

Cocaine, cardiomyopathy, and heart failure: A systematic review and meta-analysis
Supplementary Document S3:
Data Tables

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Table S3-1. Studies with cross-sectional data investigating prevalence of low EF in asymptomatic cocaine users.

Study	Subjects	N	Cocaine use measured by:	EF measured by:	Summary measure: Prevalence
Bertolet et al. 1990 ¹	Asymptomatic-male users. Age = 36. Range (25-44)	84	Urine toxicology	Radionuclide angiography (LVEF < 50%)	0.070 [0.023, 0.137] *: <i>Second paragraph of Results</i>
Willoughby et al. 1993 ²	Asymptomatic Adults with HIV and drug use. Age = 36 +/- 7	85	Self-reported	Echocardiogram (LVEF < 50%)	0.012 [0.000, 0.049] *: <i>Page 2, fourth paragraph</i>
Aquaro et al. 2011 ³	Asymptomatic users. Age = 39 +/- 7 years	50	Urine toxicology	CMR (LVEF < 55%)	0.000 [0.000, 0.036] *: <i>Page 3, 7th paragraph</i>

*: Denotes that the summary measure was calculated by writers of this systematic review. The location of the primary data is then reported.

RMRS: *Retrospective medical records search.*

CMR: *Cardio magnetic resonance.*

Table S3-2. Studies with cross-sectional data investigating prevalence of low EF in symptomatic cocaine users.

Study	Subjects	N	Cocaine use measured by:	EF measured by:	Prevalence:
Om et al. 1992 ⁴	Adults with recent cocaine use requiring a coronary angiogram.	33	Urine toxicology	Echocardiogram LVEF < 50%	0.545 [0.372, 0.713] *: 6th paragraph of Results
HollanderAIM et al. 1995 ⁵	Adults with recent cocaine use who suffered MI in hospital	122	RMRS	RMRS: Mentions of heart failure	0.055 [0.020, 0.105] *: Table 4
Weber et al. 2000 ⁶	Adults presenting to ED with chest discomfort and recent cocaine use	196	RMRS	RMRS: Mentions of heart failure	0.020 [0.004, 0.271] *: Table 1

*: Denotes that the summary measure was calculated by writers of this systematic review. The location of the primary data is then reported. The location of the primary data is then reported.
RMRS: *Retrospective medical records search*

The type of chest complaint varied greatly between studies; therefore, meta-analysis was deemed inappropriate.

Table S3-3. Studies exploring acute changes in LVEF after cocaine infusion

Study	Study characteristics	Important findings:
Eisenberg et al. 1993 ⁷	Intravenous cocaine infusion (n = 14). Placebo (n = 2).	No significant changes in LVEF.
Pitts et al. 1998 ⁸	Infusion by catheterization (n = 20). Same patients used as control when infused with saline. (n= 20).	Significant drop in LVEF fifteen minutes after cocaine infusion

Table S3-4. Cohort studies investigating EF in asymptomatic chronic cocaine users.

Study	Cohorts	EF measured by:	Summary measures:
Brickner et al. 1991 ⁹	1: Long-term asymptomatic cocaine users. ($N_1 = 30$) 2: Aged and race matched. ($N_2 = 30$)	Echocardiogram: Fractional shortening	$g = + 0.24 [-0.26, 0.75]$ *: Table 1
Chakko et al. 1992 ¹⁰	1: Long-term asymptomatic cocaine users. ($N_1 = 52$) 2: Aged match. ($N_2 = 14$)	Echocardiogram	$g = + 0.09 [-0.50, 0.68]$ *: Table 2
Roldan et al. 2001 ¹¹	1: Long-term asymptomatic cocaine users. ($N_1 = 35$) 2: Agematch. ($N_2 = 32$)	Echocardiogram	$g_{rest} = - 0.32 [-0.81, 0.16]$ *: Table 2
Maceira 2014 et al. ¹²	1: Asymptomatic long term cocaine users. ($N_1 = 94$) 2: Age and gender matched non-users. ($N_2 = 80$)	Cardiovascular MRI	$g = - 1.97 [-2.33, -1.60]$ *: Table 5
Radunski et al. 2017 ¹³	1: Asymptomatic long-term cocaine users. ($N_1 = 20$) 2: Non-users age matched. ($N_2 = 20$)	Cardiovascular MRI	$g = 0.07 [-0.55, 0.69]$ *, [⊖] : Table 4.
Tong et al. 2004 ¹⁴	1: Long-term cocaine users. ($N_1 = 123$) 2: Non-users. Not age-matched. ($N_2 = 15$)	Echocardiogram	$g = - 0.30 [-0.84, 0.23]$ *: Table 2

*: Denotes that the summary measure was calculated by writers of this systematic review. The location of the primary data is then reported.

