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Final Report on the Value of the Poison Center System

Prepared for: **American Association of Poison Control Centers (AAPCC)**

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September 26, 2012

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Executive Summary

The Lewin Group was commissioned by the American Association of Poison Control Centers (AAPCC) to analyze the existing literature regarding the impact of the poison center system on medical utilization and to quantify the value of the system as a whole. The influential role poison centers play in the US health system has largely gone unrecognized although poison centers provide value in a number of areas including direct consultation to the public and health care providers (both human and veterinary); law enforcement; product manufacturers; insurers; and local, state, and federal governments. In addition, poison centers provide real-time surveillance data allowing for the identification and tracking of public health and environmental threats. Additional poison center contributions include community educational outreach for poison prevention and safety, toxicology training to health care professionals, community monitoring and surveillance, assistance with emergency preparedness and response, and providing the public information about current events of toxicological significance (*e.g.*, the Gulf oil spill, bath salts, and button batteries).

The actual value of health care savings attributable to poison centers is difficult to quantify due to the preventive nature of their services. The efforts of poison centers have been shown to reduce unnecessary and costly health care utilization. A number of studies have demonstrated that poison centers reduce health care spending and that the amount of these savings far exceeds the cost of providing poison center services. Despite these results, poison centers have recently undergone severe reductions in federal, state and other support streams and may soon experience additional cuts in federal funding. These financial cuts threaten the existence of some poison centers while other poison centers have been forced to drastically reduce the type and quantity of services they offer their communities. Reductions in the preventive and educational services offered by poison centers are likely to result in higher health care spending paid for by federal and state governments, private insurers, and consumers.

The analyses conducted in this report confirm the overwhelming return on investment (ROI) that the poison center system contributes to the nation as a whole. The savings resulting from poison centers services are:

- $752.9 million per year due to avoided medical utilization
- $441.1 million per year due to reduced hospital length of stay
- $23.9 million per year due to in-person outreach
- $603 million per year due to reduced work-loss days.

In total, the poison center system saves over $1.8 billion per year in medical costs and productivity. The ROI is $13.39 for every dollar invested in the poison center system. Also, the savings and cost to fund poison centers relative to the population served (i.e., which includes 315,771,469 residents of the United States, Puerto Rico, US Virgin Islands, American Samoa, Micronesia, and Guam) are $5.77 per year and $0.43 per year per resident respectively. These savings are shared by the federal, state, and local governments and the private sector.

Funding Source	Total Poison Center Funding (in millions) in 2011	Estimated Medical Care Savings and Reduced Productivity Loss (in millions)/year	Medical Care Savings and Reduced Productivity Loss per Dollar of Funding per year
Federal Government	$17.1	$662.8	$38.74
State and Local Government	$83.8	$284.2	$3.39
Private	$35.1	$873.4	$24.86
Total	**$136.0**	**$1,820.5**	**$13.39**

Our estimates of savings are higher than those previously reported because our analysis is more comprehensive and includes all of the four most commonly referenced savings metrics (*i.e.*, savings due to avoided medical utilization, reduced hospital length of stay, in-person outreach, and reduced work-loss days). Please note we did not attempt to quantify the value of other recognized benefits of the poison center system, which include but are not limited to the provision of surveillance data to Federal agencies, toxicology training of health care professionals, and involvement in local, State, and Federal emergency preparedness and response. Future research should explore the influence of poison center services on mortality.

List of Acronyms

AAPCC	American Association of Poison Control Centers
AHA	American Hospital Association
AHRQ	Agency for Healthcare Research and Quality
CDC	Centers for Disease Control and Prevention
CPI	Consumer Price Index
HCUP	Healthcare Cost and Utilization Project
HRSA	Health Resources and Services Administration
HSPD-21	Homeland Security Presidential Directive 21
LOS	Length of Stay
MEPS	Medical Expenditure Panel Survey
NEDS	Nationwide Emergency Department Sample
NIS	National Inpatient Sample
NJPIES	New Jersey Poison Information and Education System
NPDS	National Poison Data System
PAHPA	Pandemic All-Hazards Preparedness Act
ROI	Return on Investment
SCHIP	State Child Health Insurance Program

I. Introduction

The Lewin Group was commissioned by the American Association of Poison Control Centers (AAPCC) to analyze the existing literature regarding the impact of the poison center system on medical utilization and to quantify the value of the system as a whole. AAPCC is a nonprofit organization that was established in 1958 to support local poison centers in the United States. Currently, the AAPCC provides support to 57 poison centers that offer free, 24-hour, over the phone, expert consultation by professionals specially trained in poison prevention and treatment. The AAPCC collects and aggregates data from poison centers into the National Poison Data System (NPDS), the only national database that maintains detailed, up-to-date information on poisonings used by many federal and state agencies. The NPDS also serves as a national biosurveillance tool described in the Pandemic All-Hazards Preparedness Act (PAHPA) and Homeland Security Presidential Directive 21 (HSPD-21).[1, 2]

