

## POISON CONTROL CENTERS: PROSPECTS AND CAPABILITIES

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The development of the poison control movement was based on the need to have available a rapid access system to identify the potential danger of an exposure to any of the thousands of chemicals—drugs, household products, industrial chemicals, etc—that are available to man. In that regard, the initial poison control centers were cataloging services providing information to the physician about the contents and toxicity of a product about which he wanted information (1). With the development of newer and better information systems, accumulation of more and better toxicology data, development of new and better poisoning managements, and the development and affiliation with the poison control center movement of clinical or medical toxicologists, the poison control movement has entered a new era.

The poison control concept was initiated in Chicago, Illinois, in 1953. Following the impetus of local health officials, pediatricians, and other interested physicians, a single center for collecting product data was established. The idea soon caught on and numerous other centers were established. In order to provide a coordinating agency for these centers, the then Bureau of Product Safety in the Food and Drug Administration established the National Clearinghouse for Poison Control Centers. This clearinghouse served as a center for collecting and standardizing product toxicology data and for distributing this data in the form of 5" by 8" index cards to recognized poison control centers. State health departments were given the responsibility for identifying poison centers within their states (1). The great interest in poison control eventually resulted in over 580 officially recognized poison control centers and numerous additional nonofficial centers, including drug information services, bringing the total to well over 600 (2). Unfortunately, many poison centers have little if any capability for providing sophisticated information or treatment for poisoning. In fact, some of these recognized poison centers handle as few as one call per week (3).

From the beginning, studies of poison control center operation have shown a wide variability in how services were provided (3-11). For purposes of simplification,

poison control services have been defined as poison information centers, poison treatment centers, and poison treatment centers with toxicology laboratory service (12). Poison information centers are services that provide telephone information but do not participate in the treatment of the poisoned patient. An example of this would be the Thomas J. Fleming Poison Information Service at the Children's Hospital of Los Angeles. This center provides information, solely to physicians or health care facilities, for over 30,000 cases annually (C. Ray, personal communication). A poison treatment center is a health care facility that treats poisoning cases and is a referral center for such in addition to providing poison information. The Intermountain Regional Poison Control Center at the University of Utah Medical Center is such a center. Poison control services also are variable in that some provide information only to physicians or health care professionals while others provide information to the public or both (3). Staffing of poison control centers likewise is quite variable. The staff of a poison center may consist only of full or part-time clerks or nurses or pharmacists without any direct medical supervision, or they may consist of a full-time M.D. clinical toxicologist-director and specially trained full-time professional staff, such as clinical pharmacists. Other centers may include as staff or consultants pharmacologists, emergency room physicians, ambulatory pediatricians, or other scientifically trained personnel (3, 13).

The current questions facing the poison control center movement two decades following its inception are how best to provide services, how to improve services, how to standardize or monitor services, to whom to provide services, and how to organize such services on a regional or national basis. The question of how to organize these services is still very much open for discussion in poison center circles (3, 4, 11, 13). In the author's view consolidation of manpower and resources into centralized or regional services is crucial. In these centralized or regional centers, information would be provided both to health professionals and to the public. Treatment facilities would be an integral part of the regional poison control center, and the staff, particularly the medical staff, would provide the treatment for poisoning victims. In addition, active supervision and even bedside consultation of poisoning cases admitted to other health care facilities would be provided. The following is a description of what a regional poison control program is and could be.

## REGIONAL POISON CONTROL: GENERAL PROGRAM DESCRIPTION

A regional poison control center should be one which, in less densely populated areas, serves a single or multi-state region, or in heavily populated areas serves a portion of a state. Generally, a regional center will be found serving no fewer than one million people, but could serve as many as five to ten million people in areas of high population density. A regional center would provide (a) comprehensive poison information, both to health professionals and consumers, (b) comprehensive poisoning treatment services, (c) a full range of analytical toxicologic services, (d) a toll-free communication system, (e) access to transportation facilities for critically ill patients, (f) professional and public education programs, and (g) collec-

tion and dissemination of poisoning experience data. In essence, a regional center must be capable of assuming ultimate responsibility for the provision of poisoning consultations and patient care for all poisonings brought to its attention within its region (13).

