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Should anyone be riding to glory on the now-descending limb of the crack-cocaine epidemic curve in the United States?¹

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Abstract

Background—Many pre-clinical and clinical researchers do not appreciate the recent decline in United States (US) population-level incidence of crack-cocaine smoking. At present, no more than about 200 young people start using crack-cocaine each day. Ten years ago, the corresponding estimated daily rate was 1,000. This short communication looks into these trends, surrounding evidence on this important public health topic, and checks whether duration-reducing treatment interventions might be responsible, versus selected alternatives.

Methods—Via analyses of standardized computer-assisted self-interview data from the US National Surveys on Drug Use and Health (NSDUH, 2002–2011; $n > 500,000$), we evaluated change in incidence estimates, perceived difficulty to acquire crack, risk of using cocaine, treatment entries, and persistence once crack use has started.

Results—We draw attention to a marked overall decline in year-specific incidence rates for crack-cocaine smoking from 2002–2011, especially 2007–2011. There is some variation in estimates of difficulty to acquire crack ($p < 0.001$) and observed risk of using cocaine among ‘at risk’ susceptibles ($p < 0.001$), but no appreciable shifts in duration of crack smoking among active users ($p > 0.05$) nor in proportion of crack users receiving treatment ($p > 0.05$).

Conclusions—Changing epidemiology of crack-cocaine smoking may rest largely on reductions in newly incident use with no major direct effects due to US cocaine treatment, incarceration, or interdiction. Concurrently, we see quite modest declines in survey-based estimates of cocaine-

¹Online supplementary material is provided to provide details on the National Surveys on Drug Use and Health (NSDUH), including survey items used to ask about crack-cocaine specifically and can be found by accessing the online version of this paper at <http://dx.doi.org> and by entering doi:...

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Conflict of interest

No conflict declared.

attributed perceived risk and cocaine availability. As such, we posit that no specific US agency should claim it is ‘riding to glory’ on the descending limb of this epidemic curve.

Keywords

Crack-cocaine; Cocaine; Epidemiology; Incidence; Epidemic

1. INTRODUCTION

This is a ‘Short Communication’ stimulated by growing awareness that prevalence proportions for use of cocaine hydrochloride (HCl) have dropped in the United States (US), with an estimated prevalence proportion of about 2.5% in 2002 shifting downward to 1.5% by 2011 [Substance Abuse and Mental Health Services Administration (SAMHSA), 2012]. Contributing to this prevalence trend is a drop in year-specific population incidence rates for crack-cocaine ‘smoking’ specifically, from which each day’s estimated tally of newly incident crack users can be derived. Estimated at more than 1,000 newly incident crack users per day 10 years ago, the corresponding estimate for 2011 is under 200 per day (SAMHSA, 2012.). Our intent is to add a selection of US community survey-based details about declining trends in estimated annual incidence for crack-cocaine, observed during years epidemiologists generally call ‘the descending limb of the epidemic curve,’ including potential influence of cocaine-attributable harms (e.g., see Johnston, 2003). This ‘short communication’ format is too constrained for thesis-length coverage of interesting concurrent trends from other data sources, ethnographies, and anecdotes from outside the US.

Given this report’s constrained focus on crack-cocaine and the numbers of newly incident crack users, any evaluation of its scientific or public health importance must be based upon a clear distinction between the individual-level risk of becoming a newly incident user and the population-level ‘incidence rate’ on one side (reflecting risk of *becoming* a user for the first time), versus a drug’s ‘prevalence proportion’ (reflecting probability of *being* a user at any point in time). As is taught in every introductory course on epidemiology, any condition’s prevalence is influenced by the composite of (i) its incidence rate, and (ii) the duration or persistence of the condition once it has started (Gordis, 2009).

Effective treatment or incarceration of persistent cocaine users might account for recent constraints on prevalence (because effective treatment or incarceration shortens duration, essentially terminating or reducing cocaine use, with potential secondary indirect effects on person-to-person spread of drug use). Accordingly, Behrens and colleagues (1999) argue that these control approaches are especially useful tools in drug epidemic end-stages. Nevertheless, there is reason to be uncertain about whether anyone should be claiming that members of the US cocaine treatment community or its criminal justice system now are ‘riding to glory on the descending limb’ of this crack epidemic curve. Perhaps the US survey evidence will support an assertion that “Whatever the drug, ‘the real front line in [curbing] these epidemics is treatment...’” (Khadaroo, 2013).

