81(1.36)	−.22*	−3.69(1.41)	.17*	−4.70(1.38)	−.22*	−4.08(1.37)	−.19*	−3.2
Age	0.03(0.13)	.01	0.05(0.12)	.02	0.03(0.13)	.01	−0.01(0.13)	−.01	0.02
Education	0.93(0.42)	.13*	0.77(0.42)	.10	0.88(0.43)	.12*	0.85(0.42)	.12*	0.67
BMI									
Cigarette[a]			−1.39(0.53)	−.16*					−1.2
Alcohol[a]					−0.43(0.69)	−.04			
FILE[b]							−0.42(0.15)	−.16*	−0.3
	R^2 = .07		R^2 = .09		R^2 = .07		R^2 = .10		
			ΔR^2 = .02[c]		ΔR^2 = 0		ΔR^2 = .03[c]		

a Mean current drug use alcohol (average drinks per week, each equivalent to .5 mL absolute alcohol), cigarettes (average number of cigarettes smoked per day).

b Distal (any time prior to the past twelve months).

c There was a significant change from previous model, $p < .05$.

* Statistically significant, $p < .05$.

Table options

Table 5, Model 1, indicates that PC use is a significant predictor of lower PMH after control for age and education ($\beta = -.22$, $p < .05$). Model 2 reveals that current cigarette use is a partial mediator of cocaine's effect on PMH ($\beta = -.16$, $p < .05$) although current alcohol use is not indicated as a mediator or independent predictor in Model 3. Distal life stress partially mediated the effect of cocaine on PMH and was an independent predictor ($\beta = -.16$, $p < .05$) of mental health problems as shown in Model 4. Model 5 presents cocaine status with all mediators added simultaneously. This model reflects a 4% increase in variance accounted for over Model 1.

4. Discussion

4.1. SF-36V2 health outcome by cocaine use during pregnancy

This ten year follow-up study examined differences in perceived physical and mental health of women who used cocaine during pregnancy compared to a polydrug, no cocaine use group with similar characteristics. Other health related factors were examined by cocaine use group and in relation to perceived health. The hypothesis that using crack cocaine during pregnancy would be associated with poorer physical and mental health after 10 years was supported. Controlling for age and education, PC women reported more bodily pain and poorer general health perceptions and overall mental health. All of the subscale scores comprising the mental health total score, including energy/fatigue, social functioning, emotional health problems and emotional well-being were rated lower by PC women, controlling for age and education.

The percentages of women reporting poor mental health, defined as one standard deviation below the mean, were significantly higher, and more than double the rate among women who used cocaine during pregnancy, compared to those women who did not. The percentage of those rating their overall health as falling one standard deviation below the mean in perceived physical health was also compared, yet was not significantly different for women who used cocaine during pregnancy vs. those that did not (23.1% vs. 13.7%).

4.2. Implications of medical, mental health and psychosocial characteristics of sample

Women who had used cocaine during pregnancy had higher rates of PTSD, alcohol, cocaine and marijuana dependence and dual disorders than NC women. These results suggest that the levels of substance use and exposure to traumatic stress experienced by women who used cocaine during pregnancy were substantial and exceeded that of women aged 18–25 years (Cotto et al., 2010) and those found in the general population (Kessler et al., 2003). A paradoxical finding is that, although not statistically significant, women in the non-cocaine use group report almost twice the level of lifetime diagnosis of major depression. While there is no clear explanation for this, one possibility is that without the burden of cocaine dependence, these women were more emotionally aware of their mental state and potentially sought out treatment for depression at greater rates.

Other aspects of physical health and health behaviors were different by cocaine group status. Body mass index over 25, which is generally considered overweight (Flegal et al., 2010), was lower for women who used cocaine during pregnancy than those who did not. This is likely due to anorexic effects of cocaine use. Even though cocaine using women were less likely to be overweight or obese, there were high rates in both groups (>68%) suggesting poor nutrition, lack of exercise and weight related health problems. The rates of any chronic condition were high for both groups, 61% and 55% respectively, indicating multiple types of health problems in this population.

Women who used cocaine during pregnancy reported more life stress, losses, illness, and family care issues (distal). There were no differences in the amount of perceived social support for women who used cocaine during pregnancy vs. those who did not. Current substance use behaviors among PC women remained higher for cocaine, alcohol and cigarettes, but not marijuana.

