A Descriptive Analysis of Hospitalized Poisoning Cases and Examination of Poison Center Consultations

by

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Abstract

Title: A Descriptive Analysis of Hospitalized Poisoning Cases and Examination of Poison Center Consultations

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This descriptive analysis of hospitalized poisoning cases in Oregon was designed to define the incidence of high acuity poisonings and to analyze the utilization of the regional poison center (PC) for consultation regarding patient management in this population. The Universal Hospital Discharge Data Set (UHDDS) was utilized to identify patients hospitalized with a toxic exposure during 1990. The PC data base was utilized to select hospitalized patients who received PC consultation. A computer match program allowed identification of cases common to both data bases through the matching of common variables.

A total of 2807 hospitalized cases were identified in the UHDDS which contained a diagnostic code related to poisoning. The costs of hospitalization of the 2574 cases with reported charges totaled over $10 million. The PC data base contained 1725 cases during the same time period which were coded as hospitalized admissions. Eight hundred cases were identified through the

computer match process as common to both groups (matched). Nonmatched UHDDS cases did not receive PC consultation.

Significant differences ($X^2=177$, $p<.001$) were seen between proportions of age groupings between matched (M) and nonmatched (NM) groups, with M cases representing a larger proportion of children less than 6 years and a smaller proportion of adults over 17 years than NM cases. M cases had a lower average cost of hospitalization ($t=3.06$, $p=.002$) and a significant shorter length of stay ($F=8.57, p<.003$). Findings suggest that PC consultation may result in more effective care of the hospitalized patient. Analysis of consultation source of matched PC cases reveals parents initiated a call to the PC in 45% of patients under 6 years, resulting in higher utilization of PC in the younger patients. Current public education efforts have resulted in an increased incidence of PC involvement in the care of hospitalized children. Future efforts should be directed at examining factors which may influence differences between cases with PC cases and others. In addition, educational efforts need to be directed towards health care providers to increase awareness and utilization of poison center services.

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Introduction

Toxic substances present a significant health concern as our environment changes and modern technology introduces an increasing number of chemicals to daily life. Toxicology, the science which deals with chemical substances as causes of disease in man, is an important aspect in modern medicine as a result of the increasing incidence of patients poisoned by drugs, chemicals, or natural toxins. Toxic exposures to chemicals occur within all age groups and in various settings. Chemical substances create risks in the work place as workers become exposed to toxic substances and fumes produced as by products and waste products. Cleaning substances, household chemicals and pharmaceutical products also present risks in the home. Individuals become exposed to these substances through misuse as well as abuse. Children become exposed during accidental ingestion of substances in their environment. The advent of occupational medicine clinics and the development of organized environmental groups expressing concern regarding the impact of toxins and pollutants on life and the environment are examples of the impact our changing environment has on human life.

The Oregon Poison Center is one of 38 certified regional poison centers established to reduce morbidity and mortality associated with poisonings. The services of the center include the provision of emergency treatment advice to the public as well as consultation to health care providers managing a poisoned patient. Patients may access poison center intervention through a variety of methods, including self referral or health care provider inquiry. Most poisoning incidents managed by poison centers throughout the country are safely managed at home, without referral to a health care facility. A smaller group of patients receive outpatient treatment, usually in a hospital emergency department. Patients experiencing a hospital admission as a result of a poisoning incident represent the smallest percentage of cases. Intervention by the center among these cases can occur at different stages during the poisoning episode, ranging from pre-admission to hospital discharge. Contact with the poison center may be initiated for a variety of reasons, ranging from curiosity to significant concern regarding an exposure. The public may contact the center to obtain reassurance or assistance in determining the seriousness of an exposure. Deteriorating patient condition or resistance to treatment may lead a health care provider to contact the center for assistance in patient management.

As a regional poison control center, the Oregon Poison Center participates in the national Toxicology Exposure Surveillance System (TESS)

maintained by the American Association of Poison Control Centers (AAPCC). Detailed information regarding patient exposure cases managed by the center is collected and submitted to this national data base. Information collected on each call includes specific product identification, site of exposure, patient demographics, course of treatment, and patient outcome. For those cases not admitted to a health care facility, the poison center record is the only documentation of the incident. On the other hand, the hospitalized poisoning cases represent higher acuity poisonings and the poison center data base lacks significant information concerning these cases, such as cost of hospitalization, length of hospital stay, and payor source.

As programs designed to provide treatment information for patients experiencing toxic exposures and to increase knowledge and education regarding poison prevention, poison centers are limited by several factors. They have very little control over who uses their services and when those services are accessed. In addition, they lack information regarding poisoning incidents in which they were not contacted. This results in limited information regarding the actual scope of poisoning incidents, and thus affects the ability to evaluate poison center program effectiveness through comparison between patient groups. A lack of centralized data bases and divergent goals between

organizations are major obstacles for poison centers seeking additional data to evaluate hospitalized patients.

This study provides a retrospective, descriptive analysis of the hospitalized poisoning cases in Oregon and a comparison between those managed by the Oregon Poison Center and those not. An analysis of hospitalized poisoning cases provides a greater understanding of the scope of the health care problem caused by toxic substances. This information is useful to allow the poison center to evaluate expenses of high acuity poisonings, as well as provide a baseline for future comparison between cases managed by the poison center and those that do not receive poison center intervention. Examining the smaller subset of hospitalized patients managed by the poison center will also provide needed insight into unique features of this patient group. The ability to examine these cases and determine the source and characteristics of poison center intervention will provide important information about the value and effectiveness of poison center services.

Review of the Literature

Incidence and Impact of Poisonings

The literature review surveyed four areas. First, the incidence and impact of poisonings are discussed. Next, research related to poison centers is

presented. The third area discusses program evaluation of health services, and lastly, evaluation of poison centers is reviewed.

An increasing number of poisoning exposures have been reported to the American Association of Poison Control Centers (AAPCC) each year since 1983. The national data collection system maintained by the AAPCC is the largest source of data regarding poisoning cases nationwide. In 1990, 1,713,462 human exposure cases were reported by 72 participating poison centers (Litovitz, Bailey, Schmitz, Holm & Klein-Schwartz, 1991). During this time period, 77% (191.7 million) of the U.S. population resided in geographic areas served by a poison center. The Oregon Poison Center reported 48,330 calls during this time period.

The increasing prevalence of poisoning has an economic impact on the health care system as well as society. In a report to Congress regarding the cost of injuries occurring in 1985, poisoning resulted in a total lifetime cost of $8.5 billion, with a cost per injured person of $5,015 ("Cost of Injury", 1989). On the basis of cost per fatality, poisoning ranked second only to firearms due to the number of deaths at younger ages ($372,691).

In summary, the increasing prevalence of chemical substances and pharmaceutical products, coupled with an expanding population, has resulted in a higher incidence of human exposures to toxic substances, and increased

case loads for poison centers. The current era of escalating health care costs has focused efforts to examine the delivery of health care services and to identify measures for health care reform. These issues demonstrate the necessity to evaluate the role of regional poison centers in providing quality, cost effective service to patients.

Poison Control Centers

Health services for individuals experiencing a toxic exposure include traditional health care facilities as well as poison information centers. Poison centers throughout the country offer a unique health care service, providing treatment recommendations for patients who have been exposed to a toxic substance. The development of poison centers began in 1951 as a result of a survey of pediatricians by the American Academy of Pediatrics (Veltri, 1982). A significant need identified by this survey was for information regarding the toxicity of chemicals, drugs, and environmental agents. The Chicago Poisoning Control Program represented the first formal effort to develop an information and treatment service. Press and Mellins (1954) describe the origination of this program. A committee comprised of the Department of Pediatrics Chairman from each medical school in Chicago and representatives from the City Board of Health, State Toxicological Laboratory, a local medical center with a children's hospital, and the Academy of Pediatrics met to

develop a resource manual identifying toxic components of household products as well as the most recent methods for treating poisoning from these substances. The guide was distributed to hospitals throughout the city. Data on cases treated was submitted to the Chicago Board of Health for further analysis and summarization. The health department personnel utilized telephone calls and home visits to provide poison prevention information to families. Data collected from poison exposures facilitated general public health measures to reduce future incidents of poisoning. The success of this program led to an expansion to other hospitals that wished to participate. Other states began to develop similar programs, based on Chicago's success. By 1957, there were 17 centers in existence throughout the country.

The need for coordination of information exchange between centers led to the formation of the National Clearinghouse for Poison Control Centers within the Public Health Service's Accident Prevention Program (Crotty & Verhulst, 1970). This clearinghouse was designated as an official program by the Surgeon General under authority of the general provisions of Section 301 of the Public Health Service Act. The American Association of Poison Control Centers (AAPCC) was also founded in 1957. In the 1960s, the American Academy of Clinical Toxicology was developed, which established a physician certification examination to be administered by the American Board

of Medical Toxicology (Thompson, Trammel, Robertson & Reigart, 1983). The functions of the clearinghouse were reassigned to the Bureau of Drugs of the Food and Drug Administration in the late 1960s. In 1972, it became the Division of Poison Control (Armstrong, 1980). The role of this entity was eventually incorporated into the Consumer Product Safety Commission's National Electronic Injury Surveillance System.

A proliferation of poison information centers occurred during the 1960s. Many of these centers consisted of a single telephone line in a hospital emergency department or pharmacy, staffed by individuals assigned to other duties and who had little or no training in clinical toxicology. In an effort to control the haphazard expansion of poison control centers, the AAPCC developed preliminary standards for regional poison control centers in 1978. These standards were reinforced by the American College of Emergency Physicians and the American Academy of Pediatrics in 1982. Through these standards, the AAPCC has guided the development of a group of Regional Poison Control Centers throughout the country. Although initially established as information resources, poison centers today provide treatment recommendations for victims of poisoning and toxic exposures, as well as professional education regarding medical management of the poisoned patient and public poison prevention education. In his articles describing regional

poison control services, Veltri (1982) states, "a regional poison control center provides comprehensive poison information to both health professionals and consumers, and should assume ultimate responsibility for the provision of patient care for all poisoning brought to its attention within its region" (p. 1469). He describes a regional center's primary objective to be the management of acute poisoning emergencies. Followup is considered an essential component of the case management activities, allowing regional poison centers to determine that appropriate treatment measures have been taken. Data collection is also a significant part of the function of the regional centers. The statistical data collected by regional poison centers provides valuable information regarding the scope of poisoning incidents as well as effective treatment measures which serve to direct care of future poisoning victims.

Program Evaluation of Health Services

The "delivery of quality patient care for a reasonable cost is the ultimate goal of most health care institutions" (Young, 1988, p. 389). Funding and staffing of health agencies can be threatened unless evaluation evidence can demonstrate the program's positive impact on the health status of the community.

In their discussions about health program evaluation, Anderson and McFarlane (1988) describe nursing evaluation of community response to a health program "in order to measure progress that is being made toward the program's goals and objectives". Although evaluation is traditionally perceived as the final step in the nursing process, the authors emphasize the crucial link between evaluation and assessment, the first step on the nursing process.

Quality assurance and improvement programs gaining prevalence in health care organizations have stimulated efforts to measure quality and effectiveness on a daily basis through monitoring program activities. These efforts have been directed at patient outcomes, and have been strongly supported by the Joint Commission on Accreditation of Healthcare Organizations. The 1994 Accreditation Manual for Hospitals (Joint Commission on Accreditation of Healthcare Organizations, 1993) emphasizes the change in focus of standards from capability to performance. These standards are "intended to stimulate the continuous, systematic, and organization wide improvement in an organization's performance and the outcomes of care" (p. ix).

The traditional economic approaches to analyze the relative value of a program have utilized one of three methods: cost benefit analysis, cost

effectiveness analysis, and cost efficiency (Pruitt & Jacox, 1991). Quantifying costs and benefits in the health care field, however, is problematic. Accounting practices and third party payors have resulted in prices which do not accurately reflect true costs or social values in the health care market.

Sarnecky (1990) describes four levels of theory developed by Guba and Lincoln for program evaluation. The first generation of evaluation utilizes a measurement-oriented approach. This level is characterized by the evaluator functioning as a technician. The emphasis is on measurement with no additional action. The second level of evaluation allows a description. "Patterns, strengths, and weaknesses in relation to explicit, predetermined objectives are described by the evaluator who now adds the role of describer to that of technician." (Sarnecky, 1990, p. 25). The third level of theory builds on the first two, but expands to utilize the evaluator as a judge. Goals and performance are evaluated. The fourth generation evaluation is evolving and is concerned with the claims, concerns and issues of involved individuals. At this level, the evaluator functions as a negotiator and change agent.

While Guba and Lincoln describe program evaluation as a series of steps to examine goals and performance, Anderson and McFarlane further describe areas which serve as the focus for evaluation. *Relevancy* refers to the need for the program. *Progress* determines whether program activities and

resources are adequate for the intended plan. *Cost efficiency* measures the "relationship between the results of a program and the costs of presenting it". *Effectiveness* determines the achievement of program objectives. Finally, *impact* is used to evaluate the long term implications of the program.

