Trends in the US Prevalence of Drug-Using Parturient Women and Drug-Affected Newborns, 1979 through 1990

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ABSTRACT

Objectives. There has been a lack of reliable national data on the number of pregnant women using drugs and the number of newborns affected by such use. The major reasons for this lack have been inadequate sampling and data collection procedures and the lack of a risk assessment perspective in analysis. This paper corrects for these inadequacies.

Methods. Data from 1979 through 1990 from the National Hospital Discharge Survey, an annual survey by the National Center for Health Statistics, were analyzed.

Results. Between 1979 and 1990 there was a 576% increase in the rate of discharges of drug-using parturient women in the United States and a 456% increase in the rate of discharges of drug-affected newborns. After adjustment for underreporting, a "best estimate" of the number of discharges from 1988 through 1990 was about 88 000 per year for drug-using parturient women and about 48 000 per year for drug-affected newborns.

Conclusions. Although the data support the occurrence of a national epidemic of drug use among pregnant women during the 1980s, the size and severity of this epidemic have been overstated. (*Am J Public Health.* 1994;84:1433–1438)

Introduction

Although much has been written about an epidemic of drug use among pregnant women in the United States during the 1980s, two recent research papers have noted that there have been almost no reliable national data on the prevalence or incidence of such use in particular years or on the nature of the historical trend associated with such use.[1,2] National data on the use of drugs by pregnant women is of special interest because of the effect drug use might have on the health of women and their newborns. The lack of reliable national data has made it difficult to estimate both the extent and seriousness of the national problem and the amount of medical and other societal resources needed to deal with the problem.

This lack of national data was partially corrected in a 1991 paper in which we used data from the National Hospital Discharge Survey (NHDS) to examine the historical trend in diagnosed drug-related births in US hospitals between 1979 and 1987.[3] Of all the recent studies of drug use affecting newborns, this is the only study with both a representative national sample and reliable data collection techniques. This study found a 339% increase between 1979 and 1987 in the estimated discharge rate for newborns with a drug diagnosis. However, after adjustment for underreporting, the absolute number of newborns with a drug diagnosis in 1987 was estimated to be about 38 000—an estimate that was much smaller than others reported in the literature. In this paper we expand the previous study by presenting data extending the historical trend for drug-affected newborns to 1990.

We also present data on the historical trend between the years 1979 and 1990 for the US population of pregnant women diagnosed as using drugs at the time they entered the hospital for delivery. These women will be labeled "drug-using parturient women" to distinguish them from the larger population of pregnant women who used drugs at some time during their pregnancy.[2] The data on parturient women are from the same set of annual surveys used for our previous study of drug-affected newborns;[3] however, the data on newborns and the data on parturient women were collected independently of one another within each annual survey. This means that information about a mother cannot be linked to information about her child. As a result, each annual estimate of the number and rate of drug-using parturient women is an independent estimate of the number and rate of drug-exposed newborns.

Methods

Data Sources

Data for the present study are from the NHDS, which is conducted annually in the United States by the National Center for Health Statistics (NCHS). Survey responses were analyzed from public use files for the 12 years 1979 through 1990. This survey uses a stratified probability sample and weights to pro-

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Note. The views expressed in this paper are the authors' and do not necessarily represent those of the Washington Consulting Group or the National Institute on Drug Abuse.

TABLE 1—Diagnostic Codes Used in Study

Description of Diagnosis	ICD-9-CM Code(s)[13]
General	
Drug psychoses	All 292's
Drug dependence	All 304's
Nondependent abuse of drugs	305.2–305.9
Polyneuropathy due to drugs	357.6
Pregnancy and birth	
Drug dependence complicating pregnancy	648.3
Suspected damage to fetus from drugs	655.5
Narcotics/hallucinogens affecting fetus/newborn	760.72, 760.73
Drug withdrawal syndrome in newborn	779.5
Poisoning	
Poisoning by analgesics	965.0, 965.8, 965.9
Poisoning by sedatives and hypnotics	967.0–967.6, 967.8, 967.9
Poisoning by other central nervous system depressants	968.0, 968.5
Poisoning by psychotropic agents	969.0–969.9
Poisoning by central nervous system stimulants	970.0–970.9
Adverse effects of drugs properly used in therapy	E935.0–E935.2, E937–E940

duce national estimates of all discharges from the approximately 6000 nonfederal short-stay hospitals in the United States. As these hospitals account for more than 99% of all births occurring in the United States,[4,5] very few births are not represented in the sample. Overall details of the NHDS's data collection, sampling, and coding strategies can be found in annual reports published by NCHS[6] and in a recent paper by Shimizu.[7]

