The Utility of Poison Control Center Data for Assessing Toxic Occupational Exposures Among Young Workers

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This study assessed the utility of Poison Control Center data for identifying and describing occupational toxic exposures to youth and the associated health outcomes of such exposures. The authors reviewed 1997 data from the American Association of Poison Control Centers' Toxic Exposure Surveillance System for occupational exposures to persons 6 to 19 years old. In 1997, there were 3442 reported occupational exposure cases among 6- to 19-year-olds. Exposure cases included underage workers, exposure to multiple substances, continuous or repeated exposure to the offending substance, and exposures occurring in the home. Poison Control Centers provide unique and valuable information on toxic workplace exposures to youth. Child labor laws may be violated in many cases, and risks exist with respect to industrial work done in the home. Prospective studies with immediate follow-back are needed. (J Occup Environ Med. *2001;43:463–466*)

Today, work is a common feature of childhood and adolescence in the United States, with more than 5 million children and teenagers legally employed and several million more working in violation of wage, hour, and safety regulations.[1] The potential benefits of youth employment go beyond the financial rewards to include enhanced self-confidence and self-esteem and the development of discipline, responsibility, and time management, interpersonal, and occupation-specific skills.

In addition to these potential benefits, work also poses potential threats to the physical, emotional, and academic health and safety of the young worker. Work in excess of 20 hours per week during the school year is associated with unhealthy and problem behaviors, and a high degree of investment in work during adolescence has been associated with decreased eventual educational attainment.[2,3]

Studies using data from emergency departments, workers' compensation departments, the US Bureau of Labor Statistics, and surveys of young workers[4] have provided some insight into the nature, extent, and circumstances surrounding work-related injuries to youth. Each year, an estimated 200,000 workers between 14 and 17 years of age experience job-related injuries, and some 64,000 of these workers require emergency department treatment. In addition, work-related incidents claim the lives of approximately 70 adolescents annually.[5]

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Far less is known about the nature, extent, and consequences of the health hazards young workers face on the job. Studies indicate that Poison Control Centers (PCCs) are useful sources of data on occupational illnesses,[6–9] but to date, no published studies have focused on the utility of PCC data for enhancing our understanding of the health hazards of youth employment.

Methods

We reviewed data from the American Association of Poison Control Centers Toxic Exposure Surveillance System (TESS) to assess the utility of these data for identifying and describing occupational toxic exposures to youth and the associated health outcomes of such exposures.

TESS data for 1997 were compiled by 66 participating regional US poison centers that serve 93.5% of the US population. Poison center information specialists collect data during their consultations with callers. Callers may include health care providers, patients themselves, and patients' employers, family members, coworkers, and friends. Telephone follow-up with the caller, in cases of "significant exposure," yields data on patient outcomes and clinical manifestations. Participating poison centers provide data electronically to the American Association of Poison Control Centers. We reviewed 1997 TESS data for occupational exposures to persons 6 to 19 years of age.

Results

Occupational exposure cases, defined as "an exposure that occurs as a direct result of the person being on the job or in the workplace," represent 2.1% of the 2,192,088 human exposure cases reported to the TESS database in 1997. Of these, the 3442 cases that occurred in 6- to 19-year-old workers represent 7.5% of the total occupational exposure cases.

Demographics

In 1997, of the 3442 young workers reported to the American Association of Poison Control Centers as exposed to toxicity at work, 9.7% were 6 to 12 years old and 90.3% were 13 to 19 years old. Among the 6- to 12-year-old workers, 50.2% were male, 45.1% were female, and the gender of the remaining patients was unknown. Among the 13- to 19-year-old workers, 67.0% were male, 32.8% were female, and the remaining patients were of unknown gender. The gender distribution among the adolescents is in keeping with studies that have consistently shown male adolescents to have a greater number of workplace injuries than female adolescents.

TESS reports do not include information on the race or ethnicity of the patient, nor do they indicate the industry or occupation in which the patient was employed at the time of the exposure. Although both the intake form and the reporting form allow for recording information on pregnancy, the reports we reviewed included no pregnancy data.