It is clear that poisons and toxic exposures pose a significant health hazard which appears to be increasing. As health care programs designed to direct care of patients who are exposed to a toxic substance, poison centers must seek opportunities to evaluate their programs in terms of effectiveness. Routine monitoring of daily activities such as staff performance and the effectiveness of operational policies can provide insight into the progress defined by Anderson and McFarlane. In addition to these aspects, however, poison centers must begin to examine their relevance as a health care service, their effectiveness in providing that service, and, finally, the impact that service has on public health.

Evaluation of Poison Centers

In their case study of poison centers, Lerner and Warner (1988) discuss the unique difficulties associated with evaluating social costs and benefits of poison center services. Factors complicating any analysis include the wide variation of service mix and case volume of poison centers, operating costs which include shared resources as well as in-kind support with supporting

institutions, and lack of quantifiable data regarding psychological costs and benefits. Through an analysis of poisoning incidence, referral patterns, and operating expenses of poison centers, the authors found the operating expenses of the centers consistently less than expenses incurred through unnecessary utilization of alternative health care resources. In concluding discussions regarding the poison control center they state: "its' social utility seems clear, its' social benefits substantially exceeding its' costs; yet its' viability in a world of highly competitive provision of health care seems fragile and uncertain" (p. 421). While the costs of poison centers are private, maintained by supporting institutions, the benefits are public and realized by a larger community.

A review of previous studies indicates the effectiveness of poison control centers has been evaluated from a variety of perspectives. Several studies evaluated the effectiveness of regional poison centers at reducing health care expenses. In a study by Chafee-Bahamon and Lovejoy (1983) evaluating emergency room visits for children's poisonings, it was determined that 63% of pediatric patients seen in an emergency department for poisoning did not require the services of a hospital. The regional poison center was shown to significantly reduce pediatric visits to emergency departments. Geller and Looser (1985) evaluated cost savings of poison center services by querying

poison center callers to determine what alternate services would be used. Responses were quantified utilizing estimated costs of alternate services. King and Palmisano (1991) evaluated patterns of community response following the elimination of a state poison control service. Findings indicated a significant increase in self-referral to health care facilities. Costs of unnecessary outpatient service utilization was estimated to be triple the annual expenses of the poison center service. The study previously mentioned by Lerner and Warner (1988) also focused on economic savings realized by the ability of poison centers to reduce visits to health care facilities. These studies did not address the role of poison centers in managing high acuity patients whose condition necessitates a hospital admission.

Many studies have been initiated by various poison centers to evaluate services from the perspective of the public. Sagotsdky, Gouveia, and Lovejoy (1977) evaluated the effectiveness of a poison information center by evaluating patient understanding of information, patient compliance with treatment recommendation, and the utilization of other resources by patients. Oderda and Klein-Schwartz (1985) demonstrated an increased public awareness of poison center services over a 6-year period. This study was designed to evaluate the center's ability to market services to the community. Other poison centers have utilized satisfaction surveys to evaluate quality of service.

The role of regional poison centers extends beyond initial patient triage. The specialized expertise of the staff combined with extensive information resources facilitates the center's ability to function as a consultant and resource to health care providers managing high acuity poison cases. Several studies have evaluated poison center services from the perspective of health care providers. Scalise, Dean, and Krenzelok (1987) utilized a satisfaction, analysis/knowledge, and opinion questionnaire to elicit information from registered nurses working in emergency departments and intensive care units. Caravati and McElwee (1991) studied the use of clinical toxicology resources by emergency physicians. Findings indicated that poison control center services are more likely utilized for acute symptomatic overdoses.

The ability of a poison center to effectively manage patient care is limited by the ability and desire of users to access services. Soslow and Woolf (1992) discovered that the poison center was not consulted in over 47% of hospital deaths attributed to poisoning in Massachusetts during a 2-year period. A similar study was performed by the Oregon Poison Center (Giffin, 1991). During a 1-year period, the Oregon Poison Center managed 1,352 patients admitted to Oregon hospitals for poisoning incidents. A review of all hospital discharge data during the same time frame indicated a total of 2,486 hospital admissions were related to poisoning. Linakis and Frederick (1993) describe

an analysis of poisoning deaths which were not reported to the regional poison control center. Their study found 29% of the deaths occurring in Rhode Island during a 4-year period were not reported to the poison center. Harchelroad, Clark, Dean and Krenzelok (1990) found only 26% of patients seen with a toxic exposure in an urban emergency department were referred for poison center consultation.

Hospital discharge data sets have been used in many states for surveillance and research regarding injuries. Smith, Colwell and Sniezek (1990) provided an evaluation of the usefulness of International Classification of Diseases external cause-of-injury and poisoning codes for surveillance of nonfatal injuries utilizing records from the Indian Health Service. Methodologic issues in using hospital discharge data sets to determine incidence of hospitalized injuries is described by Smith, Langlois and Buechner (1991). This analysis addressed the inconsistencies seen in incidence estimates due to variations in the definition of injury and the criteria for excluding repeat admissions for the same injury event. Although many studies describe utilization of hospital discharge data bases for injuries, there are very few studies which utilize these data sources for research regarding the incidence of poisoning and drug overdose. Olson and Blanc (1993) describe surveillance of poisoning and drug overdose utilizing hospital discharge coding from two

urban hospitals. Only 72% of actual poisoning cases were able to be identified utilizing N-codes and E-codes related to poisoning or toxic exposures. The authors suggest that common surveillance measures may systematically undercount morbidity.

A review of statistical information maintained by the American Association of Poison Control Centers indicates poisoning cases are managed in three places: on site, or home management; emergency department management followed by discharge; and inpatient admission for hospital care. In spite of a wealth of information regarding the public and health care professionals' perception of poison center services, and cost savings resulting from home treatment or emergency department management of patients, there is a lack of information regarding the poison center's role in dealing with hospitalized poisoning victims. The selection of hospitalized poisoning cases for a research study is supported by several factors. The Joint Commission of Accreditation of Health Care Organizations has determined that high risk and high volume cases pose a high priority for quality assurance activities. For the poison center, hospitalized poisoning cases represent those patients with the highest risk for poor outcomes. These patients have a higher acuity than those which are managed at home or those who are able to be discharged followed an emergency room visit. These patients also represent cases in which health

care expenses are high. As resources with a high level of expertise in the field of toxicology, it is natural to assume that poison centers could be highly effective at managing high acuity poisoning cases. There have been major assumptions made regarding a center's effectiveness as a resource to health care providers, but no research studies to evaluate this area of patient management. Several studies have indicated that poison centers have been underutilized as a resource for the management of seriously poisoned patients.

Efforts to study poison center effectiveness in patient management have been hindered by lack of access to patient data. The AAPCC data base contains detailed information regarding patients managed by poison centers, however efforts to identify and evaluate cases in which poison centers were not involved is problematic. Hospitals and health care providers are frequently hesitant to reveal information due to patient confidentiality as well as concerns that their medical management of cases may be scrutinized. In addition to posing limitations on evaluation of poison center effectiveness, these issues have also made epidemiologic studies of poisoning incidence difficult. This further restricts poison centers' ability to identify problem areas and educational needs within their region.

Conceptual Framework

Utilizing the conceptual approach described by Guba and Lincoln (Sarnecky 1990), an evaluation of the services of a poison center program would begin with measuring characteristics of patients served. Currently, detailed statistical analysis of case characteristics is possible utilizing the poison center data base. Information regarding the number and types of cases managed are collected by poison centers and utilized to track "performance" in terms of case volume and case mix. Poison centers must begin to move towards the second level of evaluation by utilizing a detailed descriptive analysis of what cases are managed and how they are managed. This would allow centers to identify possible weaknesses such as geographic areas underserved, exposure types which have a higher prevalence among certain age groups, or inconsistencies in care of patients experiencing similar exposures. This level of program evaluation is necessary to enable centers to begin to assess and judge their effectiveness at meeting the program goals, which constitutes the third level of evaluation. Utilizing this conceptual approach, an evaluation of the services of a poison center program would begin with measuring characteristics of patients served. General systems theory identifies structural as well as functional concepts which could also be applied to guide program evaluation. A poison center could be described as a

subsystem which is dynamic, interacting with a variety of other subsystems which provide services to similar clients. A description of clients served by other systems may provide a more complete method to evaluate program services.

Key concepts include program, client, subsystem, description, sample and community. Community is described as patients experiencing a toxic exposure. Clients refer to those patients who receive services of the poison center. Subsystems refer to programs which provide services to poisoned patients. Sample in this study represents patients who are hospitalized with a toxic exposure, and description refers to a set of demographic variables as well as cost of hospitalization, length of hospital stay and substance of exposure. Utilizing this conceptual framework, characteristics of hospitalized poisoned patients will be described. This sample will include patients who are served by poison center services as well as those who are not, providing an opportunity to compare and contrast groups.

Several factors unique to the state of Oregon allow the opportunity to access data necessary to further examine hospitalized poisoning patients, and the role of the poison center in managing those patients. The structure and operation of the Oregon Poison Center clearly establishes its' role and expertise in the area of poison management. In addition, Oregon maintains a

detailed, central data base of all hospitalized patients throughout the state. This data set provides an opportunity to examine the incidence of poisoning from a broad, statewide perspective. This data base, combined with detailed statistical data from the Oregon Poison Center, will be utilized to answer the following research questions:

1. What are the characteristics of hospitalized poisoning cases in Oregon?
2. Are the hospitalized poisoning cases from the OPC data base representative of the total population of hospitalized poisoning cases in Oregon.
3. Are there differences in characteristics of patients, exposure substances and characteristics of hospitalization between cases managed with poison center consultation and those without poison center intervention?

Methods

Design and Variables

This study seeks to answer the research questions through a retrospective analysis of patients hospitalized for poisoning and toxic exposures. The study utilizes a quantitative descriptive design, intended to describe characteristics of the population of hospitalized patients in Oregon.

The data collected by the Oregon Poison Center is utilized as well as the Universal Hospital Discharge Data Set (UHDDS) collected by the Oregon Hospital Association and utilized by the Oregon Health Division's Injury Surveillance Program.

Data fields existing on the poison center data base significant to the analysis are: date of call, age of patient, reason for exposure, source of poison center consultation, route of exposure, substance code, hospital, patient gender and site of treatment. Data fields on the UHDDS which are significant to this study are: patient age, gender, hospital, payor source, diagnostic codes (N-codes and E-codes), admission date, length of stay, and total cost of hospitalization. Hospitalized poisoning cases from each data base are described utilizing the existing variables. The two data sets were then matched to identify specific cases common to both. The structures of these two data bases are shown in appendices A and B.

Neither the OPC data base nor the UHDDS contain patient identifiers. In order to identify mutual cases, a computer program was written to allow identification of matched cases based on selected criteria common to both data bases. These criteria are health care facility and patient gender. Following selection of similar cases, the search was narrowed using date and age. To accommodate differences between the data bases it was necessary to widen the

selection criteria for these variables. While the Universal Hospital Discharge Data Set (UHDDS) contains admission date, the OPC data base utilizes call date (the date on which the poison center was contacted regarding each case). The computer program facilitated a comparison of dates from each data base, and selected cases in which dates fell within two days of one another. The UHDDS utilizes patient birth date to calculate age. The OPC data base records reported age, which in some instances may be an approximation provided by a caller who is not the patient. Search criteria included selection of cases in which the age identified in each data set fell within two years of one another. For each potential "match", the computer program identified date, age, gender and health care facility, as well as ICD.9 diagnostic codes (N-codes and E-codes) for each UHDDS case and specific product identification for each OPC case. A sample of this printout is shown in Appendix C. The codes and product identification were then manually compared to verify each match. The OPC case record was reviewed for each case in which the dates did not match exactly. The documentation on the written record was used to provide verification that hospital admission date was different from the call date. Following completion of this process, 800 cases were identified which were determined to be common to both data bases. Although it is not possible to be certain that this process allowed identification

of all matched cases, the process was intended to identify cases for which there was a strong level of certainty of a positive match. Any cases for which there was uncertainty regarding a substance match were not selected as matched cases. The criteria from each data base were combined for each matched case to provide a new expanded data base for analysis.

Variables contained in the UHDDS data base were analyzed to examine differences between the matched and unmatched UHDDS cases. DBase IV was utilized to determine frequencies for each criteria. SPSS was utilized for statistical analysis. Students t-tests were used to determine differences between means for continuous variables. Chi-square tests were utilized for non-continuous variables to identify differences between groups. In order to simplify description of substance of exposure categories, the primary substance of exposure was utilized. The OPC data base contains two possible exposure substances for each case in the event an exposure occurred to more than one substance. The substance which resulted in the most significant effects is identified as the primary substance, and was used in the analysis of this study. The UHDDS contains five possible diagnostic codes related to poisoning. Because they are identified in a hierarchical manner, the first poisoning code which appears in each record was utilized in the analysis. Total frequencies of all poisoning codes in each of the five positions is contained in Appendix F.

Data Sources

Since inception, the Oregon Poison Center has expanded expertise and service. Today, the Oregon Poison Center (OPC) fulfills three roles. The first responsibility of the center is to provide 24-hour telephone assistance to victims of poisoning and toxic exposures. The OPC utilizes nurses with advanced training in toxicology to provide patient assessment and medical treatment recommendations by phone to the public, as well as health care providers who request consultation. In addition, specialized physicians and toxicologists provide ongoing consultation and case management. The second role of the center is the establishment of an effective public education program. The dangers of poisoning and the benefits of actions leading to poison prevention are presented to teachers, parents, and children in health fairs as well as formal classroom educational sessions. Finally, the OPC plays a role in providing education and information in the field of toxicology to other health care professionals. As the only poison center in the state, the OPC assumes responsibility for cases of poisoning and toxic exposures throughout the state, as well as education to the public and health care professionals.