[⊖]: Median was reported, not the average. Interquartile range reported, not the standard deviation. Median and SD back-calculated from normal-distribution assumption

Table S3-5. Cohort studies investigating heart failure in cocaine users presenting to ED with chest complaints.

Study	Cohorts	EF measured by:	Summary measures:
Carrillo et al. 2011 ¹⁵	1: Long-term cocaine users admitted for ACS. ($N_1 = 24$) 2: Non-cocaine users admitted for ACS. ($N_2 = 379$)	Echocardiogram	$g = -0.61 [-1.02, -0.19]$ *: Table 2
Frustaci et al. 2015 ¹⁶	1: Symptomatic cocaine users. ($N_1 = 10$) 2: Matched group. ($N_2 = 10$)	Cardiovascular MRI	$g = -3.65 [-5.05, -2.22]$ *: Table 1
Dierck et al. 2008 ¹⁷	Patients presenting to ED with heart failure 1: Cocaine or methamphetamine use ($N_1 = 594$) 2: Non-users. Not age-matched. ($N_2 = 10,664$)	Chart review. Methods not reported	OR = 3.4 [2.8, 4.2] Table 1

Due to limited data and differences in each study's methodology, meta-analysis was deemed inappropriate.

Table S3-6. Cohort studies investigating heart weight by autopsy or echocardiogram.

Study	Cohorts	Heart Weight measured by:	Summary measures
Karch et al. 1995 ^{18!}	1: Trauma fatalities, testing (+) for cocaine ($N_1 = 32$). <u>Men Only</u> 2: Matched group, (-) for cocaine ($N_2 = 51$)	Autopsy	$g = + 0.48 [0.037, 0.924]$ *: 3rd paragraph of results
Karch et al. 1995 ^{18!}	1: Trauma fatalities, testing (+) for cocaine ($N = 16$). <u>Women Only</u> . 2: Matched group, (-) for cocaine ($N = 16$).	Autopsy	$g = + 0.59 [-0.11, 1.28]$ *: 3rd paragraph of results
Karch et al. 1995 ^{18!}	Combination by Random Effect Model		$g = 0.51 [0.13, 0.89]$
Karch et al. 1998 ^{19!!}	1: Cocaine related deaths. ($N_1 = 48$) 2: Matched group, trauma death, (-) for cocaine. ($N_2 = 51$)	Autopsy	$g = + 0.53 [0.13, 0.93]$ *: 2nd paragraph of findings
Mosunjac et al. 2008 ²⁰	1: Acute or chronic cocaine use ($N_1 = 63$) 2: Matched group, (-) non-users ($N_2 = 61$)	Autopsy	$g = + 1.12 [0.74, 1.50]$ *: 3rd paragraph of results
Lucena et al. 2010 ²¹	1: Cocaine-related deaths. ($N_1 = 21$) 2: Matched group. ($N_2 = 10$)	Autopsy	$g = + 0.43 [-0.33, 1.19]$ *: 4th paragraph of methods and cardiovascular findings section of results
Brickner et al. 1991 ⁹	1: Long-term asymptomatic cocaine users . ($N_1 = 30$) 2: Aged and race matched. ($N_2 = 30$)	Echocardiogram: LVMI	$g = + 1.31 [0.75, 1.86]$ *: Table 1
Cigarroa et al. 1992 ²²	1: Asymptomatic male chronic cocaine users. ($N_1 = 49$) 2: Age and race-matched group ($N = 30$)	Echocardiogram: LVMI	$g = + 1.07 [0.58, 1.55]$ *: Table 1. Combined cocaine using groups
Chakko et al. 1992 ¹⁰	1: Chronic cocaine users in rehabilitation ($N = 52$) 2: Matched group, (+) for alcohol and smoking use	Echocardiogram: LVMI	$g = + 1.50 [0.86, 2.15]$ *: Table 2

	(N = 14)		
Mondillo et al. 1997 ²³	1: Chronic cocaine users (N = 10) 2: Non-users. Matched for age. (N = 10)	Echocardiogram: LVMI	$g = + 0.54 [-0.35, 1.43]$ *: Table 1
Roldan et al. 2001 ¹¹	1: Asymptomatic chronic cocaine user (N = 35). 2: Aged-matched group (N = 32).	Echocardiogram: LVMI	$g = + 0.00 [-0.48, 0.48]$ *: Table 2
Maceira et al. 2014 ¹²	1: Asymptomatic long term cocaine users (N ₁ = 94) 2: Age and gender matched non-users (N ₂ = 80)	Echocardiogram: LVMI	$g = + 0.62 [0.31, 0.93]$ *: Table 5
Radunski et al. 2017 ¹³	1: Asymptomatic long-term cocaine users (N ₁ = 20) 2: Non-users. Aged-matched group. (N ₂ = 20)	Cardiovascular MRI: LVMI	$g = + 0.43 [-0.20, 1.05]$ *, [⊖] : Table 4
Fineschi et al. 1997 ²⁴	1: Cocaine associated death. (N ₁ = 26). 2: Head trauma death. (Age difference is statistically significant) ^t (N ₂ = 26)	Autopsy	*: Table 1
Tong et al. 2004 ¹⁴	1: Asymptomatic chronic cocaine users (N = 123) 2: Non-users. (Age difference statistically significant) ^P (N = 15)	Echocardiogram: LVMI	*: Table 2
Fineschi et al. 2005 ²⁵	1: Deaths attributed to cocaine abuse (N ₁ = 26) 2: Accidental death. (Age difference is statistically significant) ^t (N ₂ = 21)	Autopsy	*: Table 1