Nature, Duration, and Routes of Exposure

The substances most frequently involved in young worker exposure cases in 1997 included household cleaning substances, chemicals, and fumes/gases/vapors (Table 1).

Most of the reported exposures were acute in nature; 10% of exposure cases involved chronic or acute-on-chronic exposure to the substance of concern. Chronic exposures are defined as continuous or repeated exposures occurring in a period exceeding 8 hours. In 18.4% of cases, the patient was exposed to two or more substances. The principal routes of exposure were inhalation/nasal (37.2%), ocular (26%), dermal (24.6%), and ingestion (10.3%), with the remainder unknown.

Site of Exposure

Occupational exposures occurring in the patient's own residence, another residence, a health care facility, school, restaurant/food service location, or public area are coded separately from the "workplace" category. In 1997, 10.6% of young worker exposure cases occurred in the patient's own residence, 1.4% in a public area, 1.4% in a school, and 86% in a workplace.

Medical Outcomes

The TESS database recognizes several medical outcome categories. For 1997, the medical outcome is known in 62% of the young worker exposure cases. There was "no effect" in 5.4% of the cases; ie, the patient developed no signs or symptoms as a result of the exposure. In 43.0% of cases, the patient suffered "minor effects"; ie, she or he developed some signs or symptoms as a result of the exposure, but they were minimally bothersome and generally

TABLE 1
Most Common Substances Implicated in Young Worker Exposure Cases

Substance	% of Exposure Cases
Household cleaners	19.8
Chemicals	12.8
Fumes/gases/vapors	12.2
Industrial cleaners	8.6
Hydrocarbons	8.0
Insecticides/pesticides	4.0
Paint/stripping agents	2.5
Heavy metals	2.2
Plants	2.1
Building/construction products	1.9
Herbicides	1.9

resolved rapidly without residual disability or disfigurement. In 13.4% of cases, the young worker suffered a "moderate effect"; ie, he or she exhibited signs or symptoms as a result of the exposure that were more pronounced, more prolonged, or of a more systemic nature than minor symptoms and usually required some form of treatment; however, the symptoms were not life-threatening and the patient had no residual disability. In 0.2% of exposure cases, "major effects" resulted in that the young worker exhibited signs or symptoms as a result of the exposure that were life-threatening or resulted in significant residual disability or disfigurement (eg, repeated seizures, respiratory compromise requiring intubation). No deaths were reported.

The medical outcome is unknown in the remaining young worker exposure cases. In 25.6% of cases there was no follow-up call to determine the medical outcome because the substance implicated was deemed non-toxic, the amount of exposure was insignificant (2.3% of cases), or because the exposure was deemed likely to result in only minimal toxicity (23.3% of cases). In an additional 5.1% of cases, the exposure was significant and may have resulted in a moderate, major, or fatal outcome, but the patient could not be followed up for unspecified reasons. Finally, in 7.3% of cases, it was determined that the exposure was probably not responsible for the clinical effects.

Clinical Effects

TESS data also provide information on clinical effects (signs, symptoms, or laboratory abnormalities); when the caller notes more than one effect, each effect is coded. In 1997, clinical effects were coded in only 30.6% of cases. For cases in which the effects were known to be related to the exposure, the majority of effects were either dermal (26%) or ocular (26%). The remaining clinical effects were gastrointestinal (15.9%), neurological (12.1%), respiratory (9.4%), cardiovascular (2.4%), and miscellaneous (6.3%).

Management Site

TESS reports provide data on the site at which exposure cases are managed. In 1997, management was provided on-site (ie, at the workplace) in just under half (49.2%) of young worker cases. Treatment was provided in a health care facility in 45.6% of cases; 4.2% of patients refused referral to a health care facility. Of cases managed in a health care facility, 83% were treated and released. Less than 1% of patients were admitted to critical care (n = 11), less than 1% (n = 30) were admitted for non-critical care, and less than 1% (n = 2) were admitted to a psychiatric service. In 14% of cases, the young worker was lost to follow-up or left against medical advice.

