Medication Reporting in the Workplace

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Impairment from medication use in hazardous work environments has not been well studied. We analyzed incident events in an explosive manufacturing facility using a retrospective case control study to determine whether medication use was related to safety incidents. Medication use between the incident group and the controls was not significantly different. However, 28% of the incident group had been employed by the facility for less than 1 year compared with 2% of controls. Only 19% of restricted medication use was self-reported. In this study, being employed less than 1 year was a greater predictor of safety incidents than was medication use, and self-reporting did not reflect actual medication use. We conclude that medication use is not directly related to safety events and that a self-reporting program is difficult to justify in the corporate setting.

There has been increasing interest in impairment and safety of job performance among employees using prescription and over-the-counter (OTC) medications. Many medications are associated with side effects (eg, somnolence, dizziness, confusion, hypotension) that can impair an employee's ability to perform a job or the safety of fellow employees. There are little data in occupational medicine literature correlating medication use with worker impairment or measurements of occupational safety. Also, aside from our corporate policy, we were unable to identify any corporate policy that deals with this problem. DeHart and colleagues[1-8] recently addressed the state of knowledge concerning potential adverse medication effects in the workplace. Although this work is an important step toward understanding possible worker impairment due to medication use, it does not address many practical questions: What is the extent of medication use among workers?; Is the use of medications related to measurements of workplace safety?; How should employees who take medications that could affect safety be restricted?

The nonoccupational literature reveals that the use of sedative-hypnotics, benzodiazepines, and narcotics has been shown to be associated with automobile accidents and impaired driving,[9,10] and the same medication groups have caused impaired driving performance in experimental designs.[11-13] Although the majority of evidence suggests that use of diazepam impairs driving ability,[14] at least one observer has argued against driving restrictions based on use of this drug because it may relieve symptoms of anxiety, aggression, and depression.[15] Although acknowledging the association of antihistamines, sedative-hypnotics, and fatal motor vehicle accidents, a consensus panel concluded there were insufficient data to establish unequivocal impairment from use of these drugs.[16] Even less information exists correlating prescription and OTC medication use and impairment in the occupational setting. Therefore, there appears to be a tendency to rely on motor vehicle accident data and driving experimental designs to infer impairment in the workplace.

The purpose of this study was to (1) report the existence of a program dealing with medication self-reporting, (2) determine the extent of use of medications with possible side effects affecting workplace safety, (3) determine the success or failure of employee compliance with the program, and (4) determine whether medication use could be correlated with reportable incidents, a measure of workplace safety.

Methods

The Workplace

The Utah Bacchus Works facility of Hercules Aerospace, a division of Hercules Incorporated employing

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approximately 3,500 employees, provided the study site. The division produces propulsion systems, solid rocket propellants, carbon fibers, and composite structures used in the manufacture of rocket motors and other high-value aerospace products. The plant is in production 24 hours per day, 7 days per week. About 1,100 workers are employed in hazardous area jobs (Table 1). In addition, about 1,000 workers are employed in high-security positions that do not include hazardous area activities.

Bacchus Works has an on-plant medical department staffed by a full-time, board-certified, occupational medicine physician, four full-time registered nurses, and two clerical workers. The clinic is open 8 hours per day, 5 days per week and provides a variety of comprehensive occupational medicine services to the employees. Bacchus Works also employs several full-time safety engineers and industrial hygienists, and maintains a 24 hour per day fire station with its own ambulance staffed by fire fighters also trained as emergency medical technicians.

Drug and Alcohol Screening Program

A major emphasis is placed on fire and explosives safety. A mandatory drug and alcohol screening program administered by the plant's medical clinic has been in place since 1985. Screening of spot urine specimens is made for various substances of abuse. Testing occurs in the following situations: (1) preplacement applicant screening, (2) postincident for the worker(s) and supervisor directly involved in a reportable incident, (3) supervisor referral for performance problems or suspected substance or alcohol abuse, and (4) random screens for all employees in hazardous and high security areas. Reportable incidents are defined as any occurrence during the course of work resulting in faulty product, damage to product, or human injury.