### *Poison Information Services*

A regional center's poisoning information capability generally is as comprehensive as is available. The services are available 24 hours a day, every day of the year, and are accessible to both professionals and consumers. These centers have all of the basic toxicology information resources that are available, access to texts and journals related to toxicology, and ready access to a medical library.

In the case of the consumer, information is simplified to meet consumers' needs. Provision of such services is coupled with careful monitoring of consumer understanding, consumer compliance with the suggested recommendations, and assessment of the outcome of such cases. Where appropriate rapport with the consumer is established, it is feasible to manage selected exposures by telephone (14). In order to provide good telephone management, centers obtain as accurate and complete a history of the toxic exposure as possible, make an appropriate assessment of the toxicity, and determine where the victim should be managed.

### *Poison Treatment Services*

Regional centers generally are capable of providing the most sophisticated poisoning treatment available. The medical care facility in which the treatment center is housed is usually a category I comprehensive emergency service and has a fully staffed observation unit and an intensive care unit for both adult and pediatric patients. Comprehensive poisoning treatment services mean that the center is able to provide initial and subsequent treatment of all types of poisonings and to include methods of terminating the exposure, such as gastric lavage, induction of emesis, and irrigation. They have facilities for providing intensive supportive care of the patient, including resuscitation, endotracheal intubation, tracheotomy, cardiac monitoring, monitoring of fluid and electrolyte balance, monitoring of blood gases, and intensive care nursing supervision. They have available all known antidotes. The treatment service generally is staffed with full-time personnel trained specifically in the management of poisoning, including a clinical toxicologist. In addition, they have access to consultant services such as endoscopy, hemodialysis, peritoneal dialysis, exchange transfusions, plasmapheresis, or extracorporeal charcoal hemoperfusion.

### *Analytical Capabilities*

A regional poison control center should have immediate access to appropriate analytical toxicology services. These analytical services provide immediate analysis of blood, urine, and gastric aspirate in terms of an immediate drug screen, and subsequent quantitative analysis for monitoring the patient's progress and assessing the severity of the case.

*Communication and Transport*

Communication systems are set up by regional centers to provide ready access to the center. Toll-free telephone services generally are established. Outgoing communication is made by telephone or by telecopiers and hard copy information can be transmitted to affiliated hospitals in this way (B. H. Rumack, R. W. Moriarty, personal communication). Regional services also have an established system for referral and transport for patients who are critically ill and provide emergency medical recommendations for the victim prior to transfer to a medical facility in order to facilitate the movement of that victim to medical care. Transportation systems depend upon local geography and circumstances, and in many areas are tied to local emergency medical service systems. In highly populated areas, transportation by specially equipped ambulances or helicopter may be satisfactory. In less densely populated areas with large geographical expanses, more sophisticated air transport has been established (B. H. Rumack, personal communication). These transportation systems usually are used in conjunction with other programs for patient transport, but regional poison centers work with the transport system to see that the transportation equipment includes everything necessary to appropriately manage a poisoned patient during transport.

The regional center additionally services another important role in pulling together the medical care facilities within the region in the management of poisoning cases. Within the region, there may be designated subregional poison treatment centers which provide limited treatment services and which rely on the regional center for backup. In addition, there will be hospital emergency facilities that provide primary emergency management and care of poisoned patients, but are not poison treatment centers. Regional centers ideally develop an administrative posture to encourage adequate communication between themselves and the subregional centers and other primary emergency services. The regional center assumes responsibility for training subregional center personnel and other primary emergency service personnel. While not all cases necessarily are referred to them, either by telephone or in person, these centers maintain adequate liaison with other medical facilities in their region to ensure that appropriate patient care or consultation is given. All in all, regional centers must be willing to assume ultimate responsibility for all consultations regarding poisonings in their region.