NCHS redesigned the sample in 1988. Therefore, differences in NHDS estimates between 1987 and 1988 could result from sampling changes rather than changes in hospital utilization. In this study, however, we found no statistically significant differences between the years 1987 and 1988, so the sampling change does not present a problem when interpreting the overall trend presented here.

As stated above, the NHDS uses a complex, stratified sampling scheme. Therefore, to avoid confusion, all national data in the text and tables of this paper attributed to the NHDS are weighted population estimates unless otherwise stated. The number of sample cases underlying each drug-related estimate is found in the footnotes to the tables.

Statistical Techniques

NCHS has established reliability guidelines for using survey results from the NHDS.[6,8,9] To comply with these guidelines, sample cases in this study were aggregated over several years when necessary to create groups of sample size greater than or equal to 30 for newborns and greater than or equal to 60 for parturient women. However, because of the sample redesign referred to above, data for the years before 1988 were never combined with data for 1988 and later years. For combined time periods, the estimate given is an annual average estimate for each year included in the time period.[6,8–11]

Research on the incidence of drug use during pregnancy has focused on the number of cases rather than on rates. The number of cases allows for estimates of the costs or amount of resources needed to deal with problems associated with drug use during pregnancy. However, rates are more useful for assessing such relationships as changes over time, differences between populations, and differences between studies, because rates standardize for differences in population size. Here we present estimates of both numbers and rates. All differences between estimates discussed in this paper are statistically significant ($P < .05$) as determined by a multiple t test based on the Bonferroni inequality.[12]

Identification of Drug Users

Table 1 lists the diagnostic categories considered to indicate a drug-affected newborn or drug use by a parturient woman. A discharge was coded as drug-related if one or more of these *International Classification of Diseases,* Ninth Revision, Clinical Modification[13] (ICD-9-CM) diagnoses was found on the discharge record. However, not all the diagnostic categories listed were actually found.

The types of ICD-9-CM codes selected to identify drug-related discharges can affect both the shape of the historical trend and the total number of cases found. This study follows Rice and Kelman in including E-codes in the set of identifying codes.[10] E-codes indicate adverse effects associated with drugs used properly in treatment. They are included here on the assumption that some physicians may have substituted E-codes for other, more stigmatizing, drug codes when recording drug diagnoses. As this inclusion expands the universe for identifying drug discharges, this paper presents a worst-case scenario in its estimates of the total number of drug-related discharges at any given time.

Results

Drug Use among Parturient Women

Table 2 shows the historical trend in the United States in the estimated average annual number and rate of discharges for drug-using parturient women for the whole decade of the 1980s. The results shown in this table indicate that there was a continuing increase in these numbers and rates during this time. For example, the average annual number of discharges involving drug-using parturient women increased by 624%, from 3799 discharges in the 1979 through 1981 time period (95% confidence interval [CI] = 2389, 5209) to 27 506 discharges in 1990 (95% CI = 23 062, 31 950). The average annual discharge rate also showed a large increase (576%) over the 12 years examined, rising from 10.1 discharges per 10 000 parturient women in the 1979 through 1981 time period to 68.3 in 1990.