Poisonings managed by the OPC can be divided into three categories, based on the degree of severity. Non-toxic exposures are those in which the

substance is determined to be non-poisonous or the quantity of exposure is too small to cause any health problem. In these cases, the poison information specialist reassures the caller that no treatment is necessary. A second category, toxic exposures requiring treatment at home, represent the largest proportion of cases managed by the OPC. In these instances, the caller is instructed to provide treatment which may range from dilution of a poison to decontamination utilizing Syrup of Ipecac. The OPC checks back with the caller to monitor the patient's condition and ensure adequate response to treatment. The third category includes poisoning that has potential serious complications and cannot safely be treated at the site. Referral arrangements are made with the nearest appropriate emergency department for evaluation and treatment. In many instances, patients can be effectively treated in a hospital emergency room. Decontamination procedures such as administration of activated charcoal and gastric lavage may prevent further absorption of a toxin. Many patients can be discharged home after these treatments. Serious poisonings which require extensive treatment or monitoring may require inpatient admission to a health care facility. For these cases, the OPC provides ongoing consultation and follows the patient's course with the treating physician.

A standardized chart form is utilized to document information for each case managed by the OPC. This form identifies detailed information regarding patient and caller, substance of exposure, route of exposure, product ingredients, patient symptoms, course of treatment and patient outcome. A dot matrix section of the form facilitates data collection regarding initial symptoms, site of exposure, site of treatment, therapy provided, and patient outcome (see Appendix D). This section is scanned and data transferred onto a computer disk for submission to the national toxicology exposure data base. Case statistics specific to Oregon are also maintained on a computer data base by the Oregon Poison Center. These data are converted into an ASCII file which is imported into DBase IV for future data analysis. All OPC cases are reviewed upon completion for effectiveness of patient management and obvious coding errors. The scanning software contains an edit feature to identify inconsistencies in coding as well as missing data fields. These forms are returned to staff for corrections and then rescanned. A random sample of charts from each poison center is retrieved and reviewed annually by a national coding committee from the American Association of Poison Control Centers. Inter-rater reliability for coding of cases is evaluated at this time, and clarification of coding problems are identified and shared with poison center staff.

The Uniform Hospital Discharge Data Set (UHDDS), maintained by the Oregon Hospital Association, contains hospital discharge data on all patients hospitalized within the state of Oregon. The UHDDS was initially created in the late 1970s as a voluntary effort between the Oregon Association of Hospitals (OAH), the State of Oregon, and the Commission on Professional and Hospital Activities (CPHA). Hospitals have been required to submit coding data for all hospital discharge cases since mandated by the state during the 1984/85 legislative session. Standardized information from each medical record is reported in the form of codes obtained from the International Classification of Diseases, Ninth Revision, Clinical Modification. CPHA is an abstracting service which is contracted by OAH to compile a master data tape and perform preliminary edits from the data submitted by Oregon hospitals. The master tape is then submitted to the Oregon Office of Health Policy which further edits and regroups the codes. The data set has evolved to become a valuable epidemiologic tool. The Oregon Health Division's Injury Surveillance Grant, fully funded by the Centers for Disease Control (Grant H34/CC H001598), utilizes the UHDDS as an injury surveillance tool. Cases related to poisoning were retrieved utilizing the International Classification of Diseases Codes (ICD.9.CM). Diagnostic codes related to poisoning and toxic exposures fall within the 960.0 to 989.9 codes. In addition, supplemental E

codes are utilized in injury cases to identify cause of injury. E codes which relate to poisoning fall within the 850.0 and 869.9 range and those related to self injury are within the 950-959 range. For each patient record in the data base, up to five diagnostic codes/E codes are reported.

Sample

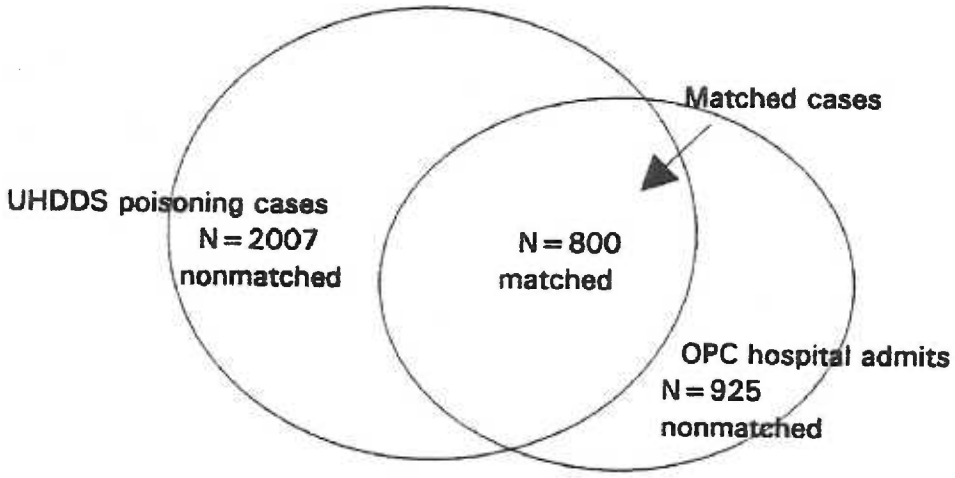
The sample of patients examined in this study represents the entire population of patients hospitalized within the state of Oregon with a coded diagnosis related to a toxic exposure. This is contained in the UHDDS. A subset of the sample consists of the population of hospitalized patients for whom poisoning was a primary diagnosis and poison center consultation occurred (OPC data). A second subset will include those cases in the UHDDS which were not identified in the OPC data base. Comparison between the latter two samples will be made by examining differences between the groups.

Results

A total of 348,217 hospital discharges were reported in the UHDDS from 1990. Of these cases, 25,497 (7%) involved an injury. Two thousand, eight hundred and seven cases were determined to be related to poisoning as defined by presence of a poisoning diagnostic code or E-code. The 1990 OPC data base contains 1,725 cases resulting in a hospital admission. Through the computer match process, 800 cases were identified as being common to both

groups. This indicates 2,007 cases in the UHDDS did not involve OPC intervention, and 925 OPC cases were not identified as having diagnostic codes related to poisoning in their hospital record. A graphic representation of the samples studied is shown in Figure 1. The results of the study will be presented in three sections, describing OPC cases, UHDDS, and "matched" cases. These sections will be followed by a comparison between the matched cases and the non-matched UHDDS cases.

Figure 1. Sample groups



Total UHDDS poisoning admits:	2807
Total OPC hospital admits:	1725
Matched cases:	800
Non matched UHDDS poisoning cases:	2007
Non matched OPC hospital admit cases:	925

Description of OPC Cases

The Oregon Poison Center was contacted for assistance for 42,189 exposure cases during 1990. Sixty-seven percent of these cases (28,295) involved children under the age of 6 years. Twenty-four percent of cases involved individuals older than 17 years. Table 1 contains details of age groups in these cases.

Table 1. Oregon Poison Center exposure calls by age group (N=42,189)

Age Group	No. of Cases	Percent
<6 yrs	28,295	67%
6-12 yrs	2,196	5%
13-17 yrs	1,487	4%
>17 yrs	10,127	24%
Unknown	84	1%
Total	42,189	100%

Details regarding disposition of exposure cases are shown in Table 2. Seventy-seven percent (32,339) of the total exposure cases were managed at home without referral to a health care facility. Nine percent (3,758) of cases were either already in a health care facility (HCF), or were being transported to a HCF when the OPC was contacted. The center staff referred 4,930 cases (12%) to a health care facility for additional evaluation or treatment. Two percent of cases (977) were managed in an alternative site, usually a physician's office, school nurse's office or clinic. Twelve percent (4,964) of

cases were evaluated in an emergency facility and discharged after treatment. Another 1,725 (4%) were admitted to a health care facility after emergency department evaluation.

Table 2. Oregon Poison Center exposure calls by management site

Management Site		No.	Percent
Managed on site: non-health facility		32,339	77%
Pt. in/enroute to HCF prior to OPC contact		3,758	9%
Treated and released (ED)	2,063		
Admitted for medical care	962		
Admitted for psychiatric care/evaluation	164		
Pt. lost to follow-up/left AMA	569		
Pt. referred to HCF by OPC		4,930	12%
Treated and released (ED)	2,901		
Admitted for medical care	499		
Admitted for psychiatric care/evaluation	100		
Pt. refused referral/did not arrive at HCF	792		
Pt. lost to follow-up/left AMA	638		
Other		977	2%
Unknown		185	<1%
Total		42,189	100%

Details of exposure substances are shown in Table 3. Exposure to pharmaceutical products represented 40% of calls. Within this group, 3,861 calls resulted from exposure to analgesics. Cough and cold products were the second largest group of exposures to pharmaceuticals, with 2,298 calls. Exposure to plants represented the largest nonpharmaceutical category, with 4,393 calls. Exposure to cleaning products resulted in 4,068 calls.

Table 3. Most frequent substances of exposure from OPC data base

Non-Pharmaceuticals	No.	Percent	Pharmaceuticals	No.	Percent
Plants	4,393	10%	Analgesics	3,861	9%
Cleaning products	4,068	10%	Cold/cough preps	2,298	5%
Cosmetics	3,219	8%	Topical medications	1,551	4%
Chemicals	1,867	4%	Antimicrobials	1,221	3%
Hydrocarbons	1,667	5%	Vitamins	1,086	3%
Pesticides	1,307	3%	Gastrointestinal prep	865	2%
Foreign bodies	1,151	3%	Sedative/hypnotics	742	2%
Other non-pharm	8,003	20%	Other pharm	4,890	12%
Total	25,675	60%	Total	16,514	40%

As shown in Table 4, among the 1,725 cases resulting in hospital admission, the largest age group represented was over 17 years, with 1,184 cases (69%). Sixteen percent of patients were under 6 years of age. Thirteen percent of cases fell within the 13 - 17 year age group. The age distribution of the OPC hospital admission cases differed significantly from the age distribution of total OPC exposure calls ($X^2_{[4,N=1725]}=2630.4$, $p<.001$) in that OPC hospital admission cases were more likely to be older than the total OPC exposure calls. Whereas 67% of total OPC cases were less than 6 years, only 16% of OPC hospital admission cases were under 6 years.

Table 4. OPC hospital admission cases by age group (N=1,725)

Age Group	No. of Cases	Percent
<6 yrs	283	16%
6-12 yrs	22	1%
13-17 yrs	233	13%
>17 yrs	1,184	69%
Unknown	3	<1%
Total	1,725	100%

As shown in Table 5, 66% of the hospitalized cases were determined by OPC staff to be the result of an intentional exposure. The American Association of Poison Control Centers defines intentional exposures as those which result from an intentional act. These include suicide attempts, misuse, or abuse of substances. Accidental exposures are considered those cases in which an individual inadvertently becomes exposed to a substance. These may include occupational or environmental exposures, as well as accidental childhood poisoning cases. Five hundred twenty cases (30%) involved an accidental exposure. The most frequent route of exposure was ingestion, with 1,589 cases (92%). Inhalation was the second most frequent route of exposure, with 62 cases (4%).

Table 5. OPC hospital admission cases by route and reason for exposure

Reason for Poisoning	**No. of Cases (%)**		**Route of Exposure**	**No. of Cases (%)**	
Intentional	1,147	(66%)	Ingestion	1,589	(92.0%)
Accidental	520	(30%)	Inhalation	62	(3.5%)
Adverse reaction	14	(1%)	Parenteral	40	(2.3)
Unknown	44	(3%)	Dermal	22	(1.3%)
			Bite/sting	8	(0.4%)
			Ocular	7	(0.4%)
			Other/unknown	22	(1.3%)
Total*	1,725	(100%)	Total*	1,750	(101.2%)

* Total exceeded 1725 and 100%, respectively, because some patients had 2 routes of exposure.

Pharmaceutical products were implicated as the primary substance of exposure for 1,421 (82%) cases resulting in hospital admission (Table 6). Among these, analgesics represented the most frequent drug category, with 351 cases. Antidepressants were identified in 269 cases, and sedative/hypnotics represented the third largest category with 247 exposures. Nonpharmaceutical substances were identified in 304 admitted cases (18%). Hydrocarbons (N=51,2.9%), alcohols (N=43, 2.5%) and cleaning products (N=40, 2.3%) represented the categories with the largest number of exposures among nonpharmaceutical products. A complete listing of all substance categories is contained in Appendix E. There was a significant difference ($X^2_{[1,N=1290]}, p < .001$) in the substance categories between the total OPC cases and the OPC admitted cases, with pharmaceutical substances representing a larger proportion of admitted patient exposures (82%), and non-pharmaceutical substances implicated in a larger percentage of total exposures (60%).