This new contribution has a specific focus on incidence rate estimation for crack-cocaine, which helped sustain US cocaine prevalence into the 1980s and beyond (but had not been

important in the first North American cocaine epidemic of the early 20th century; Musto, 1987). Lillie-Blanton and colleagues (1993), as well as Hatsukami and Fischman (1996), challenged popular misconceptions about crack during the recent mid-epidemic years. They noted that crack smoking might be differentiated from nasal insufflation of cocaine powder in relation to likelihood of developing cocaine dependence in the first years after onset of cocaine use (Chen and Anthony, 2004), but found little basis for claiming that crack-cocaine is inherently more harmful than cocaine HCl powder (Hatsukami and Fischman, 1996). Working from an ethnographic perspective, Golub and Johnson (1999) wondered whether seeds of a decline in crack-cocaine use were planted with an increased US domestic cultivation and increased availability of cannabis products (e.g., blunts) during the 1990s.

In an exploratory mode, we shed light on three specific facets of crack-cocaine epidemiology within the US, as can be illuminated via analyses of the NSDUH data: (a) whether the difficulty of getting a supply of crack-cocaine might have increased among subgroups 'at risk' for becoming newly incident users, (b) the duration of use among recently active users (a potential direct effect of treatment or incarceration), and (c) perceived cocaine-attributable risk of harm. We also seek out variations in incidence rates across population subgroups that might differentially benefit from public health interventions. Once published, this preliminary evidence from the NSDUH community surveys can be integrated in a future more comprehensive thesishlength coverage of other facts from US school surveys, treatment admissions, ethnographic observations, and drug law enforcement laboratory evidence (e.g., price, purity, and a potential role for recently introduced adulterants such as the antihelminthic agent levamisole), as well as non-US evidence about increased cocaine demand elsewhere.

2. MATERIALS AND METHODS

Data are from Institutional Review Board-approved NSDUH surveys, 2002–2011, which involved annual independently drawn nationally representative probability samples of US citizens aged 12+ years ($n=559,311$), made available via the Substance Abuse and Mental Health Data Archive (SAMHDA) public use datasets: Survey Documentation and Analysis (SDA), and Restricted-use Data Analysis System (R-DAS, <http://dx.doi.org/10.3886/ICPSR32101.v1>), as previously described in this journal (Seedall and Anthony, 2013). An online supplement offers more detail (e.g., survey items).

In brief, the NSDUH research design is cross-sectional with large multi-stage area probability samples that encompass community-dwelling US civilian residents, but with exclusion of active military personnel and institutional residents. Typically, 70%–75% of NSDUH eligible participants agree to complete its self-report confidential computer-assisted assessment.

Year-specific incidence of crack use, 95% confidence intervals (CI), and difference tests were derived via analyses with weighting and Taylor series linearization for variance estimates as required to probe for variations across years.

3. RESULTS

Figure 1 clearly depicts a ‘descending limb’ of the crack-cocaine epidemic curve via time-specific estimates of the ratio of newly incident users to the total ‘at risk’ susceptible US population from complementary SDA and R-DAS data. Here, the ‘at risk’ concept means that past crack-cocaine users (initiates in prior years) have been removed from each ratio’s denominator; past users are no longer at risk to become newly incident users. Table 1 describes characteristics of newly incident crack users.

NSDUH items ask about cocaine-attributable harmfulness, but nothing specific about crack. Gauged for cocaine products overall (including crack), in 2002–2003, an estimated 89.8% of ‘at risk susceptibles’ judged a ‘great risk’ of harm when cocaine is used 1–2 times each week (CI = 89.5%, 90.1%), while 71.2% judged ‘great risk’ when cocaine is used once per month (71.6%, 72.6%). Corresponding estimates for 2010–2011 are 88.4% (CI = 88.1%, 88.7%) and 70.7% (CI = 70.2%, 71.2%). Given the large survey samples, these attitudinal shifts have statistical significance ($p < 0.001$), even if they are judged to be modest relative to the observed sharp decline in crack-cocaine incidence. (We also note that the pool of ‘at risk susceptibles’ in the US is huge, such that a relatively small drop in an estimated proportion can refer to an important attitudinal shift for millions of individuals.)

A somewhat greater decline is seen when ‘at risk susceptibles’ are asked about difficulty to get crack ($p < 0.001$). In 2002–2003, just under 33% of these ‘at risk susceptibles’ said it was ‘probably impossible’ to get crack (CI = 31.9%, 33.0%), while 11.2% said that it was ‘very easy’ to get crack (CI = 10.8%, 11.5%); corresponding estimates for 2010–2011 are just under 38% (CI = 37.0%, 38.0%) and 8.7% (CI = 8.4%, 9.0%).

