Carisoprodol Abuse in Texas, 1998–2003

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ABSTRACT

Introduction: Texas poison centers identified carisoprodol as a skeletal muscle relaxant that is subject to abuse, and this investigation explores the abuse reported by Texas poison centers.

Methods: This study used data from six Texas poison centers to describe the epidemiology of carisoprodol abuse and drug identification (ID) calls from 1998 to 2003.

Results: Drug ID and abuse calls were 217% higher in 2003 than in 1998. Although eastern and central Texas contains 43% of the state's population, this region reported 77% of all drug ID calls and 64% of abuse calls. Male patients accounted for 51% of abuse calls and 37% of other human exposure calls. Patients from 13 to 19 years of age accounted for 17% of abuse calls and 9% of other human exposure calls. Among those human exposure calls with a known medical outcome, a higher percentage of abuse calls involved minor effects while a greater proportion of other human exposure calls involved outcomes that ranged from moderate effects to death.

Conclusions: Carisoprodol abuse is increasing in Texas and is substantially more common in the eastern part of the state. Carisoprodol abuse is much more likely, than other types of adverse carisoprodol exposures, to involve males and adolescents; and it less likely to involve adverse medical outcomes.

INTRODUCTION

Carisoprodol (N-isopropyl-2-methyl-3-propyl-1,3-propanediol dicarbamate; N-isopropylmeprobamate) is a skeletal muscle relaxant. Although carisoprodol itself is not controlled on the federal level, its active metabolite, meprobamate, is an addictive sedative and a Schedule IV controlled substance. Carisoprodol is marketed under a variety of brand names such as Soma®, Carisoma®, Flexartal®, Rela®, Sanoma®, Sodal®, Somadri®, Soprodol®, and Soridol®; and it serves as the only active ingredient or in combination with other drugs such as aspirin and codeine. The method of action of carisoprodol is unclear [1]. In the United States in 2003, carisoprodol ranked thirty-sixth among generic

drugs by number of prescriptions (9,536,000 prescriptions) and thirty-second by retail dollars (\$283,336,000) [2,3].

Abuse of carisoprodol, either alone or in combination with other substances, is known to occur [4–7]. In 1997 in Cincinnati, Ohio, carisoprodol was the fifth most common diverted prescription drug according to the police and eighth most common abused prescription drug according to the local poison center [8]. Carisoprodol abuse is important because use of the drug may result in impairment of driving ability and may lead to dependency [9–12]. Carisoprodol may result in a variety of adverse effects that impact various organ systems; such as: the central nervous system (drowsiness, lightheadedness, dizziness, fatigue, loss of motor coordination, insomnia, stupor, coma), cardiovascular

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function (tachycardia, facial flushing), respiratory function (dyspnea, respiratory depression), musculoskeletal function (hypertonia, tremor), skin responses (rash, hives), gastrointestinal responses (nausea, vomiting), and ocular function (blurred or burning vision, nystagmus) [1,13]. Carisprodol overdose has also been reported to result in an unusual movement disorder involving agitation, hypertonia, and myoclonic encephalopathy [14,15]. The effects of carisprodol may be potentiated with the use of other substances such as alcohol or other central nervous system depressants [1]. Deaths have been reported with carisprodol use [13,16].

The objective of this investigation was to describe the patterns of carisprodol abuse identified by six poison centers over a recent six-year period. Poison centers receive calls involving substance abuse as well as drug identification (ID) calls, a portion of which represent calls by potential abusers wanting to confirm the drug and a portion of calls from law enforcement officials wanting to identify confiscated substances [17–19]. Drug ID calls can also provide an indirect measure of substance abuse in a known population.

MATERIALS AND METHODS

Data for this retrospective study were obtained from the six poison centers that comprise the Texas Poison Center Network (TPCN). All six poison centers use the same Toxicall software and the Toxic Exposure Surveillance System (TESS) database to collect information from calls. Cases included all calls, involving carisprodol, received by the TPCN from 1998 to 2003.