**POISON CONTROL CENTER STAFFING**

As indicated above, staffing of centers is highly variable, but those centers with full-time highly trained individuals have the greatest potential for providing quality information. It has been recommended that each regional center should have a full-time physician who has expertise and skill in the management of poisonings (13). Such a physician would most likely have a background in one of the primary medical care fields—pediatrics, medicine, family practice, or emergency medicine, but also would need to have additional training or experience in the area of clinical toxicology, preferably with certification in that specialty such as is provided by the

American Board of Medical Toxicology of the American Academy of Clinical Toxicology. Unfortunately, very few such individuals are so trained and not all of them are affiliated with poison control programs (15).

Nonmedical staff in poison control centers are drawn from a wide variety of professionals in the health-related field. For daily operation of the information service, pharmacists and nurses with specific clinical training generally are most often used. The background of clinical pharmacists working in regional centers includes basic pharmacy education, special clinical training, and specific experience and/or training in clinical toxicology. In addition to basic nursing training, nurses usually have had additional experience and/or training in emergency care, public health, and occasionally pharmacology and clinical toxicology. While other health professionals may provide poison control information, most do not have a clinical background that would allow them to interact freely with physicians and other health care professionals in providing consultative services, nor do they have the ability to interpret basic toxicology information. We have argued that the physician-pharmacist team, with pharmacologist consultants, is the ideal staffing pattern for poison control (16).

It is neither sufficient nor acceptable that staff in a regional poison control center simply read data as are found in the printed page, so that operational staff must be capable of selecting from various resources appropriate information for specific cases. It is unfortunate but true that information resources may not have accurate data, may lack data entirely, or may have only limited information about a subject. As a result, the ability to interpret literature is a necessity. Management of cases by poison control centers requires a great deal more sophistication than just reading a response from a card file. It is anticipated that soon all operational staff in poison control centers will be certified as to their level of competence through a national certification process.

In addition to the basic operational staff, which provides telephone coverage and consultations, and the administrative staff, a regional poison center will have available an extensive list of consultants who can provide expertise in a wide range of selected fields. These consultants are chosen from various medical fields and fields related to the area of toxicology, and will include such people as an anesthesiologist, endoscopist, ophthalmologist, respiratory care specialist, radiologist, renalologist, pharmacognosist or botanist, analytical chemist, herpetologist, mycologist, pharmacologists, as well as numerous other specialists.

## TOXICOLOGY INFORMATION RESOURCES

Accompanying the development of more sophisticated poison centers has been the development of some new, more sophisticated information resources. The most comprehensive resource for listing product names and ingredients in a rapidly accessible manner is Poisindex, a computer-generated microfiche system. Poisindex contains information on over 200,000 separate products, which can be accessed by generic or trade name, manufacturer's name, or selected chemical constituents. This data source lists the product formulation, indexes the major toxic constituents, and

provides concise, but thorough, recommendations for the management of exposures or poisonings with the product. The microfiche card file is updated quarterly so that it is extremely current. The managements are written by an editorial board of physicians/toxicologists to ensure the availability of the best possible recommendations (17).

Another new resource is a data bank of information provided by the National Clearinghouse for Poison Control Centers via on-line cathode ray tube (CRT) terminals. Each CRT is on-line to the Food and Drug Administration computer via dedicated telephone lines. Access to the data is as quick as one can type the name of the product or chemical compound. It even has an allowance for phonetic access. Using the well-known poison index card data, the computer-stored data also contains experience data reported to the National Clearinghouse for Poison Control Centers. Because of its cost, the number of terminals made available to regional centers is very limited at the present time.

Numerous other resources also are becoming available. New textbooks in the basic science of poisonings, industrial toxicology, adverse drug effects, and many other topics suggest that for a poison control center to be adequately equipped, dozens of textbooks and access to numerous journals must be maintained. Nonetheless, limitations of information resources is still a major problem.