Table 6.
Substances of exposure among hospital admissions from OPC data base

Non-Pharmaceuticals	No.	Percent	Pharmaceuticals	No.	Percent
Hydrocarbons	51	2.9%	Analgesics	351	20.3%
Alcohols	43	2.4%	Antidepressants	269	15.5%
Cleaning products	40	2.3%	Sedatives/hypnotics	247	14.3%
Chemicals	33	1.9%	Cardiovascular drugs	82	4.7%
Pesticides	20	1.1%	Antihistamines	76	4.4%
Fumes/gases	19	1.1%	cough/cold preps	62	3.5%
Mushrooms	14	0.8%	Stim./street drugs	61	3.5%
Other non-pharm	84	4.8%	Other pharm	273	19.2%
Total	304	17.6%	Total	1,421	82.4%

Description of UHDDS sample

The UHDDS contains data on 2,807 patient admissions occurring in 1990 which contain a diagnostic code related to poisoning. Seven percent (185) of these cases involved a child under the age of 6 years. Eighty-two percent (2,289) of cases represented individuals older than 17 years. Eleven percent fell within the age range of 13 - 17 years, with the remainder in the 6-12 year old range. Fifty-nine percent (1,669) of the cases in this data set involved females. Details of frequencies of age groups are shown in Table 7.

Table 7. UHDDS cases by age group (N=2,807)

Age Group	No. of Cases	Percent
<6 yrs	185	7%
6-12 yrs	22	<1%
13-17 yrs	311	11%
>17 yrs	2,289	82%
Total	2,807	100%

Pharmaceutical substances represent the largest general category of exposure for patients in the UHDDS, with 2,406 cases (86%), as shown in Table 8. Among pharmaceutical substances, psychotropic drugs represent the most frequent exposure, with 823 cases. Analgesics were second, with 603 cases, followed by sedative/hypnotics (N=142), cardiovascular medications (N=130) and systemics (N=110). Fourteen percent of cases involved primary

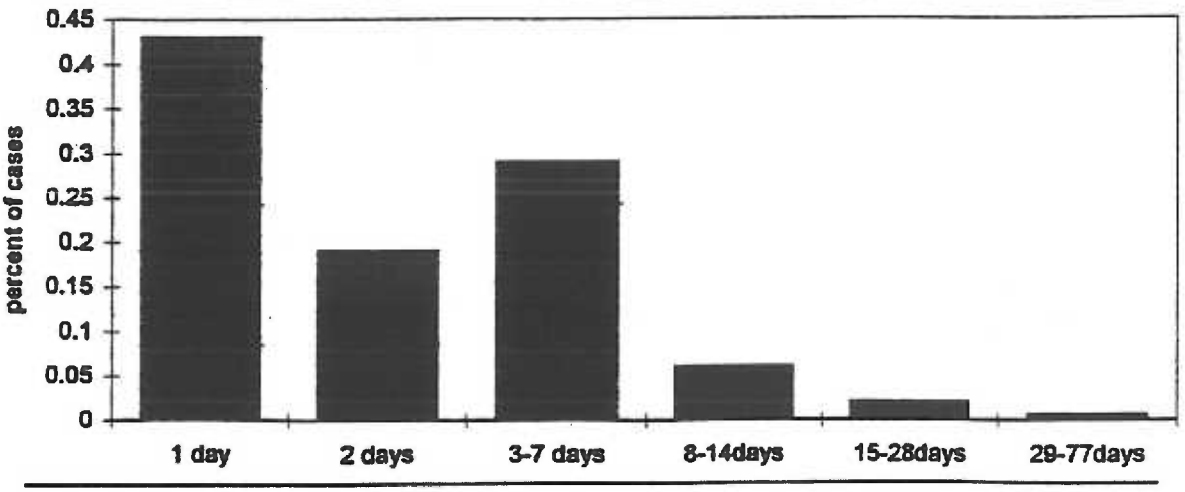
exposure to non-pharmaceutical products. Among these, alcohol represented the largest group, with 94 cases. Gases and fumes represented the second largest non-pharmaceutical category with 63 exposures. The most frequent categories of exposure substances are shown in Table 8. A full listing of all substances of exposure and frequency of incidence is contained in Appendix F.

Table 8. Most frequent substances of exposure from UHDDS

Non-Pharmaceuticals	No.	Percent	Pharmaceuticals	No.	Percent
Alcohols	94	3.3%	Psychotropics	823	29.3%
Gases/fumes	63	2.2%	Analgesics	603	21.5%
Bites/envenomation	45	1.6%	Sedatives/hypnotics	142	5.0%
Carbon monoxide	36	1.3%	Cardiovascular	130	4.6%
Corrosives	35	1.2%	Systemics	110	3.9%
Other non-pharm	128	4.6%	Other pharm	599	3.9%
Total	401	14.3%	Total	2,406	85.7%

Length of hospitalization for these patients ranged from 1 to 77 days, with an average length of stay of 3.3 days. The length of stay in children under 6 years of age averaged 1.8 days. Distribution of length of hospital stay is shown in Table 9.

Table 9. UHDDS length of stay



Adults (over 17 years) had an average length of stay of 3.5 days. Charges were reported for 2,574 cases in the data base. Cases without charges represent patients who were admitted to hospitals owned by a health maintenance organization (HMO) or to a veterans hospital. Total reported hospital charges for patients in the data base were $10,248,921. Charges for hospitalization ranged from $22 to $85,963, with an average cost of $3,982.

Private insurance represented the largest payor source among hospitalized poisoning cases, with 32% of cases. Patients without insurance represented the second largest group (22%). Other payor source data is shown in Table 10.

Table 10. Payor source for hospitalized poisoning cases

Payor	No.	Percent
Private insurance	909	32%
Self pay	616	22%
Medicare	487	17%
Medicaid	364	13%
Other/unknown	332	12%
Other government	52	2%
Workers comp	47	2%
Total	2,807	100%

Description of Matched Cases

Eight hundred cases were identified through the computer match process to be common to both the UHDDS and OPC data bases. These cases

represent those for which the poison center was consulted and will subsequently be referred to as "matched" cases. Cases existing in the UHDDS which were not identified through the match process as being common to both groups will be referred to as "unmatched" cases. These represent cases in which the OPC was not consulted for care. Among the matched cases, adults over 17 years represented the largest age group, with 536 cases (67%). Children less than 6 years represented 15% of cases (116). Details of proportion of each age group within the matched and unmatched cases are shown in Table 11.

Table 11. Cases by age group

Age Group	No. (Percent) Matched		No. (Percent) Unmatched	
<6 yrs	116	(14.5%)	69	(3.4%)
6-12 yrs	11	(1.4%)	11	(0.6)
13-17 yrs	137	(17.1%)	174	(8.7%)
>17 yrs	536	(67.0%)	1,753	(87.3%)
Total	800	(100.0%)	2,007	(100.0%)

Comparison between the matched cases and the unmatched cases showed an association between age group and match status ($X^2_{[3,N=2807]}=177$, $p<.001$). Cases receiving OPC consultation represented a significantly higher percentage of children under the age of 6 years (63% compared to 38%), and

a significantly lower percentage of adults over 17 years (23% compared to 77%). Details are shown in Table 12.

Table 12. Age group by match category

	<6 yrs	6-12 yrs	13-17 yrs	>17 yrs
Matched cases	116 (63%)	11 (50%)	137 (44%)	536 (23%)
Nonmatched cases	69 (37%)	11 (50%)	174 (56%)	1,753 (77%)
Total	185 (100%)	22 (100%)	311 (100%)	2,289 (100%)

Consultation with the poison center may be initiated by two sources; the "public", or a "health care provider". The "public" refers to the patient, friend, relative, or other layperson who may call with concern regarding a toxic exposure. "Health care providers" refer to any health professionals who consult with the poison center regarding patients under their care. Among children under 6 years who were hospitalized for a poisoning and received OPC consultation, the public represented the largest referral source (72%). Among total hospitalized children in this age group, 45% received OPC consultation as a result of initiation by a public source. Among adults over 17 years, 3% of total admissions received OPC consultation initiated by a public source. This represents 15% of the adult cases which received OPC involvement. Further details are shown in Table 13.

Table 13. OPC consultation source by age group

	No. of Cases
Patients <6 yrs	
Source of consult with OPC	
Public	83 (45%)
Health care provider	33 (18%)
No consult with OPC	69 (37%)
Total	185 (100%)
Patients > 17 yrs	
Source of consult with OPC	
Public	78 (3%)
Health care provider	458 (11%)
No consult with OPC	1,753 (86%)
Total	2,289 (100%)

Females represented 62% (N=493) of matched cases and 58% (N=1,176) of unmatched cases. Cost of hospitalization for matched cases ranged from $22 to $72,179, with an average of $3,521. Among unmatched cases, the cost of hospitalization ranged from $47 to $85,963, with an average of $4,166. The average cost of hospitalization among the matched cases was lowest within the youngest age group, and greatest within the adult age group. A significant difference in cost of hospitalization was seen between matched ($\underline{M}$=$3,521, SD=4507) and unmatched groups ($\underline{M}$=$4,166, SD=5548), with the matched cases having a lower average cost (t=3.06, p=.002). Cost of hospitalization was lowest in the matched cases within all age groups.

Table 14. Cost of hospitalization by age group

Age Group	Matched Avg. Cost	(No.)*	Unmatched Avg. Cost	(No.)*
<6 yrs	$2,157.80	(102)	$2,492.91	(64)
6-12 yrs	$3,551.10	(10)	$5,655.70	(10)
13-17 yrs	$2,634.28	(125)	$3,775.30	(165)
>17 yrs	$4,021.52	(499)	$4,264.08	(1,599)
Total	$3,521.23	(736)	$4,166.10	(1,838)

* Cases with no reported charges (HMO, VA) were removed from analysis

Within the matched group, average length of hospitalization was 2.73 days with a range from 1 to 77 days. Adults older than 17 years had the longest hospital stay, with an average length of stay of 3.14 days. Children under 6 years had the shortest hospitalization among age groups, with an average length of stay of 1.47 days. An F-test in a 2x4 (matched/nonmatched x age group) analysis of variance (ANOVA) showed a statistically significant ($F_{[1,2799]}=8.57$, $p<.003$) shorter length of stay within the matched group ($\underline{M}=2.73$, $SD=4.51$) when compared with the unmatched group ($\underline{M}=3.55$, $SD=4.89$). Comparison between matched and unmatched cases reveals shorter average length of stay among all age groups in the matched cases. There was no significant interaction between age and whether cases were matched or nonmatched ($F_{[3,2799]}=.36$, $p=.78$). Detailed comparison is shown in Table 15.

Table 15. Length of hospitalization by age group

Age Group	Matched Average LOS	Unmatched Average LOS
<6 yrs	1.47	2.25
6-12 yrs	2.82	4.00
13-17 yrs	2.23	3.30
>17 yrs	3.13	3.62
Total	2.73	3.55

Eighty-six percent (690) of matched cases involved exposures to pharmaceuticals. Among pharmaceutical products, psychotropic drugs represented the most frequent substance of exposure, with 231 cases (29%). Analgesics were involved in 198 cases (24.7%). Among non-pharmaceutical substances, corrosive chemicals were the most frequent substance of exposure, with 17 cases. A comparison of general substance categories (pharmaceuticals/non-pharmaceuticals) between matched and unmatched cases showed no significant difference ($X^2_{[1,N=800]}=0.205$, $p=0.651$). Details of exposure substances are shown in Table 16.

Table 16.
Most frequent substances of exposure among "matched cases" from UHDDS

Non-Pharmaceuticals	No.	Percent	Pharmaceuticals	No.	Percent
Corrosives	17	2.1%	Psychotropics	231	28.9%
Gases/fumes	16	2.0%	Analgesics	198	24.7%
Alcohols	15	1.9%	Sedatives/hypnotics	44	5.5%
Pesticides	12	1.5%	Systemics	37	4.6%
Food (fish, plants)	10	1.3%	Cardiovascular	36	4.5%
Other non-pharm	40	5.0%	Other pharm	144	18.0%
Total	110	13.8%	Total	590	86.2%

Among the matched cases, 580 were already in or enroute to a health care facility before the OPC was contacted. Two hundred twenty cases were referred to the health care facility by the OPC.

Discussion

It has long been recognized that poison center services are used most frequently in cases in which substances of exposure are non-toxic, or in instances when it is possible to effectively manage a patient at home without referral to a health care facility (Litovitz, et al., 1991). This study supports that finding. The Oregon Poison Center is utilized for service and information in many instances in which further HCF evaluation is not necessary. During 1990, the majority of cases (77%) managed by the OPC were cared for on-site without additional referral necessary. While 12% resulted in an emergency department visit, only 4% of the total cases managed by the center required admission to a health care facility. The high proportion of pediatric patients served by the OPC during the time frame studied reflects on the original purpose for the development of poison center services as discussed by Veltri (1982). The needs expressed by pediatricians providing care for children in 1951 are still being served today. It is interesting to note, however, that although pediatric patients represent the largest group of patients served overall by the center (67%), they represent a smaller proportion of the patients

hospitalized with a toxic exposure. Among the hospitalized patients managed by the center, adults over 17 years represent the largest age group. This difference in age groups between total cases and admitted cases also reflects the differences in reason for exposure. Pediatric patients are more frequently involved in accidental poisoning, adults more often experience intentional exposures.