Although the impression given by Table 2 is of an alarming continuous increase in the number and rate of discharges for drug-using parturient women during the 1980s, this rate of increase was continuously diminishing. The rate of increase in the number of discharges for drug-using parturient women between the 1979 through 1981 and 1982 through 1984 time periods was 102% (a doubling of the number). This rate of increase dropped continuously throughout the decade until, finally, between 1989 and 1990, the number of discharges for drug-using parturient women decreased by 13%. These statistics demonstrate that drug use by parturient women was increasing at a slower rate throughout the decade, so that by the 1988 through 1990 time period a leveling

TABLE 2—Estimated Number and Rate of Discharges of Parturient Women with a Drug Diagnosis from Nonfederal Short-Stay Hospitals: United States, 1979 through 1990

Year of Discharge	Average Annual No. of Parturient Women		SE for Drug Discharges	Estimated Range of the No. of Parturient Women with a Drug Diagnosis		Rate per 10 000 Parturient Women	Increase in Annual Average No. from Previous Time Period, %
	Total	With a Drug Diagnosis		Low	High		
1979–1981	3 773 719	3 799	719	2 389	5 209	10.1	NA
1982–1984	3 924 429	7 664	870	5 959	9 369	19.5	102
1985–1986	3 808 084	14 536	1 199	12 186	16 886	38.2	90
1987	3 910 926	19 597	1 703	16 259	22 935	50.1	35
1988	3 780 654	28 375	3 567	21 385	35 365	75.1	45
1989	3 936 703	31 706	4 255	23 367	40 045	80.5	12
1990	4 025 456	27 506	2 267	23 062	31 950	68.3	-13

Note. Years were combined to meet National Center for Health Statistics (NCHS) reliability guidelines. Sample sizes for parturient women with a drug diagnosis were as follows: for 1979–1981, n = 68; for 1982–1984, n = 121; for 1985–1986, n = 131; for 1987, n= 98; for 1988, n = 237; for 1989, n = 315; for 1990, n = 247. A discharge was counted as a drug-diagnosis discharge if any of up to seven diagnoses on the discharge record was a drug diagnosis. Standard errors were estimated as follows: before 1988, from charts in the National Hospital Discharge Survey (NHDS) annual summaries[6]; after 1988, from empirical equations in the documentation accompanying the public use tapes. The "low" and "high" estimates are based on 95% confidence intervals.

Source. National Hospital Discharge Survey, NCHS (original tabulations from public use tapes).

off had occurred in the number and rate of discharges.

A Comparison of Parturient Women and Newborns

The historical trend. The number of drug-using parturient women may be considered a surrogate measure for the number of newborns exposed to drugs at the time of delivery. But measures of exposure do not necessarily indicate the number of exposed persons with detrimental effects. The toxicity and risk assessment literatures stress the importance of maintaining a distinction, both theoretically and empirically, between the number of persons exposed and the number of persons who have received a biologically effective dose.[14–18] Therefore, a comparison between the data on drug-using parturient women and the data on drug-affected newborns may shed some light on the relationship between exposure to drugs (in the aggregate) at birth and aggregate adverse health outcomes associated with that exposure.

The basis for such a comparison was published in the paper on newborns discussed above.[3] In that paper we examined the historical trend between 1979 and 1987 in the number of newborns discharged with a drug diagnosis. All newborns with one or more drug diagnoses on their discharge records were labeled as "drug-affected." While the phrase "drug-affected newborn" does not imply any adverse health condition other than the existence of a drug diagnosis on the discharge record, many newborns with a drug diagnosis had adverse health problems at birth. For example, about 84% of all newborns with a drug diagnosis had either drug withdrawal symptoms (ICD-9-CM code 779.5) or a nondrug medical diagnosis indicating health problems other than drug exposure. The remaining 16% were coded 760.72, indicating the presence of narcotics without any specified adverse health outcome.

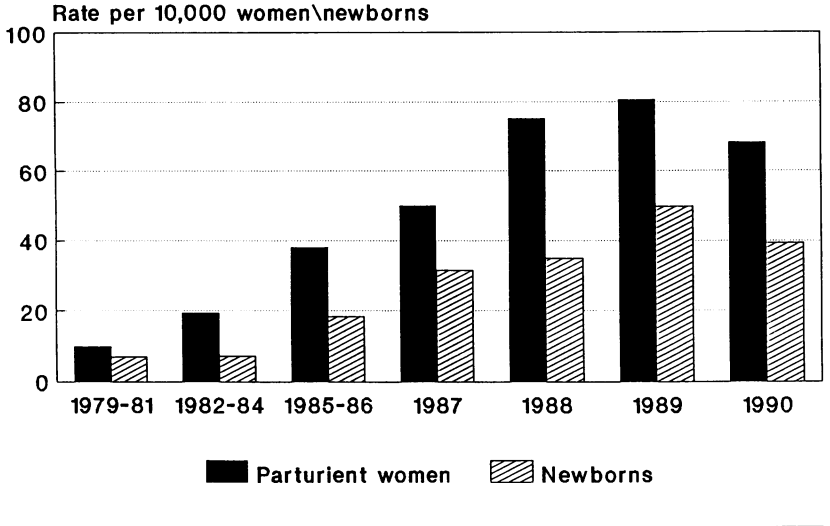

FIGURE 1—Average annual rates of women and newborns with drug-related diagnoses: United States, 1979 through 1990.