Any direct effect of treatment or incarceration on prevalence should be seen in dropping values for mean duration of use, to the extent that these ‘drug control instruments’ shorten or terminate crack-smoking. For those who had ever used crack, in 2002–2003, an estimated 12.4% either were currently enrolled in a cocaine treatment service, or their last treatment was for cocaine (CI = 10.2%, 15.0%). This estimate decreased trivially to 11.2% by 2010–2011 (CI = 9.3%, 13.5%; $p = 0.80$). In the same population of crack users who ever used, an estimated 6.1% were enrolled in treatment at a hospital, drug rehabilitation facility, or mental health center on October 1st of 2002–2003 (CI = 4.9%, 7.6%); the 2010–2011 estimate is 5.2% (CI = 4.1%, 6.5%; $p = 0.62$). As for effects of treatment or incarceration on mean duration of use, among recently active crack users of 2002–2003, the estimated mean duration of crack use is 9.3 years (median, 7.0 years). The corresponding estimate for 2010–2011 is 12.3 years (median, 12.0 years). If anything, this measure of duration of use showed an increase or no change.

Studying characteristics of the newly incident crack-smokers from 2002–2011, we found no statistically significant variations in male-female ratios ($p = 0.55$), or relative distributions of age subgroups (all $p > 0.05$). Acceptably small coefficients of variation were present for non-Hispanic Whites (i.e., 0.13% incidence in 2002–2003; 2010–2011: 0.04%; $p < 0.001$), but numbers of crack-smoking initiates in other race-ethnicity subgroups were small and had unacceptably large coefficients of variation.

4. DISCUSSION

By 2011, the US crack epidemic curve shows a descending limb, with annual incidence approaching zero values. We discovered an understandable concurrent upward shift in difficulty to obtain crack, but no more than modest increase in perceived cocaine-attributable harm. Given increasingly small numbers of newly incident crack users, race-ethnicity variations could not be studied. Analyzed in relation to the functional inter-relationships that link prevalence, incidence, and duration, the process seems to involve prevention of newly incident crack-cocaine use; there is little evidence of change in the duration of cocaine use among recently active users as one might expect from a major impact of treatment or incarceration. For these reasons, we are very hesitant to speculate that any one particular US agency should be ‘riding to glory’ on this epidemic curve’s descending limb.

A search for other epidemiologically credible crack-specific indicators for the US disclosed many interesting details about cocaine powder in general, but in general crack indicators have been combined with cocaine indicators, without specificity. For example, the National Institute on Drug Abuse (NIDA)’s Community Epidemiology Work Groups (CEWG) try to form consensus-based syntheses of all available drug indicators, but in general have combined crack formulations with cocaine HCl powder formulations. Nonetheless, in CEWG reports on some US jurisdictions, crack-cocaine has been mentioned as a major public health and public safety concern through late 2011 (NIDA, 2012). Thereafter, some interesting developments are reported (e.g., in Cincinnati, declining crack-cocaine treatment admissions increased law enforcement seizures of crack, declines in product quality of the product; NIDA, 2013). Anonymous reviewers mentioned adulteration of cocaine with antihelminthic agents (e.g., levamisole), as well as possible reduced coca bush production and increased cocaine demand outside the US, but we are hesitant to claim that any US agency is responsible for these developments, or that they account for reduced numbers of crack initiates in the US.

On principle, a major drop in ‘new adopters’ (crack initiates) should signify a marked reduction in demand, markedly dropping prices and/or increasing purity. However, reports from the CEWG and drug law enforcement suggest no more than modest reductions in crack prices and possibly no change in crack purity -- notwithstanding serious concerns expressed about validity of drug law enforcement cocaine price and purity values (Manski et al., 2001).

Limitations of this study include its focus on community-dwelling persons, a reliance on self-report data, and the limited nature of NSDUH public use datasets, but we have found no reason to suspect increasing invalidity of survey self-reports about crack-cocaine use across the relatively short time span from 2002–2011. A counterbalancing strength is the stability of NSDUH methods across this interval. In addition, whereas the Monitoring the Future (MTF) study is tightly focused on school-attending youths, and yields no time-specific estimates for numbers of crack initiates, we note MTF estimates suggestive of recent declines in crack-cocaine smoking prevalence. MTF estimates for crack-cocaine risk perceptions and disapproval ratings show no appreciable variation in recent years; some of

the trend estimates from follow up of 12-graders into the adult years actually indicate declines in perceived harmfulness (Johnston et al., 2013).