Treatment Provided

In 1997, 60.4% of young worker exposure cases received decontamination only; 17.4% received decontamination and other therapy (including measures to enhance elimination, antidote administration, and other interventions such as alkalinization); 6.3% were observed without therapy; and 5.9% received other therapy only (principally oxygen, bronchodilators, antihistamines, intravenous fluids, and calcium). Neither therapy nor observation was provided in 5.1% of cases. The remainder either refused help or the therapy provided was unknown.

Duration of Effects

In 1997, of those young workers whose exposure resulted in a minor, moderate, or major effect, the duration of effects were ≤2 hours in 25.5% of cases, ≤8 hours in 21.1%, ≤24 hours in 18.4%, ≤3 days in 12.3%, ≤1 week in 6.6%, ≤1 month in 2.0%, ≥1 month in 0.4%, and anticipated to be permanent in 0.2% of cases. (Note that the categories are not cumulative.)

Discussion

TESS data are a unique and potentially rich source of information on toxic exposures to young workers. Participating PCCs cover most regions of the United States and provide timely information on the nature, extent, and outcomes of these exposures. Although recent studies offer some insights into the nature of the *safety* hazards young workers face, far less is known about the workplace *health* hazards to which youth are exposed. The PCC data are particularly useful in this regard because, in nearly half of the cases, the calls were related to young workers who were treated at the workplace, a group not captured in any study relying on emergency department or other health care provider data. A better understanding of these toxic exposures, in addition to safety hazards, would be valuable in the development of both educational and regulatory interventions.[10,11]

TESS data raise a number of provocative issues that merit further investigation. In 1997, 333 calls to PCCs involved occupational exposures to children under the age of 13. If these data were accurately reported and coded, then by definition all (or nearly all) of these calls involved a very serious violation of federal child labor law, which prohibits the non-farm employment of minors under the age of 14. Each one of these calls should be treated as a sentinel event[12,13] and referred to the Department of Labor, Wages and Hours Division, for further investigation and follow-up. A recent study of regional PCC management of occupational exposure calls suggests that many PCCs do not have protocols in place to appropriately investigate the public health aspects of these calls.[14]

It is worth noting that 343 young worker cases involved some degree of continuous or repeated exposure to the substance that was implicated in the call to the PCC. Furthermore, the eight young workers who suffered major outcomes as a result of

their workplace exposures included an 11-year-old boy who went into cardiac arrest after inhaling chlorine gas on the job.

The 364 calls involving occupational exposures in the young workers' own homes raise questions as to the extent and nature of young workers' participation in industrial work performed in the home. The possibility of such unsupervised and unregulated employment poses tremendous potential risks to young workers and should be examined further. Some of these calls may represent children exposed to toxicity in the home as a result of a parent's or guardian's industrial homework. This possibility likewise deserves further investigation.

TESS data have some limitations. The reliability of the data is potentially problematic. The caller is not necessarily the young worker or another person with direct information about the nature and/or circumstances of the exposure, which casts doubt on the accuracy of the information provided to the PCC information specialist. There is also the potential for recording and coding inconsistencies and inaccuracies on the part of PCC staff. TESS data offer a passive surveillance approach, and PCCs do not capture all cases. Finally, without denominator data, it is impossible to make any determinations with respect to rates of exposure or effects.

Despite these limitations, calls to PCCs represent a potentially valuable source of information on the nature and extent of young workers' exposure to health hazards on the job. By collaborating with individual PCCs, researchers could develop and implement a prospective study to follow up on occupational calls involving young workers. Follow-up calls could elicit a wide range of additional information, including the race/ethnicity of the young worker; industry, occupation, and specific job tasks; number of potentially exposed coworkers; training and supervision; control measures provided; and knowledge of legal rights and responsibilities.

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