This difference in age groupings between cases managed at home and those admitted for hospitalization is most likely influenced by the substances of exposure which provide the highest acuity illness. Non-pharmaceutical substances represent the most frequent type of exposure among poison center calls (60%), with plants representing the single largest category. Among hospitalized poisoning cases, however, pharmaceutical substances are the most frequent type of exposure (82%), with non-pharmaceutical substances identified in only 18% of cases. Substances resulting in the most frequent calls do not accurately represent those cases with the highest morbidity. It is important to note that an examination of patients receiving treatment in a hospital emergency department was beyond the scope of this study. These patients, however, represent another 4,964 (12%) of cases managed by the center. The total number of patients receiving treatment in an emergency facility without poison center involvement is unknown. This potentially

represents another significant group of patients currently underserved by the poison center.

The study showed that the OPC data base is not reflective of the total population of hospitalized poisoning patients. While 1,725 (4%) of total OPC cases were hospital admissions, a total of 2,807 hospitalized patients in Oregon had some type of toxic exposure clearly identified in the hospital record during the same time frame. A total of 925 cases were identified in the OPC data base which resulted in a hospital admission, but which were not identified on the UHDDS. This suggests that these cases were not identified with a diagnostic code related to a poisoning. There are several possible reasons why these cases were not identified. It is important to note that the cases selected from the UHDDS were identified utilizing ICD.9 codes related to poisonings and toxic exposures. Excluded from this selection process were cases with diagnostic codes consistent with drug dependence or drug abuse (diagnostic codes 304.0 - 305.9). The OPC is frequently consulted regarding patients who are experiencing problems related to drug abuse. Due to variations in coding, it was not possible to consistently exclude these patients from the OPC data base. This may account for some of the unmatched cases from the OPC data base. Further analysis of the OPC data base revealed that 264 of the hospital admission cases were admitted for psychiatric evaluation. In some instances,

the toxic exposure experienced by the patient may have resolved. In these instances, the diagnostic codes may be related to a psychiatric disorder rather than a poisoning incident, explaining some of the cases which were unable to be identified in the UHDDS.

A sample of unmatched OPC cases which received care at one health care facility was selected for further analysis. A total of 60 cases admitted to one specific hospital received consultation from the OPC but did not appear as a poisoning admission on the UHDDS. The OPC records were reviewed to determine further details which may explain their lack of poison codes. Of these, 24 cases (40%) were actually admitted to a psychiatric unit for evaluation of an underlying psychiatric problem which may have resulted in an intentional toxic exposure. At the time of hospitalization, however, any medical problems related to the toxic exposure were resolved, and were not a cause of admission. Another 10 cases (17%) had clinical effects unrelated to a toxic exposure. Four cases involved questions from health care providers regarding possible adverse clinical effects seen from dosage errors. Five cases were clearly the result of chronic abuse problems. It was not possible to determine reasons for coding variances for the remaining 17 cases without further examination of the hospital medical record.

It became clear that in many cases OPC consultation may have been used to rule out a toxic exposure, and that the patient may have in actuality had another cause of illness resulting in hospitalization. This does not suggest that the consultation was inappropriate, but more importantly, suggests that the poison center may play an important role is assisting health care providers to rule out a toxic exposure in a differential diagnosis. The expertise of the poison center staff as well as the information resources available in the center are often used by health care professionals to evaluate the likelihood that a particular symptom could be related to an unknown exposure. In many instances, lab tests or additional patient evaluation is suggested by center staff, which may allow the health care provider to determine an exposure did not occur. In light of this, the poison center can provide services for patients who did not experience a toxic exposure, thus expanding the potential population served.

Comparison of specific substance categories between the OPC cases and the UHDDS cases was not possible in this study due to categorical differences in coding, however, it is apparent that the ratio of pharmaceutical substances to non-pharmaceutical substances is similar. This re-emphasizes the significant role of pharmaceutical substances in high acuity poisonings. The

slightly larger percentage of non-pharmaceutical substances among OPC cases may reflect the higher proportion of pediatric cases.

The differences between cases managed with poison center involvement, and those that did not involve the poison center reveals significant characteristics about the service the poison center provides, the perception of that service by health care providers, and the patients served. The OPC is more frequently utilized in the younger aged patients (less than 6 years), and less often utilized for older patients (greater than 17 years). There are several factors which may lead to this difference. First, the origination of poison centers to provide assistance in accidental pediatric poisoning incidents may continue to influence the perception of callers regarding poison center services. The Oregon Poison Center maintains an active public education program targeted at parents and teachers. This program emphasizes the poison center's role as a resource in instances of pediatric accidental poisonings. Among children younger than 6 years who were identified in the UHDDS and received OPC consultation, 83 (71%) were referred to the health care facility by the OPC after an initial call was received by a parent or child care provider. This group represents 45% of the total hospital admissions among this age group. These findings suggest the public education efforts of the OPC are facilitating the utilization of poison center services among parents. The

public is playing a large role in initiating poison center consultation among pediatric poisoning cases. Among the total number of hospitalized poisoning patients under 6 years, health care providers initiated contact with the OPC in 33 cases (18%). Health care providers initiated the poison center contact in 85% of instances among adults over 17 years who received poison center consultation. This represents only 11% of the total hospitalized patients in this age group, however. These findings suggest that neither the public nor health care providers are initiating contact with the poison center in adult poisoning incidents, resulting in a less frequent involvement of the OPC in admitted poisoning cases. This could reflect on a strong perception that poison center services are primarily geared towards children experiencing accidental ingestion. In addition, it may suggest that the perception of what constitutes a poisoning is varied among health care providers.

Length of stay and cost of hospitalization represent major concerns in the current health care environment. The comparison between cases managed with poison center involvement and those in which the OPC was not consulted reveals significant differences in length of stay and cost of hospitalization. Although it is clear that many factors influence these variables, this study suggests that there is a relationship between poison center involvement and reduced cost of hospitalization. Although lower cost of hospitalization is seen

in the younger age groups, this difference was seen within each age group. Due to the small sample and great variability within each age group, it is not possible to determine significance of differences between matched and unmatched cases within each age group.

The question remains that perhaps the poison center is consulted on patients with less acuity. The high percentage of consults with the poison center that are originated by the public may indeed represent less acute poisoning cases by the mere fact that the patient is not already in a health care facility. It is reasonable to assume that patients experiencing severe symptomatology, such as loss of consciousness or seizures, would probably be referred to emergency medical services through the 911 system prior to notification of the poison center. This does not explain, however, any reasons for which a health care provider would only consult with the poison center on less acute patients. It may be that the diagnosis of a toxic exposure is not clear, or the patient had other medical problems which influenced their care, however, these patients all had a diagnostic code related to poisoning, suggesting there was a clear indication in their chart that a toxic exposure was a significant diagnosis. It is also possible that for some types of poisonings, health care providers do not feel they need additional assistance in managing a patient's care. Further analysis of trends in certain substance categories or

certain health care facilities may provide insight into this area, however, this is beyond the scope of this study.

The possibility exists that there are other factors influencing the difference in charges besides age and length of stay, and is an area needing further study. It is possible that the ability of a poison center to provide assistance in diagnostic tests, monitoring guidelines, and patient assessment may actually allow a health care provider to provide more efficient care in a shorter time frame. This finding would support the premise long held by poison centers, that the resources and expertise of these centers can assist health care providers as well as the public.

Limitations of Study

There are several major limitations to this study. The most significant limitation is created by the differences in data fields between the two data bases. Because the two data bases utilized contain different information, and no patient identifiers, it is not possible to verify that "matched" cases are truly the same case. The match process was complicated by the fact that other than health care facility, there was no single data field identical to each data base which could be used for matching. Using HCF, and approximating date and patient age, often resulted in several potential matches which in some cases could not be verified. This process did not allow the opportunity to match

cases in which the patient may have been hospitalized for several days before the poison center was contacted. As a result, the match group may actually be smaller than the true number of cases which received OPC intervention.

The OPC data base contains very specific product codes which identify substance of exposure in great detail, including product brand names. These specific products are grouped in general categories defined by the American Association of Poison Control Centers. In situations in which a substance of exposure may be a combination drug, or a product comprised of several different chemicals, the groupings are intended to provide a mechanism to examine poisoning cases from a broad epidemiologic perspective. For this reason, the groupings tend to reflect those specific chemical components which create the most significant patient risk, as opposed to the component which may represent the largest percentage ingredient. The standardized groupings in the ICD.9 coding system are somewhat different. Because of these differences in the way exposure substances are grouped, a comparison of substances between these data bases was difficult.

Another limitation of the study results from the fact that components in each data base were identified by coders. In the poison center data base, the individuals coding cases are the nursing staff who are involved in that patient's management. In hospitalized cases which are followed over a period of time,

staff from several shifts may participate in the coding. This often allows errors to be identified, but does not totally eliminate the possibility that errors in coding may have occurred. The UHDDS is comprised of coded patient records from all hospitals within the state of Oregon. Although training is provided to hospital coders to maintain a standardized method of coding, errors may also occur in this data base. The medical records coders generally base coding selections on documentation in the hospital record. If certain circumstances of a patient condition are lacking in the hospital record, the coding selections may not accurately reflect the patient condition. Several studies have evaluated the utilization of ICD.9 codes, including E-codes, in surveillance activities. A study by Blanc, Jones, and Olson (1993) examined the surveillance of poisoning and drug overdose through hospital discharge coding, poison control center reporting, and the drug abuse warning network. This study of a case series at two urban hospitals showed that only 72% of poisoning patients studied were able to be identified using a search of N-codes related to poisoning or drug overdose or any E-code. This finding suggests that the actual number of patients experiencing a hospital admission related to poisoning may indeed be larger than that identified by selection of cases based on ICD.9 codes.

The final major limitation in this study is due to the nature of poisoning and toxic exposures. Patient condition, hospital course, and outcome are dependent on a multitude of factors, including the specific circumstances of exposure, patient factors, and medical treatment. For this reason, it is very difficult to identify causation of significant differences between similar exposures. Research concerning toxicology is challenging due to the difficulty of controlling all the variables which may impact outcome. This study does not allow the ability to identify reasons for differences between cases managed with poison center involvement and those that are not. It does, however, provide an opportunity to identify if and where differences do exist between these groups, suggesting areas for future study.

Recommendations for Future Research and Impending Changes

This preliminary study has facilitated development of additional studies utilizing matched cases for comparison between cases managed by the poison center and cases which were not. Such a comparison provides valuable information regarding the poison center's effectiveness in managing these high acuity patients. Additional questions which may generate future study include:

For what types of poisoning incidents are health care providers most likely to consult with the poison center?

Are there differences in patient outcome when the poison center was involved?

What additional factors may influence cost of hospitalization and length of stay among poisoning cases?

Are there significant differences between cases referred to the poison center by the public and those for which a health care provider initiated the poison center consultation?

This study has provided insight into the utilization of poison center services for hospitalized poisoning patients through comparison of two data bases. Changes to each of these data bases may facilitate future analysis. First, changes in the UHDDS will facilitate the collection of additional information on hospitalized patients within the state. The Oregon Association of Hospitals is changing the format of the data collected to an expanded format referred to as the Uniform Billing Data Set. This format was originally developed for use by the Health Care Financing Administration, and is currently used for Medicare and Medicaid billing. It is anticipated that this format will provide more consistent and complete information regarding hospital cases.

Hospitals in Oregon are not currently required to submit coded patient information for outpatient and emergency department visits. With increasing

emphasis on outpatient treatment, this patient population is rapidly expanding. Information regarding these patients could provide additional valuable information for the poison center to evaluate effectiveness and utilization.

The American Association of Poison Control Centers must begin to identify opportunities to facilitate comparison of the TESS data base with other national data bases. It became clear during this study that a direct comparison between substances of exposure among the UHDDS and OPC data bases would allow additional analysis of similar cases. Inclusion of the ICD.9 coding categories for substances in the more complete data base of the poison centers would facilitate this comparison. This would most easily be accomplished through a computer cross match of the current product codes used by the AAPCC with the corresponding ICD.9 code. Both of these codes could then be inserted into the data base for data analysis. The additional insertion of E-codes based on the reason for exposure, which is currently collected by poison centers, could further improve the value of the data base.

Minor changes in the data collected by poison centers could provide great assistance in future analysis. Additional data fields, such as patient date of birth and hospital admission date would provide more accurate analysis of cases and may facilitate comparisons between this data base and other patient data bases.

Mandatory reporting of all poisonings and toxic exposures to regional poison centers would allow poison centers to participate in the care of all high acuity poisoning incidents. This would assist centers to identify significant trends or health concerns regarding poisoning incidents and could result in health care cost savings through more effective patient management. The increased case load, however, could jeopardize existing effectiveness unless additional resources could be provided to the centers. It is clear that careful evaluation of cost effectiveness would be necessary before this option should be implemented.

This study clearly suggests the need for education of health care providers regarding the services of the poison center. The role of the poison center extends beyond the provision of information regarding chemical toxicity. Health care providers need to recognize that staff of the poison center can provide expertise in managing victims of drug overdose and occupational exposures as well as pediatric poisoning. Poison centers must begin to educate health care providers regarding their role and expertise. In addition, the centers must examine the needs expressed by providers in an effort to adapt their services to be an effective health care resource.