!: Karch1995 study. Clark County Coroner Office, Nevada. 1993-1994.

!!: Karch1998 study. San Francisco Medical Examiner 1989-1995

t: Statistical significance by *t*-test.

P: Per original authors

*: Denotes that the summary measure was calculated by writers of this systematic review. The location of the primary data is then reported.

[⊖]: Median was reported, not the average. Interquartile range reported, not the standard deviation. Median and SD back-calculated from normal-distribution assumption.

Table S3-7. Cohort studies investigating Left Ventricular End Diastolic Volume.

Study	Cohorts	LVED measured by:	Summary measures
Brickner et al. 1991 ⁹	1: Long-term asymptomatic cocaine users ($N_1 = 30$) 2: Aged and race matched ($N_2 = 30$)	Echocardiogram: LVED	$g = + 0.00 [-0.51, 0.51]$ *: Table 1
Chakko et al. 1992 ¹⁰	1: Chronic cocaine users in rehabilitation ($N_1 = 52$) 2: Matched group, (+) for alcohol and smoking use ($N_2 = 14$)	Echocardiogram: LVED	$g = 0.00 [-0.59, 0.59]$ *: Table 2
Cigarroa et al. 1992 ²²	1: Asymptomatic male chronic cocaine users ($N_1 = 49$) 2: Age and race-matched group ($N_2 = 30$)	Echocardiogram: LVED	$g = -0.11 [-0.57, 0.34]$ *: Table 1. Combined cocaine using groups
Roldan et al. 2001 ¹¹	1: Asymptomatic chronic cocaine user ($N_1 = 35$) 2: Aged-matched group ($N_2 = 32$)	Echocardiogram: LVED	$g = - 0.36 [-0.85, 0.12]$ *: Table 2
Maceira et al. 2014 ¹²	1: Asymptomatic long term cocaine users ($N_1 = 94$) 2: Age and gender matched non-users ($N_2 = 80$)	Echocardiogram: LVED	$g = - 0.32 [-0.62, -0.01]$ *: Table 5
Radunski et al. 2017 ¹³	1: Asymptomatic long-term cocaine users ($N_1 = 20$) 2: Non-users ($N_2 = 20$)	Cardiovascular MRI: LVED	$g = - 0.14 [-0.76, 0.48]$ *,@: Table 4

*: Denotes that the summary measure was calculated by writers of this systematic review. The location of the primary data is then reported.

@: Median was reported, not the average. Interquartile range reported, not the standard deviation. Median and SD back-calculated from normal-distribution assumption

Table S3-8. Cohort studies investigating Total and Relative Wall Thickness.

Study	Cohorts	Thickness measured by:	Summary measures
Brickner et al. 1991 ⁹	1: Long-term asymptomatic cocaine users ($N_1 = 30$) 2: Aged and race matched ($N_2 = 30$)	Echocardiogram. RWT calculated using PWT and LVDD.[Bierig2005]	$g = + 0.61 [0.09, 1.12]$ *: Table 1
Chakko et al. 1992 ¹⁰	1: Chronic cocaine users in rehabilitation ($N_1 = 52$) 2: Matched group, (+) for alcohol and smoking use ($N_2 = 14$)	Echocardiogram. RWT calculated using PWT and LVDD.[Bierig2005]	$g = + 1.45 [0.81, 2.09]$ *: Table 2
Cigarroa et al. 1992 ²²	1: Asymptomatic male chronic cocaine users ($N_1 = 49$) 2: Age and race-matched group ($N_2 = 30$)	Echocardiogram. RWT calculated using PWT and LVDD	$g = + 0.68 [0.22, 1.15]$ *: Table 1. Combined cocaine using groups
Mosunjac et al. 2008 ²⁰	1: Acute or chronic cocaine use ($N_1 = 63$) 2: Matched group, (-) for acute or chronic cocaine use ($N_2 = 61$)	Autopsy. Presence of LVH defined as PWT > 1.2 cm and heart weight > 450 g	$RR = 1.61 [1.15, 2.37]$ *: 2nd paragraph of Results
Lucena et al. 2010 ²¹	1: Cocaine-related deaths ($N_1 = 21$) 2: Matched group ($N_2 = 10$)	Autopsy. LV wall thickness	$g = + 0.88 [0.10, 1.67]$ *: 6th paragraphs of results
Roldan et al. 2001 ¹¹	1: Asymptomatic chronic cocaine user ($N_1 = 35$) 2: Aged-matched group ($N_2 = 32$)	Echocardiogram. RWT calculated using PWT and LVDD	$g = - 0.05 [-0.53, 0.43]$ *: Table 2
Maceira et al. 2014 ¹²	1: Asymptomatic long term cocaine users ($N_1 = 94$) 2: Age and gender matched non-users ($N_2 = 80$)	Echocardiogram. Relative wall mass	$g = + 1.11 [0.78, 1.43]$ *: Table 5