A worker may be tested more than once in any given year. At the time of testing, employees are required to declare any medication use within the past 2 weeks. No request for medication regimen or time of last dose is made. Employees are not informed of the specific drugs being screened. If an employee does not declare scheduled prescription medication use and has a positive drug screen, he or she could be terminated unless the medical director (also a trained medical review officer) can establish a legitimate reason for the positive result.

TABLE 1
Identified Hazardous Jobs at Hercules-Bacchus Works

1. Mixing, casting, preparing, or handling explosives
2. Maintaining or repairing operating equipment used in hazardous or explosive operations
3. Driving heavy equipment or using overhead cranes
4. Requiring a Hercules on-plant drivers' license
5. Regularly working with power tools or heavy machinery
6. Regularly working on ladders, platforms, or elevated surfaces
7. Regularly working in classified high technology or structural facility areas

Medication Self-Reporting Program

Because of the potential for high-cost human errors in this workplace, a medication self-reporting program was implemented at the request of management in 1987. An alphabetized list of commonly used OTC and prescription medications with advised "constraint periods" was compiled and is updated regularly (Table 2). Advised constraint periods for specific medications were developed for workers employed in hazardous area positions. The constraint periods and program rationale are explained to employees and their supervisors at orientation, at training sessions, and at the time of self-reporting. Occupational health nurses notify management of the constraint period after interviewing the patient and consulting the constraints list. Management must then determine whether workplace accommodations are possible. The worker is also educated about possible nonconstrained OTC medication alternatives or alternate prescription medications to discuss with the prescribing private physician.

Constraints are placed on any medication that has possible adverse side effects (such as hypotension, dizziness, drowsiness, fatigue, depression, syncope, anxiety) that may result in impaired employee performance. Because there are few data available for most medications with regard to duration of impairment after dosage, the constraint period of most medications has been set at one half-life of a single dose of the medication or 8 hours, whichever is longer.[17] This allows 50% of the drug to be cleared, presumably reducing the risk of an adverse side effect. Five half-lives is cited as necessary to clear >95% of a pharmaceutical from the system,[18] but this length of time is not practical in the workplace with most medications.

Several options in the constraint list are available to deal with potential medication-induced impairment. Many medications have no significant increase in impairing side effects over placebo in double-blind clinical trials (allopurinol and sulfasalazine). For these medications, no constraint period is recommended. The next most frequent group of medications have known side

TABLE 2
Abbreviated Medication Constraint List

Generic	Constraints	Constraint Period
Allopurinol	No	–
Sulfasalazine	No	–
Chlorpheniramine	Yes	8 h
Propoxyphene	Yes	8 h
Prochlorperazine	Yes	8 h
Clorpheniramine (extended release)	Yes	12 h
Alprazolam (one dose)	Yes	12 h
Amitriptyline	Yes	1 wk/letter
Lorazepam	Yes	1 wk/letter
Imipramine	Yes	Sign form after 3 d
Atenolol	Yes	Sign form after 3 d
Nadolol	Yes	Sign form after 3 d
Carbamazepine	Yes	Refer to MD/OHN*
Phenobarbitol	Yes	Refer to MD/OHN
Meclizine	Yes	Refer to MD/OHN

* OHN, occupational health nurse.

effects of concern, but they have a relatively short duration of action (half-life <8 hours). These have recommended constraint periods of 8 hours after ingestion before performance of hazardous work. A few medications have longer half-lives (8 hours to 12 hours), and, consequently, the constraint period is set at 12 hours. Most of these medications are sustained-release preparations of antihistamines.

Several medications are of much greater concern because they have a much higher incidence of sedating side effects and may be administered on a regular basis (sedating antidepressants, benzodiazepines consumed regularly, or a few heavily sedating centrally active antihypertensives). These medications require a longer period of time off hazardous duty, set at 1 week, to ensure tolerance without side effects. Often, issues such as specific medication use and job restrictions need to be discussed with the treating private physician, especially when the medication falls in this category.