4.3. Mediators of prenatal cocaine use on health outcome

Mediating or partial mediating effects of cocaine on health outcome were examined in this study. Perhaps one of the most interesting findings was the suppressor effect of lower BMI on cocaine's effect on physical health. BMI is a well-studied negative health outcome. However, women who used cocaine during pregnancy continued to have overall lower BMI compared to NC women ten years later. Although PC women had lower BMI, they reported poorer health than heavier NC women when BMI was adjusted. Current alcohol and tobacco use did not mediate or independently predict the effects of PC on physical health. Cocaine use during pregnancy was a consistently strong predictor of perceived mental health problems at 10 years post-partum. These findings support our earlier studies which examined severity of psychological distress symptoms using the Brief Symptom Inventory both immediately post-partum and over a six year period beginning post-partum (Minnes et al., 2008b and Singer et al., 1995). Current cigarette use, which was greater among those who used cocaine during pregnancy, partially mediated the effect of cocaine on mental health. Greater current cigarette use can be a function of prenatal cigarette use and confound the effects of prenatal cocaine use on mental health. As PC women used more cigarettes during pregnancy than NC women, greater level of ongoing current cigarette use may also indicate the effect of prenatal cocaine use on the subsequent cigarette use even a decade later. However, current alcohol use did not have a similar effect on mental health symptoms. Distal life stress, which was greater among those who used cocaine during pregnancy, also had a partial mediating effect and an additive effect on both physical and mental health. The measure used for distal life stress does not clearly indicate that the stress occurred after prenatal cocaine use, but measures all lifetime stress up to a year prior to the 10 year measurement. This suggests that distal life stress may have an independent effect on outcome, may predispose an individual to cocaine use in pregnancy or be a partial mediator as our study suggested.

Results indicate that prenatal cocaine use is consistently related to greater physical health problems, particularly bodily pain and general health perceptions, and mental health problems, even 10 years after identification in this relatively young group of women. The subcategory of bodily pain and its association with cocaine use and perception of physical health needs further exploration as it is common among patients in

drug treatment and may be a key factor in perpetuating cocaine dependence (Larson et al., 2007).

4.4. Findings in relation to other studies/implications

Despite methodological differences such as sample makeup (female subjects), survey/health form used, evaluation of other health behaviors and outcomes, and overall objectives of the study, findings of this research generally support earlier studies. The study by Stein et al. (1998) sampled a primarily young male group seeking treatment and found no relationship between cocaine/polydrug abuse and overall physical function. Similarly, Falck et al. (2000a) found that cocaine use was associated with all SF-36V2 subscales except physical functioning and a large sample of cocaine/polydrug using homeless individuals reported poorer mental but not physical health (Grinman et al., 2010). Without BMI in the model we did not find a relationship between prenatal cocaine use and physical health as prior studies have found. However, our study suggested BMI as a suppressor, which revealed the impact of cocaine on physical health.

Results of the present study indicate a substantial and enduring risk of mental health symptoms among women who used crack cocaine prenatally compared to similar women who did not use cocaine (Minnes et al., 2008b). The consistency of these findings indicate that clinicians who encounter crack cocaine using women, whether during a prenatal, postnatal or general medical encounter, should consider a thorough mental health assessment and provide intervention if indicated. Earlier intervention could alleviate suffering, aid in drug treatment recovery efforts, enhance parenting experiences and child outcome, and lessen the impact of prolonged mental health symptoms on further physical health decline. Earlier interventions for mental health symptoms among this group of high risk women will need further investigation (McGorry et al., 2011).

4.5. Strengths and limitations

The present study has several strengths over previous studies of long term health outcomes among individuals who use cocaine, yet there are methodological limits to consider. Weaknesses of this study include lack of corroboration of medical symptoms and their severity with medical chart review or actual physical assessment by a health care or emergency room provider. In addition there was no baseline mental health information. However, the strength of the SF-36V2 assessment of perceived health status is that it is highly predictive of actual mental and physical health quality and mortality, even in the absence of physical and psychiatric data (Ware et al., 1993 and Ware, 2000). Additionally, the use of the DIS-C (Robins et al., 1981) provided standardized descriptive mental health information that supports the findings of poorer perceived mental health outcomes among women who used cocaine during pregnancy.