Conclusion

Management of patients experiencing a poisoning or toxic exposure presents challenges to the health care system. Evaluation of the Toxic Exposure Substance Surveillance system maintained by the American Association of Poison Control Centers reveals an increasing number of poisonings reported to poison control centers throughout the country each year (Litovitz, Schmitz, & Bailey, 1990). This data base indicates the majority of poisoning incidents managed by poison centers are managed without referral to a health care facility. The role poison centers play in this population is clear. The data base has also been utilized to provide a description of the types of poisonings requiring or receiving treatment in a health care facility. Because poison centers are dependent on the public or health care providers to initiate consultation with a poison center, it has been difficult to examine the true incidence of poisonings and toxic exposures. As poison centers seek opportunities to examine their role and effectiveness in providing treatment recommendations for poisoned patients, this lack of information has been critical.

This study has examined the actual incidence of hospitalized poisoning cases in the state during a 1-year period utilizing a data base containing information regarding all hospitalized patients throughout the state. Through a

computerized match process, it was possible to identify from this group of patients those in which the poison center was consulted for treatment. This process enabled the examination of differences between cases which received poison center consultation and those which did not.

It is clear that toxic exposures represent a significant health concern in Oregon. During the time period studied, 2,807 patients were hospitalized with a poisoning or toxic exposure. Total costs of hospitalization among the 2,574 cases in the data base with reported charges exceeded $10 million. In addition to these patients, the OPC was consulted for another 925 hospitalized patients for which poisoning was not identified as related to their admission at the time of discharge. The cases managed by the OPC with the additional hospitalized cases without poison center involvement totaled over 44,000 cases during this time frame. This study has shown that the poison center can provide services for patients who have not experienced a toxic exposure. In these instances, the poison center can assist health care providers to rule out the possibility of a toxic exposure.

This study has shown there are significant differences in cost of hospitalization and length of stay in hospitalized patients receiving poison center consultation. The shorter length of stay and reduced costs of hospitalization among these cases may mean that the poison center can assist in

the provision of more effective care of the hospitalized patient or that the poison center is involved with cases of lower acuity.

Only 28% of hospitalized poisoning cases examined in this study received OPC consultation. It is clear that although poison centers can play an important role in the care of high acuity patients, centers are not well utilized in these cases. Poison centers must begin to take further steps to increase involvement and consultation in the care of hospitalized poisoning patients. The poison center is consulted in a large percentage of hospitalized pediatric poisoning patients. Parents of young children are initiating contact with the poison center in many of these cases. This suggests the public education efforts directed at parents is assisting the poison center to become involved in the care of pediatric poisoning patients. The poison center is not well utilized in adult hospitalized poisoning cases. Establishing closer relationships with health care providers may increase consultation for these cases. Educational programs must be directed to health care providers to increase their awareness of the significant role the poison center can play in patient management, particularly among adult patients. Further efforts should also be directed at educating health care providers regarding important concepts in toxicology and patient management.

The evaluation process allows poison centers to meet the changing needs of the public and to determine priorities of service in light of budget constraints. This research study has provided the opportunity to gather a large amount of data regarding the hospitalized poisoning patient. The identification of characteristics such as cost of hospitalization, length of stay, referral, and utilization patterns provide information which may assist the poison center staff in better patient management as well as future program planning.

In the current environment all health care programs must continuously evaluate their services for relevancy, effectiveness, cost efficiency, and impact. This study represents an initial examination of the population of hospitalized poisoning cases in Oregon. The incidence of poisoning indicates there is a continued need for the services provided by poison centers. In addition, the possibility of reduced hospital costs among the population served suggests the services of the poison center are cost efficient as well as effective. In summary, poison centers can have a positive impact on public health. Further examination of the services provided by these programs may facilitate the ability to quantify cost savings.

Poison centers provide a unique service for an expanding population base. As programs which provide effective patient assessment, triage and patient management, poison centers may serve as a model for innovative health

care delivery systems in the years to come. Their value may be not only in the service they provide, but in the manner in which they provide that service.

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Appendix A

Structure of OPC Data Base

Field	Field Name	Type	Width	Dec	Index
1	FORMNUM	Numeric	8		N
2	HD_MATCH	Numeric	5		N
3	MONTH	Numeric	2		N
4	DAY	Numeric	2		N
5	YEAR	Numeric	2		N
6	CALLDATE	Date	8		N
7	DAYOFWEEK	Numeric	1		N
8	TIME	Numeric	2		N
9	CALL_T	Numeric	1		N
10	CALL_V	Numeric	1		N
11	CALL_E	Numeric	1		N
12	CALL_R	Numeric	2		N
13	AGE_INFANT	Numeric	2		N
14	AGE_CHILD	Numeric	2		N
15	AGE_ADOLES	Numeric	2		N
16	AGE_ADULT	Numeric	2		N
17	AGE_UNK	Numeric	1		N
18	AGE	Numeric	3		N
19	SEX	Numeric	1		N
20	CALLSITE	Numeric	1		N
21	HCF	Numeric	3		N
22	EXPOSITE	Numeric	1		N
23	CALLERLOC	Numeric	6		N
24	CITY	Numeric	3		N
25	COUNTY	Numeric	2		N
26	STATE	Numeric	2		N
27	INGESTION	Logical	1		N
28	INHALATION	Logical	1		N
29	OCULAR	Logical	1		N
30	DERMAL	Logical	1		N
31	BITE_STING	Logical	1		N
32	PARENTERAL	Logical	1		N
33	OTHERROUTE	Logical	1		N
34	UNK_ROUTE	Logical	1		N
35	INITIAL	Numeric	1		N
36	PCODE1	Numeric	7		N
37	PCODE2	Numeric	7		N
38	TOTAL_SUBS	Numeric	2		N
39	FLOW	Numeric	1		N
40	HOSPITAL	Numeric	1		N
41	REFERRAL	Numeric	1		N
42	ADMIT	Logical	1		N
43	INITIALHCF	Numeric	3		N
44	FINALHCF	Numeric	3		N
45	LATER_SX	Logical	1		N
102	DOB	Date	8		N
103	AGE_HD	Numeric	3		N
104	SEX_HD	Numeric	1		N
105	ADMIT_HD	Date	8		N
106	DISCHARGE	Date	8		N
107	LOS	Numeric	3		N
108	ORIGDX1	Character	6		N
109	ORIGDX2	Character	6		N
110	ORIGDX3	Character	6		N
111	ORIGDX4	Character	6		N
112	ORIGDX5	Character	6		N
113	PX1	Character	4		N
114	PX2	Character	4		N
115	PX3	Character	4		N
116	PX4	Character	4		N
117	PX5	Character	4		N
118	DISPO	Numeric	1		N
119	PAYOR	Numeric	2		N
120	CHARGES	Numeric	6		N
** Total **			476		

Appendix B

Structure of UHDDS Data Base

Field	Field Name	Type	Width	Dec	Index
1	HOSP	Numeric	4		N
2	HOSPZIP	Numeric	5		N
3	HOSPCITY	Numeric	3		N
4	HOSPCOUNTY	Numeric	2		N
5	OPC_CODE	Numeric	3		N
6	ZIP	Numeric	5		N
7	DOB	Date	8		N
8	AGE	Numeric	3		N
9	SEX	Numeric	1		N
10	ADMIT	Date	8		N
11	DISCHARGE	Date	8		N
12	LOS	Numeric	3		N
13	ORIGDX1	Character	6		N
14	ORIGDX2	Character	6		N
15	ORIGDX3	Character	6		N
16	ORIGDX4	Character	6		N
17	ORIGDX5	Character	6		N
18	PX1	Character	4		N
19	PX2	Character	4		N
20	PX3	Character	4		N
21	PX4	Character	4		N
22	PX5	Character	4		N
23	DISPO	Numeric	1		N
24	PAYOR	Numeric	2		N
25	CHARGES	Numeric	6		N
** Total **			113		

Appendix C

Printout from Computer Match

```
For 01/06/90  55 1 944.26 518.5  941.37 943.31 987.9   17
     No match found within constraints defined

For 01/07/90  53 2 300.4  E950.4 E950.3 969.7  972.6   63
     No match found within constraints defined

For 01/07/90  33 1 963.0  E858.1 309.0     .      .    83
     No match found within constraints defined

For 01/07/90  85 2 311.   969.4  E950.3 496.   707.0    31
     No match found within constraints defined

For 01/07/90  16 2 965.7  963.0  296.24 E950.0 E950.4  40
    Check  10591778 01/09/90  15 2 ACUTRIN 16 HOUR TABLET from CIBA CONSUMER PHARMACEUTICALS (CAFFEINE

For 01/07/90  18 2 974.1  535.5  599.0     .      .    29
    Check  10591808 01/09/90  19 2 IMIPRAMINE HYDROCHLORIDE TABLET 50 MG from SCHEIN   0

For 01/07/90  41 2 962.3  E950.4 348.3  518.81 518.4   83
     No match found within constraints defined

For 01/07/90  39 2 962.3  251.0  E858.0 250.41 583.81  0
     No match found within constraints defined

For 01/08/90  85 2 562.10 578.1  535.4  E850.3 250.00  0
     No match found within constraints defined

For 01/08/90  39 2 969.1  296.54 969.5  E950.3     .    64
     No match found within constraints defined

For 01/08/90  28 1 969.1  295.64 E950.3     .      .    40
    Check  10591364 01/06/90  30 1 TALACEN CAPLET from WINTHROP  85
    Check  10591914 01/10/90  26 1 GENERAL POISON  74

For 01/08/90  52 2 965.4  E950.0 305.00 311.   715.90  15
     No match found within constraints defined

For 01/08/90  19 2 966.3  E936.3 345.90     .      .    82
    Check  10591808 01/09/90  19 2 IMIPRAMINE HYDROCHLORIDE TABLET 50 MG from SCHEIN   0

For 01/08/90  33 1 965.09 300.4  E950.0     .      .    40
     No match found within constraints defined

For 01/08/90  25 1 966.1  305.00 E950.4     .      .    3
    Check  10591914 01/10/90  26 1 GENERAL POISON  74

For 01/09/90  15 2 965.4  E950.4 965.1  E950.0 977.8   83
    Check  10591778 01/09/90  15 2 ACUTRIN 16 HOUR TABLET from CIBA CONSUMER PHARMACEUTICALS (CAFFEINE

For 01/09/90  33 2 969.0  969.4  E950.3 311.      .    47
     No match found within constraints defined

For 01/09/90  27 2 973.1  276.5  558.9  E943.1     .    40
     No match found within constraints defined

For 01/09/90  62 2 965.4  E950.0 305.02 401.1  440.9   0
     No match found within constraints defined

For 01/09/90  19 2 969.0  E950.3     .      .      .    61
    Check  10591808 01/09/90  19 2 IMIPRAMINE HYDROCHLORIDE TABLET 50 MG from SCHEIN   0
```

14153553

AAPCC COOPERATIVE POISON CENTER REPORT FORM

DATE: _____ TIME: _____

CALL TYPE (T) (one only)	Victim (V) (one only)	Exposure Type (E) (one only)	REASON (R) (one only)			
			Accidental	Intentional	Adverse Reaction	Unknown
1 Human 2 Animal	1 Human 2 Animal	1 Acute 2 Chronic 3 Unknown	1 General 2 Occupational 3 Environmental 4 Misuse 5 Unknown	6 Suicidal 7 Misuse 8 Abuse 9 Unknown	10 Drug 11 Food 12 Other	13 Unknown Reason

PATIENT DATA

Name: _____

Telephone no.: ( )

Address: _____

Zip: _____

Age: _____ ☐ mo ☐ yr Weight: _____ ☐ lbs _____ kg

Sex: ☐ Male ☐ Female ☐ Unknown

Pertinent Medical History: _____

Check here if patient is pregnant ☐

PMD name & no.: _____

CALLER DATA

Name: _____ ☐ MD ☐ RN ☐ RPh ☐ OHP

Relationship to patient: ☐ Self ☐ Father ☐ Mother ☐ Other _____

Telephone no.: ( )

Address: _____

Zip: _____ County: _____

Site of Caller		Site of Exposure
☐	Residence	☐
☐	Workplace	☐
☐	Health Care Facility	☐
☐	School	☐
☐	Other	☐
☐	Unknown	☐