We conclude our ‘short communication’ by describing a challenge for future research on crack-cocaine epidemiology, including a need to synthesize these new NSDUH estimates with material from other data sources, possibly along lines recently sketched by Fryer and colleagues (2013) for the epidemic years before 2002. Against this background NSDUH evidence on the descending limb of the US crack-cocaine epidemic curve and the concurrent increase in difficulty to obtain crack among ‘at risk susceptibles’ in US communities-at-large, we see no good evidence of markedly increased perceptions of harmfulness nor treatment- or incarceration-induced reductions in mean duration of use. For the time being, the ‘at risk’ susceptibles seem to be ‘riding to glory’ on the descending limb, but no specific treatment, law enforcement, or other drug agency in the United States can lay claim to success in curbing this particular drug epidemic.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Estimated Incidence of Crack-Cocaine Use in the United States, 2002–2011, with 95% Confidence Intervals. Data on newly incident crack-cocaine users in US communities from complementary SDA and R-DAS public use datasets of the National Surveys on Drug Use and Health (NSDUH).*

● NSDUH ■ R-DAS

* NSDUH public use datasets are available in two forms: (1) the Survey Documentation and Analysis System (SDA), and (2) the Restricted - Data Analysis System (R-DAS). SDA provides analysis weights and variance estimation tools for both online analyses and downloadable datasets, year by year. R-DAS provides analysis weights and variance estimation tools strictly for contingency table analyses, with no downloadable datasets, with analysis weights constructed for (a) pairs of years, as shown above (2002–2003, 2004–2005, etc.), and (b) 4-year and 8-year aggregates. The SDA and R-DAS samples for these public use datasets can be considered in terms of a Venn diagram. Many participants in the SDA sample also are members of the R-DAS sample set. Nonetheless, some members of the SDA set are not members of the R-DAS set. It is possible to state specific unweighted numbers for each cell in an SDA analysis, but this possibility does not exist for the R-DAS analyses. Instead, it is necessary to derive approximate unweighted R-DAS cell sizes; exact unweighted cell counts are not provided.

Table 1

Characteristics of newly incident crack-cocaine users in the United States: weighted proportions (Panel A) and unweighted numbers (Panel B). Data from the United States National Surveys on Drug Use and Health, 2002–2011.

Panel A: Weighted Two-Year Estimated Proportions for Sex, Age and Race-Ethnicity Subgroups. ^a Data from R-DAS.					
Subgroup of Interest	Estimated Distribution of Newly Incident Crack-Smokers (% of Subgroup Total), Specific for Subgroups under Study				
	2002/3	2004/5	2006/7	2008/9	2010/11
Sex					
Male	53.0	45.9	65.9	54.0	47.5
Female	47.0	54.1	34.1	46.0	52.5
Age					
12–17 Years	26.4	16.7	15.9	11.9	20.7
18–25 Years	35.8	57.3	38.2	49.9	49.8
26 Years +	37.8	26.0	45.9	38.2	29.5
Race/Ethnicity					
Non Hispanic White ^b	76.9	83.8	67.5	84.2	84.8
Non Hispanic Black/African	2.4	1.6	18.7 ^c	2.6	1.6
Non Hispanic Other	8.5	3.4	6.5	2.8	4.9
Hispanic	12.2	11.2	7.3	10.4	8.7

Panel B: Unweighted Two-Year Approximate Numbers for Sex, Age and Race-Ethnicity Subgroups. [*] Data from SDA. ^{**}					
Subgroup of Interest	Unweighted numbers of newly incident crack-cocaine smokers				
	2002/3	2004/5	2006/7	2008/9	2010/11
Sex					
Male	136	128	122	81	48
Female	145	114	116	76	44
Age					
12–17 Years	120	64	67	32	21
18–25 Years	132	161	146	103	64
26 Years +	29	17	25	22	7
Race/Ethnicity					

Panel B: Unweighted Two-Year Approximate Numbers for Sex, Age and Race-Ethnicity Subgroups. * Data from SDA. **						
Subgroup of Interest	Unweighted numbers of newly incident crack-cocaine smokers					
	2002/3	2004/5	2006/7	2008/9	2010/11	
Non Hispanic White	212	189	173	116	69	
Non Hispanic Black/African	4	5	10	3	2	
Non Hispanic Other	25	14	32	16	10	
Hispanic	40	34	23	22	11	
TOTAL	281	242	238	157	92	

a. The denominator for these year-specific proportions is the total number of newly incident crack-smokers that year (e.g., in 2002/3, an estimated 53.0% of newly incident crack-smokers were male; the corresponding male estimate for 2010/11 is 47.5%).

b. The p-value reported in the text is based on the null hypothesis that the 2002/3 subgroup estimate is not different from the 2010/11 subgroup estimate.

c. Estimated proportion from 2006/7 in Non Hispanic Black/African Americans has large variation driven by small-unweighted numbers.

* The unweighted numbers reported in the Panel B are based on NSDUH derived definition of incident crack users (see Appendix A for more information).

** These numbers are from SDA as they are not available in R-DAS. (See footnote to Figure 1.)