Although our study conceptualized current drug use as a mediator affected by prenatal cocaine use, a causal relationship may not be made. Cocaine use in pregnancy is a marker of risk known to encompass other well established prenatal behaviors such as increased tobacco use. Multicollinearity problems between prenatal and postnatal drug use precluded simultaneous analyses of both variables.

Despite the methodological concerns noted, there are several significant strengths to this prospective longitudinal study. The sample was large enough to detect group differences, to accommodate control variables, and to explore mediating variables of cocaine's impact on health. Another advantage was the use of a control group that did not use cocaine during pregnancy matched for race and socioeconomic status, increasing internal validity of the study. In addition the findings point to specific social and behavioral factors that might be targeted to improve health outcomes for women.

4.6. Implications

There are several important implications of this study. The findings indicate that cocaine use during pregnancy identifies women as being at increased risk for perceived physical and mental health problems, including problems with bodily pain, general perceptions of physical health, energy, social functioning, emotional health and well-being at even

relatively young ages. Almost one-third of PC women reported mental health problems at a standard deviation below the standardized mean for their age and gender. Given that emotional difficulties and pain contribute greatly to daily productivity, including advanced education, employment, and parenting, they are very likely costly to the individual as well as to society. These data underscore the need for mental health intervention in this underserved population.

Since the women in the study were relatively young at the time of evaluation, the reported perceptions of health are likely to worsen as the women age. Preventive interventions aimed at alleviating symptoms early and providing education to reduce further harm through improved diet, exercise, smoking cessation, and stress reduction will likely reduce mortality.

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Contributors

Drs. Sonia Minnes, Meeyoung O. Min, and Lynn T. Singer conceived of and designed the study. Dr. Min and Ms. Wu performed the data analyses. Dr. Minnes reviewed the research literature and data and was the primary text author. Ms. Edguer and Ms. Thi participated in data management, summary of results and review of the literature. All authors contributed to the final manuscript.

Conflict of interest

No conflict of interest declared.

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References

American Psychiatric Association, 1994 American Psychiatric Association
Diagnostic and statistical manual of mental disorders
American Psychiatric Association, Washington, DC (1994)

Baron and Kenny, 1986 R.M. Baron, D.A. Kenny
The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations
J. Pers. Soc. Psychol., 5 (1986), pp. 1173–1182

CrossRef | View Record in Scopus | Citing articles (33515)

Baum and Posluszny, 1999 A. Baum, D.M. Posluszny
Health psychology: mapping biobehavioral contributions to health and illness
Annu. Rev. Psychol., 50 (1999), pp. 137–163

CrossRef | View Record in Scopus | Citing articles (214)

Beckwith et al., 1999 L. Beckwith, J. Howard, M. Espinosa, R. Tyler
Psychopathology, mother-child interaction, and infant development: substance-abusing mothers and their offspring
Dev. Psychopathol., 11 (1999), pp. 715–725

CrossRef | View Record in Scopus | Citing articles (43)

Borders et al., 2009 T.F. Borders, B.M. Booth, R.S. Falck, C. Leukefeld, J. Wang, R.G. Carlson
Longitudinal changes in drug use severity and physical health-related quality of life among untreated stimulant users
Addict. Behav., 34 (2009), pp. 959–964

Article | PDF (179 K) | View Record in Scopus | Citing articles (15)

Chaves et al., 2011 T.V. Chaves, Z.M. Sanchez, L.A. Ribeiro, S.A. Nappo
Crack cocaine craving; behaviors and coping strategies among current and former users

Rev. Saude Publica., 45 (6) (2011), pp. 1168–1175

CrossRef | View Record in Scopus | Citing articles (28)

Cotto et al., 2010 J.H. Cotto, E. Davis, G.J. Dowling, J.C. Elcano, A.B. Staton, S.R. Weiss
Gender effects on drug use, abuse, and dependence: a special analysis of results from the National Survey on Drug Use and Health
Gend. Med., 7 (2010), pp. 402–413

Article | PDF (141 K) | View Record in Scopus | Citing articles (66)