SUBSTANCE DATA

Substance: _____

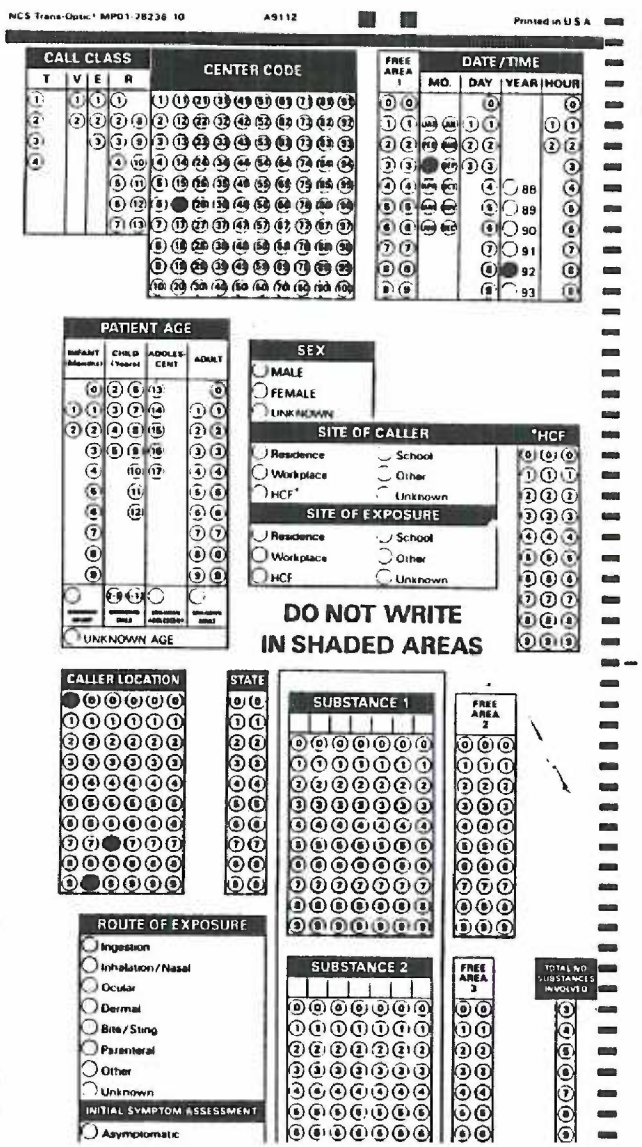
Amount: _____

Ingredients:

Time of / Since exposure: _____

Route of Exposure: ☐ Ingestion ☐ Inhalation/Nasal ☐ Ocular ☐ Dermal ☐ Bite/Sting ☐ Parenteral ☐ Unknown ☐ Other _____

HISTORY, ASSESSMENT, SYMPTOMS & CALCULATIONS



Treatment
Facility: _____

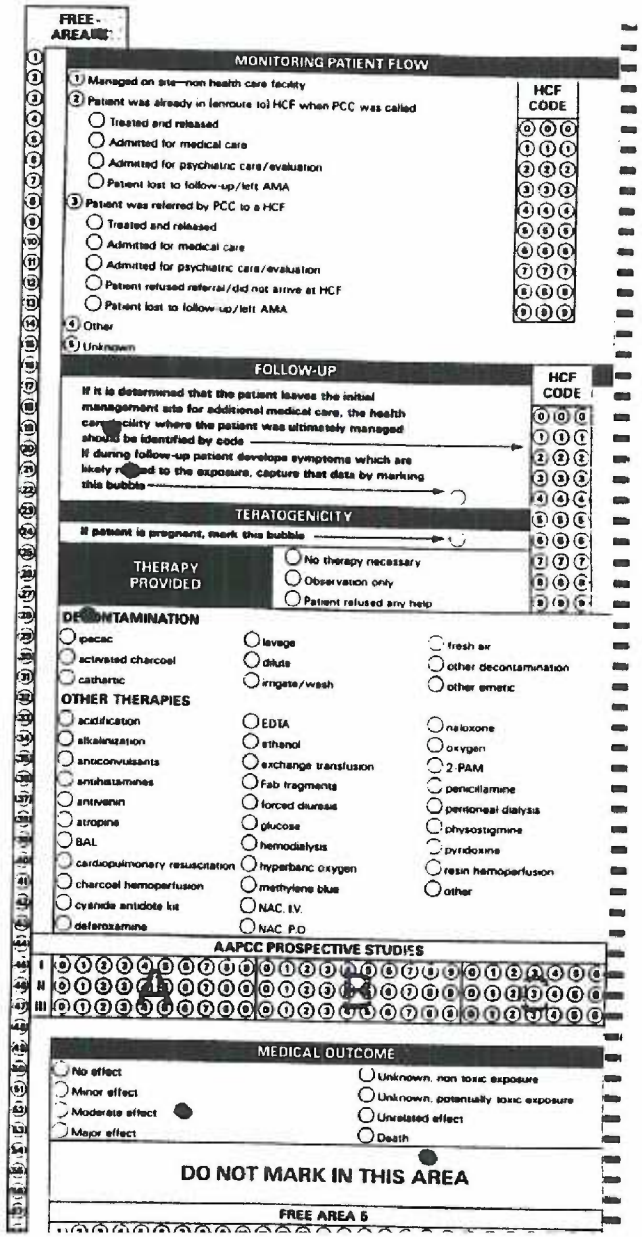
_____ Code: _____

MANAGEMENT PLAN, FOLLOW-UP NOTES AND OUTCOME: (Time & date each entry)

DATE / TIME

CONSULTANTS/RESOURCES USED: ☐ Medical director _____ ☐ Other consultant _____

☐ Texts _____ ☐ Other _____ ☐ Poisindex®



Appendix E

Total Exposures from OPC Product Categories

Non-pharmaceuticals	
Plants	4393
Cleaning products	4068
Cosmetics	3219
Chemicals	1867
Hydrocarbons	1667
Pesticides	1307
Foreign Bodies	1151
Alcohols	680
Food poisoning	651
Arts/Crafts	606
Mushrooms	597
Bites/Env	591
Paint	554
Adhesives	491
Tobacco	356
Fumes/Gases	316
Deoderizers	314
Unknown	314
Rodenticides	266
Herbicides	245
Automotive	241
Fertilizers	231
Batteries	201
Heavy Metals	195
Building supplies	160
Polishes	159
Lacrimators	129
Unknown	118
Matches	112
Swimming Pool	101
Essential oils	94
Moth Repellents	61
Fire Extinguishers	56
Fungicides	55
Dyes	51
Sporting Equip.	34
Photo Products	22
Radio-Isotopes	2
	25675

Phamaceuticals	
Analgesics	3861
Cold/cough preps	2298
Topicals	1551
Antimicrobials	1221
Vitamins	1086
Gastrointestinal preps	865
Sedative/hypnotics	742
Antihistamines	611
Antidepressants	583
Electrolytes	562
Hormones	555
Cardiovascular Drugs	396
Stimulants/Street drug	387
EENT preps	325
Asthma Therapies	265
Misc. Drugs	262
Unknown Drugs	216
Anticonvulsants	164
Anesthetics	132
Muscle Relaxants	128
Veterinary Drugs	79
Diuretics	69
Anticholinergics	55
Information Calls	46
Anticoagulants	20
Serums/vaccines	15
Diagnostic Agents	11
Antineoplastics	7
Narcotic Antagonists	1
Radiopharmaceuticals	1
	16514

Appendix F

Frequency of Diagnostic Codes from UHDDS

		DX1	DX2	DX3	DX4	DX5
Antibiotics						
960	Penicillins	2	3	4	2	0
960.1	Antifungals	0	0	0	0	0
960.2	Chloramphenicol	0	0	0	0	0
960.3	Erythromycin	1	1	5	1	2
960.4	Tetracycline	1	1	1	0	0
960.5	Cephalosporin	2	0	1	0	0
960.6	Antimycobacterials	1	0	0	0	0
960.7	Antineoplastics	0	1	0	0	0
960.8	Other specified	0	1	2	0	0
960.9	Unspecified	1	0	1	0	0
Anti-infectives						
961	Sulfonamides	0	0	0	0	0
961.1	Arsenicals	0	1	0	0	0
961.2	Heavy metal	0	0	0	0	0
961.3	Quinoline/hydroquinoline	1	0	1	0	0
961.4	Antimalarials	5	1	1	0	0
961.5	Other antiprotozoal	2	0	1	0	0
961.6	Anthelmintics	0	0	0	0	0
961.7	Antiviral	2	0	0	0	0
961.8	Other antimycobacterials	2	0	0	0	0
961.9	Other and unspec. anti-infectives	0	0	1	0	0
Hormones/synthetic substitutes						
962	Adrenal cortical steroids	3	1	1	0	0
962.1	Androgens/anabolic congeners	0	0	0	0	0
962.2	Ovarian hormones	0	1	2	1	0
962.3	Insulins/antidiabetics	49	2	3	0	0
962.4	Anterior pituitary hormones	0	0	0	0	0
962.5	Posterior pituitary hormones	0	0	0	0	0
962.6	Parathyroid	0	0	0	0	0
962.7	Thyroid	1	2	2	0	0
962.8	Antithyroid	0	0	0	0	0
962.9	Other and unspecified hormones	0	0	0	0	0
Primarily systemics						
963	Antiallergic/antiemetic	78	21	11	10	9
963.1	Antineoplastic/immunosuppressive	3	1	0	0	0
963.2	Acidifying	0	0	0	0	0
963.3	Alkalizing	1	0	0	0	0
963.4	Enzymes	0	0	0	0	0
963.5	Vitamins	3	0	0	0	0
963.8	Other specified systemics	0	0	0	0	0
963.9	Unspecified systemics	0	0	0	0	0
Agents affecting blood constituents						
964	Iron	7	0	0	1	2
964.1	Liver preparations	1	0	0	0	0
964.2	Anticoagulants	6	2	0	1	1
964.3	Vitamin K	0	0	0	0	0
964.4	Fibrinolysis-affecting drugs	0	0	0	0	0
964.5	Anticoagulant antagonistsCoagulants	0	0	0	0	0

964.6		Gamma globulin	0	0	0	0	0
964.7		Natural blood/blood products	0	0	0	0	0
964.8		Other specified agentsaffecting blood	0	0	0	0	0
964.9		Unspecified agents	0	0	0	0	0
Analgesics/antipyretics/antirheumatics							
965		Opiates	84	20	18	7	3
	965	Opium	4	3	3	2	0
	965	Heroin	20	0	2	2	0
	965	Methadone	3	0	0	0	0
	965	Other	57	17	13	3	3
965.1		Salicylates	121	30	27	8	2
965.4		Aromatic analgesics	171	35	17	13	14
965.5		Pyrazole	4	0	0	0	0
965.6		Antirheumatics	34	16	17	4	2
965.7		Other non-narcotics	3	0	1	0	1
965.8		Other specified	32	10	6	7	3
965.9		Unspecified	7	6	2	0	1
Anticonvulsants/anti-Parkinsonism							
966		Oxazolidine	0	0	0	0	0
966.1		Hydantoin	29	3	4	0	0
966.2		Succinimides	1	0	0	0	0
966.3		Other and unspeicified	44	4	2	2	1
966.4		Anti-Parkinsonism	4	2	0	0	1
Sedatives/hypnotics							
967		Barbiturates	67	4	3	1	0
967.1		Chloral hydrate	1	0	0	1	0
967.2		Paraldehyde	1	0	0	0	0
967.3		Bromine	0	0	0	0	0
967.4		Methaqualone	0	0	0	0	0
967.5		Glutethimide	1	0	1	0	0
967.6		Mixed sedatives	0	0	0	0	0
967.8		Other sedatives/hypnotics	13	3	1	1	0
967.9		Unspecified	22	3	7	0	0
Central nervous system depressants							
968		Central nervous system muscle-tone depress.	32	9	6	5	3
968.1		Halothane	0	0	0	0	0
968.2		Other gaseous anesthetics	0	0	0	0	0
968.3		Intravenous anesthetics	0	0	0	0	0
968.4		Other and unspecified	0	0	0	0	0
968.5		Surface and infiltration anesth.	9	4	6	0	0
968.6		Peripheral nerve- and plexus-blocking	0	0	0	1	0
968.7		Spinal anesthetics	0	0	0	0	0
968.8		Other and unspecified	0	0	0	0	0
Psychotropic agents							
969		Antidepressants	358	55	36	13	10
969.1		Phenothiazines	42	12	11	2	5
969.2		Butyrophenones	8	0	2	1	1
969.3		Other antipsychotics/neuroleptics/major tranquilizers	12	3	3	1	0
969.4		Benzodiazepines	175	53	30	16	11
969.5		Others	24	8	4	1	1
969.6		Psychodysleptics	4	4	3	0	0
969.7		Psychostimulants	28	4	3	3	4

969.8	Others	26	7	3	1	2
969.9	Unspecified	1	0	0	0	0
Central Nervous system stimulants						
970	Analeptics	0	0	0	0	0
970.1	Opiate antagonists	0	0	0	0	0
970.8	Other specified	1	0	1	0	0
970.9	Unspecified	1	1	0	0	0
Autonomic nervous system						
971	Parasympathomimetics	1	1	0	0	0
971.1	Parasympatholytics/spasmolytics	10	5	8	3	3
971.2	Sympatomimetics	22	4	4	2	4
971.3	Sympatholytics	0	0	0	0	0
971.9	Unspecified	0	0	0	0	0
Cardiovascular						
972	Cardiac rhythm regulators	20	3	1	0	1
972.1	Cardiotonic glycosides	56	2	2	1	0
972.2	Antilipemic/antiarteriosclerotic	0	0	0	0	0
972.3	Ganglion-blockers	0	0	0	0	0
972.4	Coronary vasodilators	7	2	0	1	0
972.5	Other vasodilators	2	1	0	0	0
972.6	Other antihypertensives	19	4	2	1	2
972.7	Antivaricose/sclerosing	0	0	0	0	0
972.8	Capillary-active	0	0	0	0	0
972.9	Other and unspecified	7	1	0	0	0
Gastrointestinal system						
973	Antacids/antigastric secretion	4	1	0	0	0
973.1	Irritant cathartics	1	0	0	0	0
973.2	Emollient cathartics	0	0	0	0	0
973.3	Other	0	0	0	2	0
973.4	Digestants	0	0	0	0	0
973.5	Antidiarrheals	2	2	1	0	0
973.6	Emetics	0	0	0	0	0
973.8	Other	1	0	0	0	0
973.9	Unspecified	0	0	0	0	0
Water/mineral/uric acid metabolism						
974	Mecurial diuretics	0	0	0	0	0
974.1	Purine	42	4	1	1	0
974.2	Carbonic acid anhydrase	0	0	0	0	0
974.3	Saluretics	2	1	1	0	1
974.4	Other	10	0	2	3	0
974.5	Electrolytic/caloric/water-balance	3	0	3	0	0
974.6	Other mineral salts	0	0	0	0	0
974.7	Uric acid metabolism	1	0	0	0	0
Smooth/skeletal muscles and resp. system						
975	Oxytocic	3	0	0	0	0
975.1	Smooth muscle relaxants	0	1	1	1	0
975.2	Skeletal muscle relaxants	7	2	0	0	1
975.3	Other and unspecified	8	0	1	1	1
975.4	Antitussives	2	2	1	1	0
975.5	Expectorants	2	0	0	0	0
975.6	Anti-common cold	2	0	2	0	0
975.7	Antiasthmatics	20	0	0	1	1