The study by Mosunjac had sufficient data to calculate the risk-ratio of left ventricular hypertrophy between the two groups (but not enough to calculate other effect sizes).

Table S3-9. Retrospective studies investigating treatment of cocaine users with cardiac complications. All studies in United States.

Study	Subject Group	Comparison Group	Total no. of participants	Exclude ACS patients?	Study period (years)	Average treatment/ follow-up (months)	Primary disease outcome(s)	Other outcomes
Nguyen et al., 2017	ADHF patients with positive history of chronic cocaine use	ADHF patients with no history of cocaine use	90 vs 177	Yes	19	32 months	Readmission for ADHF, Hypertensive Emergency, Stroke, ACS, Death	None
""	positive history of chronic cocaine use. Treated	patients with positive history of chronic cocaine use. Treated with active	54 vs 36	""	""	""	Mortality	""
Egbuche et al., 2018	HFREF patients positive for cocaine. Treated with BP	patients positive for cocaine. Treated with other medications	231 vs 37	No	3.92	12 months	30-day readmission due to all-cause and heart failure	1-year mortality rate
Lopez et al., 2019	patients with active cocaine use. Treated	patients with active cocaine use. Treated with other medications	38 vs 34	No	1	12 months	NYHA Functional Classification	LVEF

Table S3-10. Other findings.

Study	Patients	Important findings
Kasper et al. 1994 ³⁰	Patients admitted for heart failure due to dilated cardiomyopathy. (n = 673).	About 1% of dilated cardiomyopathy cases were related to cocaine use.
Willet et al. 1995 ³¹	Asymptomatic chronic cocaine users. Blacks (n = 79) Whites (n = 33)	LV mass, posterior and septal wall thickness were significantly higher in Black chronic cocaine users.
Melon et al. 1997 ³²	Asymptomatic chronic cocaine users. (n = 9). Asymptomatic non-users. (n = 6).	Radio-chemical study by C-11-hydroxyephedrine demonstrates reduced NE reuptake in cocaine users, which suggests prolonged exposure to elevated catecholamine levels.
Mehta et al. 2002 ³³	Newborns exposed to cocaine in utero (n = 82). Normal controls (n = 87).	Prenatal exposure to cocaine results in regional wall abnormalities but no significant difference in systolic function.

The study by Willett et al. of cocaine users directly compared septal wall and posterior wall thicknesses between whites and blacks and found significantly higher values for the latter.³¹ Since there were no comparison to non-cocaine users, the data could not be included in the meta-analysis of relative wall thickness.

Only one manuscript was identified which studied systolic function among newborns exposed to cocaine in utero which found zero of the 82 patients included in the study were found to have a low LVEF.³³

We did not identify any articles which investigated clinical prognosis of HF in chronic cocaine users.

Table S3-11. Results from heterogeneity and publication bias tests.

Meta-analysis	Number of studies	<i>Q</i>	<i>I</i>²	Rank correlation test. Kendall's τ:	<i>p</i>-value	Regression test. <i>z</i>:	<i>p</i>-value
Prevalence. Low EF. Asymptomatic	3	6.6	69.8	-0.33	1.00	-0.95	0.34
Ejection Fraction. Asymptomatic.	5	74.3	94.6	0.40	0.48	2.89	0.00
Heart Weight	11	22.7	55.9	0.09	0.76	-0.05	0.96
LVED. Asymptomatic.	6	2.2	0.0	0.33	0.47	1.00	0.32
RWT. Asymptomatic.	5	20.2	80.2	-0.07	1.00	0.31	0.76
SubGroup (Heart Weight)							
Autopsy	4	6.88	56.4	0.33	0.75	-0.61	0.54
LVMi	7	15.9	62.3	0.14	0.77	0.16	0.88

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