Dudina et al., 2011 A. Dudina, M.T. Cooney, D. De Bacquer, G. De Backer, P. Ducimetiere, P. Jousilahti, U. Keil, A. Menotti, I. Niolstad, R. Oganov, S. Sans, T. Thomsen, A. Tverdal, H. Wedel, P. Whincup, L. Wilhelmsen, R. Conroy, A. Fitzgerald, I. Graham
Relationships between body mass index, cardiovascular mortality, and risk factors: a report from the SCORE investigation
Eur. J. Cardiovasc. Prev. Rehabil., 104 (2011), pp. 734–741

View Record in Scopus | Citing articles (1)

Dunn and Dunn, 1981 L.M. Dunn, L.M. Dunn
Peabody Picture Vocabulary Test-Revised
American Guidance Service, Circle Pines, MN (1981)

Falck et al., 2000a R. Falck, J. Wang, R. Carlson, H. Siegal
Crack-cocaine use and health status as defined by the SF-36
Addict. Behav., 25 (2000), pp. 579–584

Article | PDF (50 K) | View Record in Scopus | Citing articles (33)

Falck et al., 2000b R. Falck, J. Wang, H. Siegal, R. Carlson
Longitudinal application of the medical outcomes study 36-item short-form health survey with not-in-treatment crack-cocaine users
Med. Care, 38 (2000), pp. 902–910

CrossRef | View Record in Scopus | Citing articles (28)

Falck et al., 2002 R.S. Falck, J. Wang, R.G. Carlson, M. Eddy, H.A. Siegal
The prevalence and correlates of depressive symptomatology among a community sample of crack-cocaine smokers
J. Psychoactive Drugs, 34 (2002), pp. 281–288

CrossRef | View Record in Scopus | Citing articles (57)

Flegal et al., 2010 K.M. Flegal, M.D. Carroll, C.L. Ogden, L.R. Curtin
Prevalence and trends in obesity among US adults, 1999–2008
JAMA, 303 (2010), pp. 235–241

CrossRef | View Record in Scopus | Citing articles (4120)

Geckova et al., 2001 A. Geckova, J. Tuinstra, M. Pudelsky, M. Kovarova, J.P. van Dijk, J.W. Groothoff, D. Post
Self-reported health problems of Slovak adolescents
J. Adolesc., 24 (2001), pp. 635–645

Article | PDF (264 K) | View Record in Scopus | Citing articles (24)

Goldstein et al., 2009 R.A. Goldstein, C. DesLauriers, A. Burda, K. Johnson-Arbor
Cocaine: history, social implications, and toxicity: a review
Semin. Diagn. Pathol., 26 (2009), pp. 10–17

Article | PDF (277 K) | View Record in Scopus | Citing articles (22)

Grinman et al., 2010 M.N. Grinman, S. Chiu, D.A. Redelmeier, W. Levinson, A. Kiss, G. Tolomiczenko, L. Cowan, S.W. Hwang
Drug problems among homeless individuals in Toronto Canada: prevalence, drugs of choice, and relation to health status
BMC Public Health (2010), p. 10

Hall and Degenhardt, 2009 W. Hall, L. Degenhardt
Adverse health effects of non-medical cannabis use
Lancet, 374 (2009), pp. 1383–1991

Hirani, 2011 V. Hirani
Generalised and abdominal adiposity are important risk factors for chronic disease in older people: results from a nationally representative survey
J. Nutr. Health Aging, 15 (2011), pp. 469–478

CrossRef | View Record in Scopus | Citing articles (7)

Hollingshead, 1957 A.B. Hollingshead
Two Factor Model of Social Position
Yale University, New Haven, Connecticut (1957)

Johanson et al., 1999 C.E. Johanson, T. Roehrs, K. Schuh, L. Warbasse
The effects of cocaine on mood and sleep in cocaine-dependent males
Exp. Clin. Psychopharmacol., 7 (1999), pp. 333–346

Kandel et al., 1998 D.B. Kandel, L.A. Warner, R.C. Kessler
Epidemiology of drug use and abuse among women
NIH (1998), pp. 105–130

View Record in Scopus | Citing articles (2)

Kessler et al., 2003 R.C. Kessler, P. Berglund, O. Demler, R. Jin, D. Koretz, K.R. Merikangas, A.J. Rush, E.E. Walters, P.S. Wang, National Comorbidity Survey Replication
The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R)
JAMA, 289 (2003), pp. 3095–3105