Some medications have fewer concerning side effects but are taken on a regular basis, for example, amitriptyline or guanabenz. These are constrained by having the employee report to clinic on the third day of consuming the medication. They are interviewed by an occupational health nurse who determines whether any side effects are present and signs a form stating there are no side effects present or specifying which side effects are present. This further alerts the employees to our concerns. Should side effect(s) be present, management would be notified and hazardous-duty restrictions likely would be recommended. An additional benefit of these employee interactions is a heightened awareness for potential impairment of motor vehicle operation both on plant and during commuting.

The last option is occasionally used for a few drugs representing the greatest level for concern. These medications (eg, carbamazepine, lithium, chlorpromazine, meclizine) signal a potentially impaired employee who probably should not be in hazardous duty areas of the plant. When use of these medications is reported, there is close scrutiny of reasons for medication use and control of underlying conditions. Most often, a clinic visit is required.

Management may or may not choose to comply with the advised constraints. Typically, the worker is removed from hazardous operations during the constraint period. If the medication reported has advised constraints, a reported medication use form is placed in the worker's medical chart. If the medication has no advised constraints, no form is filed.

Subjects

An incident cohort of 86 workers involved in 92 reportable incidents was randomly selected[19] from a total of 229 workers employed in hazardous work areas who had been involved in 287 reportable incidents. The worker(s) were solely involved, a member of a group involved, or a supervisor of the worker(s) involved in the incident occurring between November 1, 1989 and October 31, 1990.

A control cohort of 89 workers, involved in 92 episodes of random alcohol and drug screening, was randomly selected from a total of 376 workers employed in hazardous or high security areas, who had been selected for 378 episodes of random alcohol and drug screening tests during the same period. (Those who also had been involved in reportable incidents [n = 23] between November 1, 1989 and October 31, 1990 were excluded from random selection.)

Study Protocol

A chart review of the plant's medical record for each worker in both cohorts was made. When a worker was represented more than once in either of the two cohorts, each incident or episode of random screening was analyzed independently. The members of each cohort were assessed for demographic factors, testing factors, and reportable incident factors of interest, as well as for the results of alcohol and drug screening (Table 3).

Data Analysis

Statistical methods used to analyze the data included percentages, group frequency distributions, ranges, means, and standard deviations, and, when appropriate, t tests of significance, Pearson χ^2 tests, and the Fisher exact test. For analytic purposes, categories were collapsed in years employed and medications variables. Statistical significance was acknowledged when the P value, using the two-tailed value, was less than .05.

Results

Findings of comparison variables (Table 4) showed the incident cohort to be significantly younger ($P <$ .001), have significantly fewer females ($P = .012$), and have significantly more workers who had been employed

TABLE 3
Study Cohorts and Variables Relating to Medication Use and Workplace Incidents

Variables	Incident Cohort (n = 92)	Random Cohort (n = 92)
Demographic factors		
Age	*	*
Sex	*	*
Years employed	*	*
Testing factors		
Season of testing	*	*
Medications of recent use	*	*
Prior self-reported use	*(n = 36)	
Reportable incident factors		
Plant materials damage	*	
Human injury	*	
Individual involvement	*	
Group status	*	
Management status	*	
Alcohol and drug screen results	*	*

at Bacchus Works less than 1 year ($P < .001$) compared with the random group. Use of constrained medications, as well as results of alcohol and drug screening were not significantly different between the two cohorts ($P = 1.00$ and $P = .25$, respectively). Broad categories of the medications used are included (Table 5), although there are no significant differences between the incident and random groups.