975.8		Other and unspecified resp.	0	0	0	0	0
Skin/mucous membrane/opthalmological/otorhinolaryngological/dental							
976		Local anti-infectives/anti-inflammatory	0	4	2	1	1
976.1		Antipruritics	0	1	0	0	0
976.2		Local astringents/local detergents	1	0	0	0	0
976.3		Emollients/demulcents/protectants	0	0	0	0	0
976.4		Keratolytics/keratoplastics/other hair treatment	2	0	0	0	0
976.5		Eye anti-infectives	0	0	0	0	0
976.6		Anti-infectives for ear/nose/throat	1	0	0	0	0
976.7		Dental-topical	0	0	0	0	0
976.8		Other	0	0	1	1	0
976.9		Unspecified	0	0	0	0	0
Other and unspecified drugs							
977		Dietetics	0	1	0	0	0
977.1		Lipotropics	0	0	0	0	0
977.2		Antidotes/chelating	0	0	0	0	0
977.3		Alcohol deterrents	4	1	0	0	0
977.4		Pharmaceutical excipients	0	0	0	0	0
977.8		Other specified	32	10	5	3	1
977.9		Unspecified	30	9	2	0	1
Bacterial vaccines							
978		BCG	0	0	0	0	0
978.1		Typhoid and paratyphoid	0	0	0	0	0
978.2		Cholera	0	0	0	0	0
978.3		Plague	0	0	0	0	0
978.4		Tetanus	0	0	0	0	0
978.5		Diptheria	0	0	0	0	0
978.6		Pertussis and combinations	0	0	0	0	0
978.8		Other and unspecified	0	0	0	0	0
978.9		Mixed bacterial vaccines	0	0	0	0	0
Vaccines and biologicals							
979		Smallpox vaccine	0	0	0	0	0
979.1		Rabies vaccine	0	0	0	0	0
979.2		Typhus vaccine	0	0	0	0	0
979.3		Yellow fever vaccine	0	0	0	0	0
979.4		Poliomyelitis vaccine	0	0	0	0	0
979.5		Other and unspecified	0	0	1	0	0
979.7		Mixed viral-rickettsial and bacterial vaccines	0	0	0	0	0
979.9		Other and unspecified	0	0	0	0	0
Alcohols							
980		Ethyl alcohol	57	35	65	34	21
980.1		Methyl alcohol	3	0	0	0	0
980.2		Isopropyl alcohol	8	3	1	1	1
980.3		Fusel oil	0	1	0	0	0
980.8		Other specified	1	0	0	0	0
980.9		Unspecified	4	2	1	2	2
Petroleum products							
981		Petroleum products	12	0	0	0	0
Solvents (non-petroleum)							
982		Benzene and homologues	3	0	1	0	0
982.1		Carbon tetracholride	0	0	0	0	0
982.2		Carbon disulfide	0	0	0	0	0

982.3		Other chlorinated hydrocarbon solvents	2	0	0	0	0
982.4		Nitroglycol	0	0	0	0	0
982.8		Other nonpetroleum-based solvents	11	0	0	0	0
Corrosive aromatics/acids/caustic alkalis							
983		Corrosive aromatics	0	0	0	0	0
983.1		Acids	2	0	0	0	0
983.2		Caustic alkalis	10	2	1	0	0
983.9		Caustic, unspecified	10	3	0	0	1
Lead							
984		Inorganic lead	1	0	0	0	0
984.1		Organic lead	0	0	0	0	0
984.8		Other lead	0	0	0	0	0
984.9		Unspecified lead	5	0	2	0	0
Other metals							
985		Mercury	1	0	0	0	0
985.1		Arsenic	5	0	0	0	0
985.2		Manganese	0	0	0	0	0
985.3		Beryllium	0	0	0	0	0
985.4		Antimony	0	0	0	0	0
985.5		Cadmium	0	0	0	0	0
985.6		Chromium	0	0	0	0	0
985.8		Other specified	11	2	0	0	1
985.9		Unspecified metals	0	1	0	0	0
Carbon monoxide							
986		Carbon monoxide	30	4	2	0	0
Other gases/fumes/vapors							
987		Liquid petroleum gases	7	0	2	0	0
987.1		Other hydrocarbon gas	2	3	0	0	0
987.2		Nitrogen oxides	0	0	0	0	0
987.3		Sulfur dioxide	0	0	0	0	0
987.4		Freon	1	0	0	0	0
987.5		Lacrimogenic gas	1	0	0	0	0
987.6		Chlorine gas	0	0	0	0	0
987.7		Hydrocyanic acid gas	0	0	0	0	0
987.8		Other specified gases/fumes/vapors	8	0	3	1	0
987.9		Unspecified gas/fume/vapor	17	4	3	3	3
Noxious substances eaten as food							
988		Fish and shellfish	2	0	0	0	0
988.1		Mushrooms	8	0	0	0	0
988.2		Berries and plants	4	0	0	0	1
988.8		Other specified	1	0	0	0	0
988.9		Unspecified	0	0	0	0	0
Other substances/nonmedicinal							
989		Hydrocyanic acid and cyanides	1	0	0	0	0
989.1		Strychnine and salts	1	0	0	0	0
989.2		Chlorinated hydrocarbons	1	0	0	0	0
989.3		Organophosphate and carbamate	8	0	1	1	0
989.4		Other persicides	7	1	1	1	0
989.5		Venom	41	1	2	1	0
989.6		Soaps and detergent	2	0	1	0	0
989.7		Aflatoxicn and other mycotoxin	0	0	0	0	0
989.8		Other substances	5	1	0	1	0

989.9		Unspecified	2	0	0	0	0
EXTERNAL CAUSE OF INJURY CODES							
E codes: Accidental injury							
	Analgesics/antipyretics/antirheumatics						
850		Heroin		6	2	2	6
850.1		Methadone				1	
850.2		Other opiates/narcotics		5	6	9	7
850.3		Salicylates		8	7	8	4
850.4		Aromatic analgesics		11	4	2	2
850.5		Pyrazole					
850.6		Antirheumatics		1	1	2	
850.7		Other non-narcotic analgesics			1		
850.8		Other specified		1		1	3
850.9		Unspecified					
	Barbiturates						
851		Bartiturates		9	3	2	5
	Sedatives/hypnotics						
852		Chloral hydrate		1			
852.1		Paraldehyde					
852.2		Bromine					
852.3		Methaqualone					
852.4		Glutethimide				1	
852.5		Mixed sedatives					
852.8		Other specified		2		1	
852.9		Unspecified		3	2	2	
	Tranquilizers						
853		Phenothiazines		7	1	1	3
853.1		Butyrophenone		1	1	2	
853.2		Benzodiazepine		18	5	7	3
853.8		Other specified		3	1	1	1
853.9		Unspecified		1	1		
	Psychotropics						
854		Antidepressants		30	12	4	3
854.1		Psychodysleptics		1	2		
854.2		Phychostimulants		7	1	4	2
854.3		Central nervous sytsem stimulants					
	CNS/ANS drugs						
855		Anticonvulsants/anti-Parkinsonism		9	8	6	5
855.1		Other CNS depressants		4	3	3	1
855.2		Local anesthetics		3	2	3	2
855.3		Parasympathomimetics					
855.4		Parasympatholytics/spasmotics		1	1	2	3
855.5		Sympathomimetics		5	2	1	3
855.6		Sympatholytics					
855.8		Other specified		1	4	1	2
855.9		Unspecified					
	Antibiotics						
856		Antibiotics		1	1	2	1
	Other anti-infectives						
857		Anti-infectives		4		1	
	Other drugs						
858		Hormones		18	11	6	3

858.1		Primarily systemic		9	1	1	3
858.2		Blood constituants		4	6	3	2
858.3		Cardiovascular		19	8	9	6
858.4		Gastrointestinal		2	1	2	2
858.5		Water, mineral,uric acid metabolism		11	5	5	9
858.6		Smooth and skeletal muscles/resp.system		16	1	1	2
858.7		Skin and mucous membrane/ophthalmological/dental			1	1	
858.8		Other specified		3	3		2
858.9		Unspecified		3	3		
	Alcohol						
860		Alcoholic beverage		10	4	12	19
860.1		OTher and unspecified					
860.2		Methyl alcohol		1			
860.3		Isopropyl		3	2	1	
860.4		Fusel oil				1	
860.8		Other specified					
860.9		Unspecified		1	1		1
	Cleaning/polishing/disinfect./paint/varnish						
861		Detergents/shampoos		1	1		
861.1		Soap					
861.2		Polishes		1			
861.3		Other			1		
861.4		Disinfectants		3	1		
861.5		Lead paints		1			
861.6		Other paints/varnish					
861.9		Unspecified					
	Petroleum products/solvents						
862		Petroleum solvents					
862.1		Petroleum fuels and cleaners		5		3	
862.2		Lubricating oils					
862.3		Petroleum Solids					
862.4		Other specified solvents		6	4	1	1
862.9		Unspecified solvent		1			
	Agricultural/horticultural chemicals						
863		Insecticides-organochlorine		1			
863.1		Insecticides-organophosphorus		4		2	3
863.2		Carbamates				1	
863.3		Mixtures of insecticides					
863.4		Other and unspecified		2			
863.5		Herbicides				2	
863.6		Fungicides		1			
863.7		Rodenticides			1		
863.8		Fumigants			1		
863.9		Other and unspecified			1		
	Corrosives and caustics						
864		Corrosive aromatics				1	
864.1		Acides			1		
864.2		Caustic alkalis			3	1	3
864.3		Other specified		2		1	
864.4		Unspecified		1	1		
	Foodstuffs and poisonous plants						
865		Meat					

865.1		Shellfish					
865.2		Other fish		1		1	
865.3		Berries and seeds					
865.4		Other specified plants		3			
865.5		Mushrooms and other fungi		2	1	1	
865.8		Other specified foods		4			
865.9		Unspecified foodstuff or poisonous plant			1		
		Other and unspecified solid and liquid substances					
866		Lead				3	1
966.1		Mercury					
866.2		Antimony					
866.3		Arsenic		1	1		
866.4		Other metals		2	1		
866.5		Plant foods and fertilizers					
866.6		Glues and adhesives				1	1
866.7		Cosmetics					
866.8		Other specified solid or liquid substances		2			
866.9		Unspecified solid or liquid substances			1		1
867		Gas distributed by pipeline					
		Other utility gas and other carbon monoxide					
868		Liquified petroleum gas distributed in mobile containers		6	2		3
868.1		Other and unspecified utility gas		2			
868.2		Motor vehickle exhause gas		3	1	2	
868.3		CO from incomplete comustion of other fuels		2	1		
868.8		COfrom other sources			1	1	
686.9		Unspecified CO		1	3	1	
		Other gases and vapors					
869		Nitrogen oxides			1		
869.1		Sulfur dioxide					
869.2		Freon				1	
869.3		Lacrimogenci gas					
869.8		Other specified gases and vapors		7	4	1	3
869.9		Unspecified gases and vapors		2			1
E-codes: Suicide/intentional injury							
		Solid or liquid					
950		Analgesics, antipyretics, antirheumatics		174	117	84	52
950.1		Barbiturates		22	7	4	6
950.2		Other sedatives/hypnotics		19	7	8	6
950.3		Tranquilizers/psychotropic agents		241	165	140	67
950.4		Other specified drugs		149	105	86	46
950.5		Unspecified drugs and medicinal substances		10	10	2	2
950.6		Agricultural chemicals		3	2	1	
950.7		Corrosive and caustic substances		5	5	5	2
950.8		Arsenic		1			
950.9		Other and unspecified solid and liquid		38	23	56	35
		Gases in domestic use					
951		Gas distributed by pipeline					
951.1		Liquified petroleum gas in mobile containers					
951.8		Other utility gas					
		Other gases and vapors					
952		Motor vehicle exhaust		5	2	1	
952.1		Other carbon monoxide		2	3		
952.8		Other specified gases and vapors				1	
952.9		Unspecified gases and vapors					