CrossRef | View Record in Scopus | Citing articles (4209)

Krantz and McCeney, 2002 D.S. Krantz, M.K. McCeney
Effects of psychological and social factors on organic disease: a critical assessment of research on coronary disease
Ann. Rev. Psychol., 53 (2002), pp. 341–369

CrossRef | View Record in Scopus | Citing articles (255)

Larson et al., 2007 M.J. Larson, M. Paasche-Orlow, D.M. Cheng, C. Lloyd-Travaglini, R. Saitz, J.H. Samet
Persistent pain is associated with substance use after detoxification: a prospective cohort analysis
Addiction, 102 (2007), pp. 752–760

CrossRef | View Record in Scopus | Citing articles (71)

Luppino et al., 2010 F.S. Luppino, L.M. de Wit, P.F. Bouvy, T. Stijnen, P. Cuijpers, B.W. Penninx, F.G. Zitman
Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies
Arch. Gen. Psychiatry, 67 (2010), pp. 220–229

CrossRef | View Record in Scopus | Citing articles (942)

MacKinnon et al., 2000 D.P. MacKinnon, J.L. Krull, C.M. Lockwood
Equivalence of the mediation, confounding and suppression effect
Prev. Sci., 1 (2000), pp. 173–181

CrossRef | View Record in Scopus | Citing articles (1112)

Manzanares Galan et al., 2012 S. Manzanares Galan, A. Hernández Santalla, I. Vico Zúñiga, M. Setefilla Criado López, A. Pineda Lloréns, J. Luis Gallo Vallejo
Abnormal maternal body mass index and obstetric and neonatal outcome
J. Matern. Fetal Neonatal Med., 25 (3) (2012), pp. 308–312

McCubbin et al., 1991 H.I. McCubbin, J.M. Patterson, L.R. Wilson
FILE: family inventory of life events and changes
D.H. Olson (Ed.), Family Inventories, University of Wisconsin, Madison (1991)

McGorry et al., 2011 P.D. McGorry, R. Purcell, S. Goldstone, G.P. Amminger
Age of onset and timing of treatment for mental and substance use disorders: implications for preventive intervention strategies and models of care
Curr. Opin. Psychiatry, 24 (2011), pp. 301–306

View Record in Scopus | Citing articles (90)

Minnes et al., 2008a S. Minnes, L.T. Singer, R. Humphrey-Wall, S. Satayathum
Psychosocial and behavioral factors related to the post-partum placements of infants born to cocaine-using women
Child Abuse Negl., 32 (2008), pp. 353–366

Article | PDF (161 K) | View Record in Scopus | Citing articles (16)

Minnes et al., 2008b S. Minnes, L.T. Singer, H.L. Kirchner, S. Satayathum, E.J. Short, M. Min, S. Eisengart, J.P. Mack
The association of prenatal cocaine abuse and childhood trauma with psychological symptoms over 6 years

Arch. Womens Ment. Health, 11 (2008), pp. 181–192

CrossRef | View Record in Scopus | Citing articles (6)

Nolen-Hoeksema, 2004 S. Nolen-Hoeksema
Gender differences in risk factors and consequences for alcohol use and problems
Clin. Psychol. Rev., 24 (2004), pp. 981–1010

Article | PDF (249 K) | View Record in Scopus | Citing articles (335)

Ostrea et al., 1992 E.M. Ostrea, M. Brady, S. Gause, A.L. Raymundo, M. Stevens
Drug screening of newborns by meconium analysis: a large-scale, prospective, epidemiologic study
J. Pediatr., 89 (1992), pp. 107–113

View Record in Scopus | Citing articles (262)

Parrott, 2006 A.C. Parrott
Nicotine psychobiology: how chronic-dose prospective studies can illuminate some of the theoretical issues from acute-dose research
Psychopharmacol, 184 (3–4) (2006), pp. 567–576

CrossRef | View Record in Scopus | Citing articles (44)

Ribeiro et al., 2010 L.A. Ribeiro, Z.M. Sanchez, S.A. Nappo
Surviving crack: a qualitative study of the stategies and tactics developed by Brazilian users to deal with the risks associated with the drug
BMC Public Health (2010), p. 671