The distribution of cases was identified by major type of call (human exposures, animal exposures, drug IDs, or other information requests). Until 2002, information on the source of a drug ID call (whether from a public citizen, health care provider, or law enforcement official) was not collected, so the source of drug ID calls was not evaluated in this study. The number of cases by year was determined by four categories of calls: (1) all calls, (2) all drug ID calls, (3) all human exposure calls, and (4) those

human exposure calls involving abuse. Abuse calls were defined as those human exposure calls involving intentional misuse or abuse of carisprodol and excluded unintentional misuse and suspected suicide calls. These four categories were then examined for annual trends and statistical significance determined by calculating the Chi-square test for trend.

Texas is divided into eleven Public Health Regions (PHRs). The distribution of carisprodol drug ID and abuse calls by PHR was determined and compared to the total population distribution based on information from the 2000 Census.

Abuse calls were then compared to all other human exposure calls with respect to patient gender, patient age, exposure site, management site, and medical outcome. The groupings within these variables were based on the categories in the TESS database. The medical outcome categories were defined as follows: no effect (no symptoms due to exposure), minor effect (some minimally troublesome symptoms), moderate effect (more pronounced, prolonged symptoms), major effect (symptoms that are life-threatening or cause significant disability or disfigurement), and death.

All variables were unavailable for all of the relevant cases, so the sum of the subcategories might not equal the total number of calls. Comparisons between abuse calls and all other human exposure calls were evaluated for statistical significance by calculating the ratio of the rate among abuse calls to the ratio of the rate among other exposure calls and the 95% confidence intervals by Poisson probability using the Fisher’s exact text.

RESULTS

The TPCN received 11,184 carisprodol calls from 1998 to 2003. Of these calls, 5,570 (49.8%) were human exposures, 54 (0.5%) animal exposures, 4,871 (43.6%) drug IDs, and 689 (6.2%) other information. Of the human exposure calls, 936 (16.8%) were abuse calls.

Table 1 presents the distribution of carisprodol calls by year. All examined categories of calls increased over the six-year period.

TABLE 1. Distribution of carisprodol calls received by the TPCN from 1998 to 2003 by year						
Year	All calls No.	Drug ID calls		Human exposure calls No.	Abuse calls	
		No.	% of all calls		No.	% of human exposure calls
1998	1,215	442	36.4	653	83	12.7
1999	1,696	745	43.9	789	135	17.1
2000	1,495	528	35.3	886	109	12.3
2001	1,726	610	35.3	1,017	175	17.2
2002	2,336	1,119	47.9	1,079	199	18.4
2003	2,716	1,427	52.5	1,146	235	20.5
Total	11,184	4,871	43.6	5,570	936	16.8

TABLE 2. Distribution of selected carisoprodol calls received by the TPCN from 1998 to 2003 by location of caller

Public Health Region (area: major cities)	Total population ¹		Drug ID calls				Abuse calls			
	No.	% of total known	No.	% of total known	RR ²	95% CI ³	No.	% of total known	RR ²	95% CI ³
1 (Northeast: Amarillo Lubbock)	780,733	3.7	46	1.1	0.29 ⁴	0.21–0.38	33	3.6	0.96	0.66–1.35
2 (North-central: Abilene, Wichita Falls)	549,267	2.6	66	1.5	0.59 ⁴	0.46–0.74	27	2.9	1.12	0.75–1.60
3 (North-central: Dallas, Fort Worth)	5,487,477	26.3	320	7.5	0.29 ⁴	0.26–0.32	161	17.6	0.67 ⁴	0.57–0.78
4 (Northeast)	1,015,648	4.9	69	1.6	0.33 ⁴	0.26–0.42	89	9.7	1.99 ⁴	1.61–2.44
5 (East)	740,952	3.6	430	10.1	2.84 ⁴	2.58–3.12	97	10.6	2.98 ⁴	2.41–3.63
6 (Southeast: Houston)	4,854,454	23.3	2,031	47.7	2.05 ⁴	1.96–2.14	341	37.2	1.60 ⁴	1.43–1.78
7 (Central: Austin)	2,309,972	11.1	731	17.2	1.55 ⁴	1.44–1.67	58	6.3	0.57 ⁴	0.44–0.73
8 (South-central: San Antonio)	2,146,154	10.3	353	8.3	0.80 ⁴	0.72–0.89	41	4.5	0.43 ⁴	0.31–0.59
9 (West-central)	524,884	2.5	64	1.5	0.60 ⁴	0.45–0.76	23	2.5	1.00	0.65–1.47
10 (West: El Paso)	704,318	3.4	32	0.8	0.22 ⁴	0.15–0.31	16	1.7	0.52 ⁴	0.30–0.84
11 (South: Corpus Christi, Brownsville)	1,737,961	8.3	120	2.8	0.34 ⁴	0.28–0.40	31	3.4	0.41 ⁴	0.28–0.58
Total known	20,851,820		4,262				917			