Combining data on drug-affected newborns from the previous paper with new data for the 1988 through 1990 time period calculated for this paper, Figure 1 compares the historical trend between 1979 and 1990 in the discharge rate for drug-using parturient women and drug-affected newborns (as defined above). The overall curve for drug-using parturient women is very similar to the overall curve found for drug-affected newborns. Both show a rapid and continuous rise in the rate of drug-related discharges until 1989 and then a decrease in 1990. The overall similarity in the shape of the historical trend for the two populations suggests two things: first, that these two populations represent two aspects of one phenomenon, drug exposure among newborns, and second, that each of the

TABLE 3—Estimated Average Annual Number and Rate of Discharges with a Drug Diagnosis for Newborns and Parturient Women, for the Combined 3-Year Period 1988 through 1990

Population	Average Annual No. of Discharges: Total	Average Annual No. of Discharges: With a Drug Diagnosis	SE for Drug Discharges	Estimated Range of the No. of Discharges with a Drug Diagnosis: Low	Estimated Range of the No. of Discharges with a Drug Diagnosis: High	Rate per 10 000
Newborns	3 828 702	15 846	2 519	10 908	20 784	41.4
Parturient women	3 914 271	29 196	3 334	22 660	35 731	74.6

Note. Years were combined to get a best estimate. Sample size for parturient women with a drug diagnosis for the combined years is 799. Sample size for drug-affected newborns for the combined years is 512. A discharge was counted as a drug-diagnosis discharge if any of up to seven diagnoses on the discharge record was a drug diagnosis. Standard errors were estimated from empirical equations in the documentation accompanying public use tapes for these years. The "low" and "high" estimates are based on 95% confidence intervals.
Source. National Hospital Discharge Survey, NCHS (original tabulations from public use tapes).

populations is a reliable indicator of the national historical trend in drug-related discharges associated with pregnancy in short-stay hospitals in the United States. The decrease in the rate for 1990 is suggestive because it is found in both populations examined. Whether this 1-year decline in the otherwise continuous increase represents the beginning of a long-term decrease or is merely a short-term phenomenon cannot be ascertained at this time.

Although the curves are similar, the rates shown in Figure 1 also suggest that the two populations do not represent exactly the same phenomenon. In every time period examined, the rate per 10 000 for drug-using parturient women was notably higher than the rate per 10 000 for drug-affected newborns. Of the seven possible comparisons in Figure 1, five differences are statistically significant at the .05 level, and these differences are important in an absolute sense. On the average, over all 12 years, the number of drug-affected newborns was only 53% of the number of parturient women diagnosed as using drugs.

Best estimates for 1988 through 1990. For comparisons with other studies in the literature, average estimates for the 3 years 1988 through 1990 are desirable because the single estimates in this paper for these years are not statistically different from one another ($P > .05$). Furthermore, the direction of the historical trend is inconsistent, first rising and then falling over this time period. This seems to indicate a leveling of the historical trend, which is best represented by a single average estimate. Such an estimate is also based on a larger number of sample cases, thus increasing statistical reliability.

Table 3 indicates that the average annual estimate of the number of discharges for drug-using parturient women in the United States during 1988 through 1990 was 29 196 discharges per year (95% CI = 22 668, 35 731). For drug-affected newborns, the average annual estimate for the same 3 years was 15 846 discharges per year (95% CI = 10 908, 20 784). The associated average annual rate of drug use per 10 000 parturient women was 74.6; the average annual rate of newborns who were born drug-affected was 41.4 per 10 000.