A majority of both cohorts used no medications or only nonconstrained medications. At the time of drug testing, 41% of the incident cohort reported use of constrained medications within the past 2 weeks, compared with 40% of the random cohort ($P = 1.00$). The incident cohort used more constrained medications of expected short-term use with set constraint periods (36% compared with 25%) whereas the random cohort used more constrained medications of expected long-term duration, with variable constraint periods (5% compared with 15%).

Three results from alcohol and drug screening were positive, all from the incident cohort. However, the difference in test results between the two cohorts was not statistically significant ($P = .25$). Positive findings for propoxyphene and opiates of two workers correlated with medication declaration before testing. A positive finding for opiates in the third worker was attributed to recent consumption of poppy seeds.

The roles incident cohort members played were determined (Table 6). The workers directly responsible for the incident injury comprised 71% of the cohort. About one-fourth of the cohort were supervisors. Data were available on only 36 of the 38 workers who declared use of constrained medications at the time of postincident alcohol and drug screening. Of these 36 workers, only 19% had reported use of constrained medications before incident occurrence.

Regarding declared constrained medication use, one or more of 38 different medications, by generic name of active ingredients, were reported taken within the past 2 weeks by each of 75 workers between the two cohorts. Of these medications, use of 15 were reported by two or more workers (Table 7). By far the most frequently declared constrained medication used was the antihistamine chlorpheniramine (31% of workers using constrained medications), and the most frequent period for constraint was 8 hours.

Discussion

This study is the only reported assessment of medication use and its relationship to measurements of workplace safety, as well as the only reported program of self-reporting medication use in the workplace we were able to document. Numerous inquiries were made to major corporations and government agencies for infor-

TABLE 5
Medication Use Among the Incident and Random Groups

	Incident Group, n = 92		Random Group, n = 92	
	No.	(%)	No.	(%)
None	19	(21)	13	(14)
Nonrestricted	34	(37)	41	(45)
Restricted (nonnarcotic, short-term use)	29	(32)	17	(18)
Restricted (nonnarcotic, long-term use)	5	(5)	14	(15)
Restricted (narcotic)	4	(4)	6	(7)
Not known	1	(1)	1	(1)

TABLE 6
Categories of Members of the Incident Cohort

Category	Number	Percent
Supervisor of person or group involved in an incident	21	23
Member of group involved in an incident	11	12
Person responsible for injury to plant materials	44	48
Person responsible for injury to self or other persons	21	23
Person using constrained medication who reported medication use before incident	7	19

TABLE 4
Comparison of Results Between the Incident and Random Groups

	Incident Group, n = 92		Mean ± SD (range)	Random Group, n = 92		Mean ± SD (range)	Test* P value
	No.	(%)		No.	(%)		
Age (years)			36 ± 9 (19–58)			42 ± 11 (22–63)	<.001
Sex							
Male	80	(87)		65	(71)		
Female	12	(13)		27	(29)		.012
Years employed							
<1	21	(23)		2	(2)		
>1	71	(77)		90	(98)		<.001
Medications							
None or nonrestricted	53	(58)		54	(59)		
All others (restricted)	38	(41)		37	(40)		1.00 NS†
Test result							
Negative	89	(97)		92	(100)		
Positive	3	(3)		0	(0)		.25 NS

* t tests, Pearson χ^2 tests, and the Fischer exact test (all two-tailed) were used where appropriate.
† NS, nonsignificant.

TABLE 7
Declared Constrained Medication Use*

Generic Medication	Workers Using, n = 75		Usual Constraint Period (h)
	No.	(%)	
Chlorpheniramine	23	(31)	8
Alcohol	7	(9)	8
Hydrocodone	5	(7)	8
Triprolidine	5	(7)	8
Oxycodone	4	(5)	8
Hydrochlorothiazide and triamterene	4	(5)	Variable
Brompheniramine	3	(4)	8
Captopril	3	(4)	Variable
Codeine	3	(4)	8
Phenylpropanolamine and chlorpheniramine	3	(4)	12
Fluoxetine	2	(3)	Variable
Hydrochlorothiazide	2	(3)	Variable
Metoprolol	2	(3)	Sign form after 3 d
Propranolol	2	(3)	Sign form after 3 d
Trazodone	2	(3)	1 wk/letter