CrossRef

Robins et al., 1981 L.N. Robins, J.E. Helzer, J. Croughan, K.S. Ratcliff
The NIMH Diagnostic Interview Schedule: its history, characteristics, and validity
Arch. Gen. Psychiatry, 38 (1981), pp. 381–389

CrossRef | View Record in Scopus | Citing articles (23)

Ross-Durow and Boyd, 2000 P.L. Ross-Durow, C.J. Boyd
Sexual abuse, depression, and eating disorders in African American women who smoke cocaine
J. Subst. Abuse Treat., 81 (2000), pp. 79–81

Article | PDF (40 K) | View Record in Scopus | Citing articles (16)

Schwartz et al., 2010 B.G. Schwartz, S. Rezkalla, R.A. Kloner
Cardiovascular effects of cocaine
Circulation, 122 (2010), pp. 2558–2569

CrossRef | View Record in Scopus | Citing articles (102)

Sexton et al., 2011 K.R. Sexton, L. Franzini, R.S. Day, A. Brewster, S.W. Vernon, M.L. Bondy
A review of body size and breast cancer risk in Hispanic and African American women
Cancer, 117 (23) (2011), pp. 5271–5281

CrossRef | View Record in Scopus | Citing articles (19)

Singer et al., 1997 L.T. Singer, R. Arendt, K. Farkas, S. Minnes, J. Huang, T. Yamashita
The relationship of prenatal cocaine exposure and maternal psychological distress to child developmental outcome
Dev. Psychopathol., 9 (1997), pp. 473–489

View Record in Scopus | Citing articles (81)

Singer et al., 1995 L.T. Singer, R. Arendt, M. Minnes, K. Farkas, T. Yamashita, R. Kliegman
Increased psychological distress in postpartum, cocaine using mothers
J. Subst. Abuse, 7 (1995), pp. 165–174

Article | PDF (641 K) | View Record in Scopus | Citing articles (35)

Singer et al., 2004 L.T. Singer, S. Minnes, E. Short, R. Arendt, K. Farkas, B. Lewis, N. Klein, S. Russ, M.O. Min, H.L. Kirchner
Cognitive outcomes of preschool children with prenatal cocaine exposure
JAMA, 291 (2004), pp. 2448–2456

CrossRef | View Record in Scopus | Citing articles (144)

Stein et al., 1998 M.D. Stein, K.P. Mulvey, A. Plough, J.H. Samet
The functioning and well-being of persons who seek treatment for drug and alcohol use
J. Subst. Abuse, 10 (1998), pp. 75–84

Article | PDF (560 K) | View Record in Scopus | Citing articles (55)

Strandberg et al., 2008 A.Y. Strandberg, T.E. Strandberg, K. Pitkälä, V.V. Salomaa, R.S. Tilvis, T.A. Miettinen
The effect of smoking in midlife on health-related quality of life in old age: a 26-year prospective study
Arch. Intern. Med., 168 (2008), pp. 1968–1974

CrossRef | View Record in Scopus | Citing articles (59)

Ware et al., 1993 J.E. Ware, K.K. Snow, M. Kosinski, B. Gandek
SF-36 Health Survey Manual and Interpretation Guide
The Health Institute New England Medical Center, Boston, MA (1993)

Ware, 2000 J.E. Ware Jr.
SF-36 Health Survey Update
Spine, 25 (2000), pp. 3130–3139

CrossRef | View Record in Scopus | Citing articles (1467)

Watson et al., 1992 R. Watson, L. Bakos, P. Compton, F. Gawin
Cocaine use and withdrawal: the effect on sleep and mood
Am. J. Drug Alcohol Abuse, 8 (1992), pp. 21–28

CrossRef | View Record in Scopus | Citing articles (45)

Weschler, 1989 D. Weschler
Weschler Adult Intelligence Scale- Revised
Psychological Corp., San Antonio, TX (1989)

Zimet et al., 1988 G.D. Zimet, N.W. Dahlem, S.G. Zimet, G.K. Farley
The multidimensional scale of perceived social support
J. Pers. Assess., 52 (1988), pp. 30–41

CrossRef | View Record in Scopus | Citing articles (388)

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