Discussion

The Historical Trend

The results reported here give strong support to the perception that an epidemic of drug use among pregnant women occurred in the United States between 1979 and 1990,[19] although changes in physicians' reporting practices and increased use of improved drug testing technology may have also contributed to the results.[3]

A reverse trend for drug use has been reported among women of childbearing age (i.e., between the ages of 15 and 45).[1] Khalsa and Gfroerer, using the Household Survey on Drug Abuse sponsored by the National Institute on Drug Abuse, show that the rate of previous-month drug use among these women decreased from about 1500 drug-using women per 10 000 in 1985 to about 800 in 1990.[1] This is a 47% drop in the rate for previous-month users over this 5-year period.

These contrasting results suggest that modeling drug use among pregnant women on the basis of drug use among women of childbearing age, as was done in a recent Institute of Medicine study,[20] would lead to erroneous estimates of both direction in historical trend and incidence of use. Drug-using parturient women seem to be a distinct subpopulation within the larger population of childbearing women, who have historically been immune to the social forces causing drug use to decrease. Instead, countervailing forces increased drug use among this subpopulation.

Assessing Incidence

Each annual discharge in the NHDS represents both a new case (incidence) and a specific person because it is rare for a woman to deliver more than one child in a 12-month period. Given that this assumption is valid, neither the data for parturient women nor the data for newborns support the higher national estimates of the number of drug-using pregnant women (or drug-exposed newborns) presented in the literature for the years 1988 through 1990. Most of these estimates have ranged between 100 000 and 739 000 women or newborns with a drug diagnosis.[20–26] The best annual estimate for these years based on the NHDS is only 29 196 drug-using women or newborns exposed to drugs. The best annual estimate of the number of drug-affected newborns is 15 846. These numbers raise questions about the reliability and validity of the higher national estimates found in the literature. Because none of the other estimates were derived from surveys with both representative samples of all births in the United States and reliable data collection techniques, these findings suggest that the number of drug-using pregnant women and drug-affected newborns was much smaller in this time period than previously thought.

Adjusting for Underreporting

One criticism of using the NHDS to study the incidence of drug-related discharges is that the survey produces low numbers because drug use is underreported on discharges. We used findings on underreporting from local drug testing studies comparing self-reports with biomarker indications (urine, hair, meconium, and so forth) to construct an algorithm for adjusting estimates from the

NHDS.[3] While these studies varied greatly in the amount of false reporting found, an upper bound for underreporting could be assessed. The results suggested that findings from the NHDS should be weighted by a multiplier of 3 for estimates from 1986 through 1990.[3] This statistical adjustment for underreporting is found in Table 4.

Because the adjusted numbers in Table 4 represent statistical adjustments based on a limited number of studies from local hospitals in areas of high drug use, they should be thought of as provisional, but they are nevertheless revealing. They indicate that after adjustment for probable underreporting, only about 88 000 pregnant women per year can be estimated to have used illicit drugs at the time of delivery in the United States during the 1988 through 1990 time period (95% CI = 67 984, 107 192). During the same time period, after adjustment for underreporting, the estimate is that only about 48 000 newborns might have been adversely affected by drugs annually in the United States (95% CI = 32 726, 62 350). The equivalent estimated national rates per 10 000 are 224 drug-using parturient women and 124 drug-affected newborns.

TABLE 4—Estimated Average Annual Number and Rate of Discharges with a Drug Diagnosis for Newborns and Parturient Women, Adjusted for Underreporting, for the Combined 3-Year Period 1988 through 1990

Population	Average Annual No. with a Drug Diagnosis	Adjustment Factor	Adjusted No. with a Drug Diagnosis	Adjusted SE	Adjusted Range of the No. with a Drug Diagnosis		Adjusted Rate per 10 000
					Low	High	
Newborns	15 846	3	47 538	7 557	32 726	62 350	124.2
Parturient women	29 196	3	87 588	10 002	67 984	107 192	223.8

Assessing Risks to the Newborn

Perhaps the most interesting finding of this study is the gap in incidence between the number of drug-using parturient women and the number of drug-affected newborns. This gap was found in each time period and was always in the same direction. While the gap varied in size among time periods, on average over all 12 years the number of discharges for drug-affected newborns was estimated to be only about half (53%) of the number of discharges for drug-using parturient women.