* List includes medications used by two or more workers in the study.

mation on formal medication-reporting programs similar to ours. Among contacts, no medication-reporting programs or policies dealing with medication-induced impairment were identified. Our study suggests that a substantial percentage of workers in hazardous and high security areas (about 40%) use medications identified by the plant's medical department as requiring job constraints of varying time length. However, use of these constrained medications did not seem to be related to the occurrence of reportable incidents as a measurement of workplace safety. Workplace safety was inversely related to age and length of employment at Bacchus Works.

With regard to reportable incidents, more than one third of the persons with incident involvement were not immediately responsible for the incident: about one fourth of persons were supervisors of the person directly involved, and 13% of persons were members of a group either directly or indirectly involved in the incident. Twice as many incidents involving plant materials occurred as incidents involving human injury. No human injury was serious. Financial assessment of plant material damage was not in the scope of this study.

The medication use self-reporting program instituted in this facility was intended to meet these goals: (1) to give the medical clinic a quantitative and qualitative measurement of the overall use of constrained medications among workers in high-risk areas; (2) to instruct workers using constrained medications about constrained activities, constraint time-periods, and possible nonconstrained medication alternatives; (3) to inform managers of possibly impaired workers and advised constraints for these workers; (4) to decrease reportable incident occurrence by decreasing the number of impaired workers due to constrained medication use, who might otherwise continue to perform high-risk jobs during advised constraint periods if uninformed.

Alcohol and drug screening may be reliable in identifying workers who recently have used prescription or illegal drugs. However, use of these drugs was declared by only 16% of workers who reported recent use of constrained medications, and only 2% of workers screened in this study had positive test findings. Clearly, screening only for the particular drugs currently specified, as the sole indication of possible worker impairment due to constrained medication use, is a poor tool in this population. Few workers would be expected to declare use of illicit drugs such as marijuana, cocaine, or phencyclidine before alcohol and drug screening, but use of many of the medications declared by these workers (associated in the literature with potential performance impairment) would not be detected with the current alcohol and drug screening.

The population from which the incident cohort was selected (workers in hazardous areas) was a subset of the population from which the random cohort was drawn (workers in hazardous and high security areas). Therefore, the random cohort is not a true control cohort. However, with information available to the medical clinic, workers selected for random screening in high-security areas could not be separated from the workers in hazardous areas. Because a control cohort was desirable for comparison, use of the random cohort seemed the most acceptable, available choice.

At first glance, one might conclude that the program was not working well and that a poor cost-benefit ratio could be anticipated. However, several confounders could be present. First, the workers may have become educated and begun to avoid constrained medications; this would indicate an even higher rate of constrained medication consumption in previous years. We could never disprove this. Evidence would have to come from a prospective study implemented at a site before a medication self-reporting program was instituted. Second, employees may have memorized the constraints on their favored OTC and prescription medications and were not consuming them within the constraint period and, therefore, not notifying the clinic, except when required at a screening. This would require further investigation. Third, employees may be simply avoiding taking any medications. Fourth, prescribing habits of physicians could have changed as a result of the program. We do not believe this possibility has occurred but cannot disprove it. Fifth, the actual extent of medication use may have been only partially determined. Patient recall was important because not all medications were in the screening panel. Presumably, most medications (except, perhaps, a few rare, illicit drugs) used over the 2 weeks before alcohol and drug screening were identified, but neither the regimen of use nor the time of last ingestion was obtained. Collection of this data over an extended time may yield more conclusive findings.