In most poison control centers, assessment of the toxicity of an agent or exposure must be based on data found in several general rapid retrieval information resources, selected textbooks, and available center-generated files. Ideally the staff of poison centers develop additional expertise in managing cases and learn by experiences how to evaluate discrepancies in the available resources and to fill in the gap of information that is not available, but this may not always be the case. Our personal evaluation of current information resources suggests that unless the staff of a poison control center is capable of evaluation of resources and personally updating them, errors in management can occur. For example, if faced with a case of digoxin poisoning, the information about the types of cardiac manifestations, degree of toxicity, and indication or contraindication of administering potassium are all at variance if one refers to the most commonly used information resources (17-20). It appears that no single information resource at the current time is sufficient to provide comprehensive toxicological data.

## ACTIVITIES OF A REGIONAL POISON CONTROL CENTER

Current activities of poison control centers involve the management of large numbers of chemical exposures, but only some of them can be considered actual poisonings. At the Intermountain Regional Poison Control Center, we handled 13,790 calls during July 1974 to June 1975. Of these 11,109 (80.6%) involved actual exposures, the remaining 2681 cases being requests for information only. Of the actual exposures, 8788 (79.1%) were sufficiently minor that they could be managed at home. Of the cases managed at home, most were not considered to be of sufficient potential toxicity that some form of active intervention was initiated. While not all of these cases were followed up in great detail, in a selected group of cases in which

ippecac-induced emesis was initiated, careful monitoring of the course of the illness was made (14). In this study, 776 cases were examined that were considered to be of sufficient level of potential toxicity that ippecac emesis at home was warranted but referral to an emergency care facility was not deemed necessary if emesis ensued. Through use of a standardized protocol, 98.8% of the patients vomited successfully. In following these patients we found only 51 (6.7%) had symptoms four hours following ingestion, all of which were minor, and only 11 (1.4%) had symptoms at 24-hour follow-up, again, all of which were minor. In no case did serious symptoms arise. The appearance of some symptoms, even with 98.8% successful emesis, suggests that these ingestions did involve significant exposures, but were not serious and could be managed appropriately as was done in the victims' homes. During this same 12-month period, 1558 (17.7%) cases were either already in emergency rooms or doctors' offices or were referred there. Only 314 (3.6%) of these eventually were admitted to the hospital. Only three (0.03%) were known to result in death. From our experience it would appear that the major efforts of poison control centers are directed toward identifying agent and exposure toxicity, selecting and recommending emergency measures when necessary, while less frequently acting as consultants on serious poisonings. In fact, the principal function of a poison control center still remains that of identifying whether an agent or an exposure is indeed toxic.

## LIMITATIONS AND FUTURE NEEDS

As we look at the limitations of the current poison control system, it is apparent that the current principal limitation is that we have not developed more regional programs. In addition, we continue to need more information on product toxicity and human toxicology, and we need to develop better equipped, more highly trained people to service poison control programs.

For many years, the need for regionalization has been stressed (3, 4, 13). This logic is applicable both for information services and treatment services. We must proceed more rapidly at developing regional plans along regional needs and integrating these plans with other regional health care facilities. Centralization of information resources, integration of individual expertise, and coordination of treatment facilities for poisoning should be given high priority.

Just as important a need is the need for increased research in the areas of human toxicology. One of the principal limitations of poison control services is the lack of good information about the real toxicity of a product. Undoubtedly, many patients are undertreated, overtreated, or just mistreated because our knowledge of certain problems is not sufficient. Just how toxic is that cleaning agent? How serious is that industrial exposure? What is the real hazard of eating part of that plant? What is the best way to treat the hepatotoxicity produced by an overdose of that drug? Both basic research and human experience data are vitally needed.