Two possible explanations (or hypotheses) for this phenomenon come to mind, neither of which can be tested with the data on hand. The first, and most likely, explanation is that the gap represents an exposure–toxicity relationship. In the exposure–toxicity hypothesis, the gap represents the aggregate risk that a drug-exposed newborn will have an adverse health outcome. There is support for this explanation in the literature. For example, the biomarker literature suggests that many exposed newborns appear normal at birth despite a finding of drug use by the mother.[27] Also, Chasnoff reports that fewer than half of newborns exposed to cocaine in utero show any adverse effects at the time of birth.[22] This explanation of the gap is also consistent with the general model for environmental risk assessment research recommended by the Environmental Protection Agency.[15,16]

The second explanation is that the gap represents reporting errors. For the reporting error hypothesis to be likely, the recording of diagnoses for parturient women and newborns would have to represent independent acts wherein knowledge of the medical condition of one partner in the mother–newborn pair does not affect the diagnosis given the other partner. This condition does not hold for the diagnoses under investigation here. For example, it is hard to believe that attending medical personnel who are aware that the mother used drugs prior to delivery would not diagnose the newborn as drug-affected unless the newborn appeared unaffected by the mother's use of drugs. This implies the hypothesis that, during the 1980s, it was customary for medical personnel to give a known drug-exposed newborn a drug diagnosis only when the newborn either had a diagnosable adverse medical condition or tested positive for drugs. From a risk assessment perspective, therefore, a parturient woman could be correctly diagnosed as drug-using while her newborn was not diagnosed as drug-affected, implying an exposure–toxicity relationship of less than one.

Errors in the opposite direction also do not invalidate the exposure–toxicity hypothesis. These errors occur when a physician discovers that a newborn has tested positive for drugs but fails to classify the mother as drug-using. Such errors underestimate the number of drug-using parturient women, making the incidence gap smaller than it otherwise would be.

The consistency, size, and direction of the gap, plus the lack of independence in diagnoses, make it unlikely that the gap is primarily the result of reporting errors. Rather, the gap represents the risk, when examining aggregates, of an adverse health outcome among newborns exposed to drugs near the time of delivery.

While this risk (approximately 0.5) suggests a very high rate of toxicity if all cases are attributed to drug exposure, it raises questions about some methods used in the literature to estimate the number of drug-affected newborns at birth. For example, studies that use the number of drug-using pregnant women as a surrogate measure of the number of newborns adversely affected by drugs would overstate this number by about 100%. The key variable in assessing the burden on hospital services of exposure to a toxic substance is not the number exposed but the number adversely affected by the exposure. If there is no adverse health outcome, then there is no medical reason for special treatment, longer lengths of stay, or other extra services that lead to higher costs and additional burdens on a hospital system. Studies that use an estimated national incidence of more than 50 000 adversely affected newborns to estimate the national hospital costs associated with drug-related births (such as that of Phibbs et al.[28]) overstate the burden on the US hospital system.

Furthermore, the results presented here on the number of drug-affected newborns only indicate an upper bound for the possible toxic effect of drug use (in the aggregate) during pregnancy. This is because evidence is accumulating that many pathological conditions in the newborn thought to be directly attributable to drugs may instead be attributable to other causes associated with drug use by the mother.[2,14,29–32]

Our findings support the perception that drug use among pregnant women steadily increased during the 1980s until 1988, when it appeared to level off. However, the findings do not support

other perceptions concerning drug use during pregnancy. The estimated number of drug-using pregnant women and drug-affected newborns in the 1988 through 1990 time period was much smaller than would be expected on the basis of other reports in the research literature and popular media. The reason for the discrepancy seems to be a lack of representative samples and reliable data collection methods in the studies from which these reports were derived. Finally, the risk of an adverse health outcome among newborns exposed to drugs was found to be much smaller than the risk implied in many discussions of drug use during pregnancy. Above all, our findings do not support the model that one instance of drug exposure in the mother always yields an adverse health outcome in the newborn. One must conclude, therefore, that while an epidemic of drug use among pregnant women did take place during the 1980s, both the size and the severity of the epidemic have been overstated. □

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