¹ According to 2000 Census

² Ratio of call % to total population %

³ CI = confidence interval

⁴ Statistically significant, i.e., 95% confidence interval does not include 1.00

The proportion of total calls represented by drug ID calls substantially increased from 36.4% in 1998 to 52.5% in 2003 ($p < 0.05$), and the proportion of all human exposure calls represented by abuse calls significantly increased from 12.7% in 1998 to 20.5% in 2003 ($p < 0.05$).

Table 2 contains the distribution of drug ID and abuse calls for carisoprodol by PHR. The geographic distribution of abuse calls differed from geographic distribution of drug ID calls, and distribution of both types of calls differed from that of the total population, with many of these differences being statistically significant. For example, although PHR 3 contains 26.3% of the Texas population, it accounted for 7.5% of drug ID calls and 17.6% of abuse calls. And while PHRs 4–7 contains 42.8% of the state's population, these PHRs reported 76.5% of all drug ID calls and 63.8% of all abuse calls.

Of the 936 carisoprodol abuse calls, 362 (38.7%) did not involve other substances. Of the 4,634 other human carisoprodol exposure calls, 1,901 (41.0%) did not involve other substances (rate ratio 0.94, 95% confidence interval 0.84–1.06). Table 3 shows the distribution of carisoprodol abuse calls and other human exposure calls by various demographic and clinical factors. Although abuse calls were evenly distributed between male and

female patients, other human exposure calls were significantly more likely to involve females. And while the majority of both types of exposure calls involved adult patients, the proportion of abuse calls represented by patients from ages 13 to 19 years was substantially greater than other human exposure calls.

Both abuse and other human exposure calls predominantly came from the patient's own residence. However, of other exposure sites, a much higher proportion of abuse calls came from other residences, schools, and public areas.

The pattern of management site was similar for both types of human carisoprodol exposure calls. However, among those human exposure calls with a known medical outcome, a substantially higher percentage of abuse calls involved minor effects while a greater proportion of other human exposure calls involved effects that varied from moderate outcomes to death.

DISCUSSION

This investigation described the epidemiology of carisoprodol abuse calls to Texas poison centers during a recent six-year period. Such information is important because carisoprodol is a commonly prescribed drug in the United States. However,

TABLE 3. Distribution of calls involving human exposure to carisoprodol received by the TPCN from 1998 to 2003 by selected factors

Factor	Abuse calls		All other human exposure calls		RR ¹	95% CI ²
	No.	%	No.	%		
Patient gender						
Male	474	50.8	1,722	37.4	1.36 ³	1.23–1.51
Female	459	49.2	2,884	62.6	0.79 ³	0.71–0.87
Total known	933		4,606			
Patient age (years)						
<13	7	0.8	315	7.1	0.11 ³	0.04–0.23
13–19	151	16.5	383	8.6	1.91 ³	1.58–2.32
≥20	758	82.8	3,751	84.3	0.98	0.91–1.06
Total known	916		4,449			
Exposure site						
Own residence	774	87.0	4,123	93.9	0.93	0.86–1.00
Other residence	36	4.0	994	2.1	1.89 ³	1.25–2.80
Workplace	5	0.6	15	0.3	1.64	0.47–4.76
Health care facility	4	0.4	22	0.5	0.90	0.23–2.64
School	18	2.0	17	0.4	5.22 ³	2.54–10.79
Restaurant/food service	2	0.2	4	0.1	2.47	0.22–17.21
Public area	43	4.8	78	1.8	2.72 ³	1.83–4.00
Other	8	0.9	37	0.8	1.07	0.43–2.33
Total known	890		4,390			
Management site						
Outside health care facility	129	13.8	560	12.1	1.14	0.94–1.39
At/en route to health care facility	624	67.0	3,293	71.2	0.94	0.86–1.03
Referred to health care facility	175	18.8	763	16.5	1.14	0.96–1.34
Other	4	0.4	11	0.2	1.81	0.42–6.09
Total known	932		4,627			
Medical outcome						
No effect	117	18.0	634	19.0	0.94	0.77–1.15
Minor effect	386	59.3	1,650	49.5	1.20 ³	1.07–1.34
Moderate effect	122	18.7	675	20.3	0.92	0.76–1.12
Major effect	25	3.8	358	10.7	0.36 ³	0.23–0.54
Death	1	0.2	14	0.4	0.37	0.01–2.40
Total known	651		3,331			