Finally, characteristics of this study population may not be representative of populations of other large manufacturing facilities, even other aerospace and explosives manufacturing plants, especially if located outside Utah. For example, alcohol and drug use may be signif-

icantly different between comparison populations. Surveys have shown that Utah has about half as many alcohol and illicit drug users per capita compared with the US averages; however, rates for nonmedical use of analgesics are higher for residents of Utah of all ages than are national averages.[19]

Conclusion

No relationship was found between constrained medication use and measurements of workplace safety, possibly a consequence of the retrospective nature of this study. A younger age and shorter employment time on plant (less than 1 year) were greater determinants of reportable incident occurrence. Further information on the medication regimens of workers using constrained medications is needed to better assess the relationship between constrained medication use and workplace safety in this plant and in occupational settings in general.

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References

1. DeHart R. Medication and the work environment. *J Occup Med.* 1990;32:310–312.
2. Tilson H. Medication monitoring in the workplace: toward improving our system of epidemiologic intelligence. *J Occup Med.* 1990;32:313–319.
3. Meltzer E. Antihistamine- and decongestant-induced performance decrements. *J Occup Med.* 1990;32:327–334.
4. Nicholson A. Hypnotics and occupational medicine. *J Occup Med.* 1990;32:335–341.
5. Kruyer W, Hickman J. Medication-induced performance decrements: cardiovascular medications. *J Occup Med.* 1990;32:342–349.
6. Greaves W. Metabolics and biologicals in the workplace. *J Occup Med.* 1990;32:350–354.
7. Potter W. Psychotropic medications and work performance. *J Occup Med.* 1990;32:355–361.
8. Payne R. Medication-induced performance deficits: analgesics and narcotics. *J Occup Med.* 1990;32:362–369.
9. Poklis A, Magnin D, Barr J. Drug findings in 'driving under the influence of drugs' cases: a problem of illicit drug use. *Drug Alcohol Depend.* 1987;29:57–62.
10. White J, Clardy D, Graves M, et al. Testing for sedative-hypnotic drugs in the impaired driver: a survey of 72,000 arrests. *Clin Toxicol.* 1981;18:945–957.
11. Linnoila M, Hakkinen S. Effects of diazepam and codeine, alone and in combination with alcohol, on simulated driving. *Clin Pharmacol Ther.* 1973;15:368–373.
12. de Grier J, Hart B, Nelemans F, Bergman H. Psychomotor performance and real driving performance of outpatients receiving diazepam. *Psychopharmacology.* 1981;73:340–344.
13. Schmidt U, Brendemuhl D, Ruther E. Aspects of driving after hypnotic therapy with particular reference to temazepam. *Acta Psychiatr Scand Suppl 332.* 1986;74:112–118.
14. Soames R. Does diazepam affect driving ability? *Med J Austr.* 1982;1:89–91.
15. Landauer A. Diazepam and driving ability. *Med J Austr.* 1981;1:624–626.
16. Consensus Development Panel. Drug concentrations and driving impairment. *JAMA.* 1985;254:2618–2621.
17. *Physicians' Desk Reference,* 44th ed. Oradell, NJ: Medical Economics Company; 1990.
18. Gilman AG, Goodman LS. *Pharmacological Basis of Therapeutics.* 7th ed. New York: Macmillan Publishing Co., 1985:3–34.
19. Arkin H, Colton R. *Tables for Statisticians,* 2nd ed. New York: Barnes and Noble Books; 1963:158–161.

Junk Science in the Courtroom, II

What accounts for the proliferation of pseudoscientific shantytowns all around the modern American courthouse? Beginning in about 1975, when the federal rules of evidence were codified for the first time, both federal and state courts began to be far more permissive about scientific testimony. Many abandoned an old standard—known as the Frye rule—. . . which had previously required an expert witness to report views "generally accepted" in the wider scientific community. . . . As Donald Elliott said in a speech, . . . the law today "extends equal dignity to the opinions of charlatans and Nobel Prize winners, with only a lay jury to distinguish between the two."

—From "Junk Science in the Courtroom." by P. Huber. *Forbes* 1991; 148:1:68 (Excerpted from the author's book, *Galileo's Revenge: Junk Science in the Courtroom.*)