A third limitation is the lack of appropriate manpower. Frequent pleas for more toxicologists are heard, but the need for poison control centers is to develop clinically oriented toxicologists. Programs for training physicians in clinical toxicology are sparse. Programs for training pharmacists or pharmacologists in toxicology are

just about as sparse, and clinically oriented programs are rare. Training of nurses in toxicology is nonexistent. As a result, almost all of our manpower development comes as a result of on-the-job experience. While this has proven to be workable in the past, the need for more sophistication in information evaluation and dissemination and in patient management demands the development of training programs. As a minimum, postgraduate fellowships in medical toxicology need to be made available for physicians. In addition, special training programs for poison center staff need to be initiated, hopefully in conjunction with ongoing educational programs such as clinical pharmacy training programs.

Poison control has come of age. Offering sophisticated consultative and patient management services, poison control programs now have the potential for greatly improving the care of poisoning exposures. While limited in number and hampered by limited resources, the development of appropriate regional centers has brought the poison control concept to fruition.

#### Literature Cited

1. Verhulst, H. L., Crotty, J. J. 1969. Poison control division. *FDA Pap.* March, pp. 11-13
2. Natl. Clgh. Poison Control Cent. July-August 1976. Directory. *Bulletin.* USDHEW, Public Health Serv., FDA, Bethesda, Maryland
3. Lovejoy, F. H., Alpert, J. J. 1970. A future direction for poison centers; a critique. *Pediatr. Clin. North Am.* 17: 747-53
4. Temple, A. R., Done, A. K. 1972. Organization of emergency treatment facilities for the management of acute poisonings. *Emergency Room Care*, ed. W. W. Oaks, S. Spitzer, 107-15. New York: Grune & Stratton. 300 pp.
5. Goulding, R. 1975. Poison control centers—an essay on information and prevention. *Essays Toxicol.* 6:79-100
6. Teitelbaum, D. T. 1968. New directions in poison control. *Clin. Toxicol.* 1:3-13
7. Luckens, M. M. 1972. Developing total service capabilities in poison information centers. *Am. J. Public Health* 62:407-10
8. Matthew, H., Proudfoot, A. T., Brown, S. S., Aitken, R. C. B. 1969. Acute poisoning: organization and work-load of a treatment centre. *Br. Med. J.* 2:489-93
9. Grayson, R. 1962. The poison control movement in the United States. *Ind. Med. Surg.* 31:296-97
10. Adams, W. C. 1963. Poison control centers: their purpose and operation. *Clin. Pharmacol. Ther.* 4:293-96
11. Barry, P. Z. 1974. A workshop on poison control centers. A report of workshop held April 1-2, 1974, Chapel Hill, North Carolina, pursuant to contract no. FDA 74-30
12. Am. Assoc. Poison Control Cent. 1972. Standards
13. Temple, A. R., Veltri, J. C. 1976. A program guide for regional poison control centers. A report prepared for the National Clearinghouse for Poison Control Centers, pursuant to contract no. PHS 223-75-3013
14. Veltri, J. C., Temple, A. R. 1976. Telephone management of poisonings using syrup of ipecac. *Clin. Toxicol.* 9:407-17
15. Diplomates Am. Board Med. Toxicol. 1976. *ACTION* 4:3
16. Temple, A. R. 1972. Role of toxicology education in pharmacy education. *Forum Adv. Toxicol. Newsl.* 5:(4) 4
17. Poisindex, Micromedex, Inc., 2645 South Santa Fe Drive, Denver, Colorado 80223
18. Gosselin, R. E., Hodge, H. C., Smith, R. P., Gleason, M. N. 1976. *Clinical Toxicology of Commercial Products*, III: 124-33. Baltimore: Williams & Wilkins. 1783 pp. 4th ed.
19. Dreisbach, R. H. 1974. *Handbook of Poisoning: Diagnosis & Treatment*, 332-34. Los Altos, Calif: Lange Med. Publ. 517 pp. 8th ed.
20. Poison Index Cards, National Clearinghouse for Poison Control Centers, DHEW-PHS-FDA