¹ Ratio of abuse call % to all other exposure call %

² CI = Confidence interval

³ Statistically significant, i.e., 95% confidence interval does not include 1.00

carisoprodol use can be associated with impairment of driving ability, dependency, and a number of adverse effects. Abuse of this drug could cause serious problems. In spite of this fact, epidemiologic information on carisoprodol abuse is limited.

There is a primary limitation to this investigation: reporting carisoprodol exposures to poison centers in Texas is strictly voluntary, and poison centers do not actively seek out carisoprodol exposures. The number of carisoprodol exposures, especially those involving potentially adverse effects or abuse, in Texas is unknown. But those calls received by the TPCN are expected to represent only a fraction of the total. Thus there is potential for bias in the present analysis. However, the current investigation may inspire subsequent research not subject to this limitation.

Although there was an increase in carisoprodol calls of all types examined during the six-year period of the study, this annual trend was particularly strong for drug ID and abuse calls. Drug ID and abuse calls were 216.6% higher in 2003 than in 1998; they represented 43.2% of all calls in 1998 and 61.2% in 2003. This would indicate that carisoprodol abuse is becoming an increasing problem in Texas.

The geographic distribution of carisoprodol drug ID calls and abuse calls was not consistent with the population distribution within the state. Of note, the population of PHRs 4–7 (east and central Texas, including the major cities of Houston and Austin) accounted for a disproportionate number of calls based on the size of their population. This finding suggests that carisoprodol abuse is a greater problem in the eastern part of Texas than the rest of the state and that carisoprodol abuse education and prevention activities should be concentrated in these areas.

It might be suggested that drug ID calls to poison centers can serve as a measure of abuse of these substances within the population [17]. The facts that carisoprodol drug ID and abuse calls increased disproportionately over the period of this investigation appear to bear this out. However, this suggestion is tempered by the observation that the geographic distribution of drug ID and abuse calls was not consistent, with some areas reporting higher than expected drug ID calls but reporting lower than expected abuse calls and vice versa.

The provision of drug IDs by poison centers is somewhat controversial [20]. Providing drug IDs requires use of limited poison center resources, and some may speculate that it may contribute to the abuse of substances [17]. Currently, the TPCN is evaluating which drug ID call policy would best serve the needs of the poison centers.

Although roughly the same proportion of carisoprodol abuse and other human exposure calls involved the presence of other substances, abuse calls tended to differ from other human exposure calls in various ways. When compared to other human exposures, carisoprodol abuse was much more likely to involve males, adolescents, and occur at other residences, schools, or in public areas. Moreover, although abuse and other human exposure calls were similar with respect to management site, other

human carisoprodol exposures were more likely to involve serious medical outcomes. These differences suggest that the education and prevention strategies and management for carisoprodol abuse should differ from those for other adverse human exposures to carisoprodol.

In summary, carisoprodol abuse is increasing in Texas and is more common in the eastern and central part of the state. Carisoprodol abuse is much more likely than other types of adverse carisoprodol exposures to involve males and adolescents and to occur in schools and public areas and less likely to involve adverse medical outcomes.

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