The provision of patient health care has been a fundamental part of poison center services. Poison center professionals serve as primary health care providers for the home management of suspected poisonings and as toxicology consultants for health care providers and hospitals. In less than a few minutes, callers are connected to specially trained individuals knowledgeable of the treatment, prevention and safety measures that should be taken to prevent injury from a number of hazardous materials. This rapid early intervention often limits morbidity and prevents mortality. Poison center staff follow up on each case of suspected or known poisoning in order to assess the effects of treatment, to advise about continuing care, and to collect data on the occurrence of poisonings. In addition, poison centers have emerged as a useful asset in the response to local, state, national, and international emergencies by providing up-to-date information to the public and the media specifically targeting the communities they serve.[3, 4] The services offered by poison centers are available in over 150 languages and are accessible to those who are deaf and others who may have hearing disabilities. Poison centers do not charge the public a fee for any of the services they provide.

There are many direct and indirect beneficiaries of poison center activities. The actual value of health care savings attributable to poison centers is difficult to quantify due to the preventive nature of their services. The influential role they play in the US health system has largely gone unrecognized although poison centers provide value in a number of areas including direct consultation to the public and health care providers (both human and veterinary); law enforcement; product manufacturers; insurers; and local, state, and federal governments. In addition, poison centers provide real-time surveillance data allowing for the identification and tracking of public health and environmental threats.[3-5] Additional poison center contributions include community educational outreach for poison prevention and safety, toxicology training to health care professionals, community monitoring and surveillance, assistance with emergency preparedness and response, and providing the public with information about current events of toxicological significance (*e.g.*, the Gulf oil spill, bath salts, and button batteries).[1] The efforts of poison centers have been shown to reduce unnecessary and costly health care utilization.

A. Research Justification

A number of studies have demonstrated that poison centers reduce health care spending and that the amount of these savings far exceeds the cost of providing poison center services. Despite this knowledge and their accomplishments in the past 50 years, poison centers have recently

undergone severe reductions in federal, state and other support streams and may soon experience additional cuts in federal funding.[6] These financial cuts threaten the existence of many poison centers while other poison centers have been forced to drastically reduce the type and quantity of services they offer their communities. Reductions in preventive and educational services offered by poison centers are likely to result in higher health care spending paid for by federal and state governments, private insurers, and consumers. It is therefore prudent to reevaluate the influence of the poison center system on health care utilization and health care spending because it is important to understand and update information regarding the cost efficiencies these organizations provide their communities and the nation as a whole.

B. Research Objectives

In this white paper, we provide the results of our analysis which, for the first time, describes the value of the poison center system using all four of the most commonly referenced savings metrics (*i.e.*, savings due to avoided medical utilization, in-person outreach, reduced hospital length-of-stay (LOS) and reduced work-loss days). The specific objective of this research is to provide a full analysis of the cost and benefits of the US poison center system.

II. Background

In order to determine the value of the poison center system, basic information is needed on poison center operational costs and sources of funding. The AAPCC administered a Financial Survey to its members through an independent survey research organization in December 2011. There was a 79% response rate with 45 of 57 poison centers providing self-reported, de-identified information. Respondents were asked to report funding amounts for their most recently completed fiscal year. Fiscal year varies by poison center, with most poison centers ending their fiscal year in June or December 2011.[7] As a result, the most recent cuts in federal funding were not reflected in the results of this survey.

A. Sources of Funding and Expenditures for Poison Centers

Using information gathered from the Financial Survey, the total cost of the poison center system was estimated to be $136 million. States were the primary source of funding (excluding state-administered block grants and Medicaid), followed by private and federal funding. Poison centers were found to spend an overwhelming majority (76%) of their funding on personnel. Using information from the survey in addition to AAPCC knowledge of specific grant amounts from the Health Resources and Services Administration (HRSA), funding sources were grouped into three categories: Federal HRSA grants, State and Local Funds, and Private Funds. Federal funding includes only the federal HRSA grants of $18.6 million, less 8% for administration which equals $17.1 million (13% of the $136 million total). All remaining public funds (federal, state, county and city) were included in state and local government funding. Specific breakdowns for poison center sources of funding and expenditures are shown in Exhibits 1 and 2 respectively.[7]

Exhibit 1. Sources of Poison Center Funding

Source of Funding	%	Amount in 2011 (in millions)
Federal HRSA Grants (excluding administration)	13%	$17.1
State and Local Funds (including preparedness funds, Medicaid, State-Administered block grants and other state, city and county funding)	62%	$83.8
Private Funds (including hospital, host institution, research, grants, donations, health insurers, HMOs and other business funds)	25%	$35.1
Total	**100%**	**$136.0**

Exhibit 2. Poison Center Expenditures

Expenditure Type	%	Amount in 2011 (in millions)
Personnel	76%	$103.4
Databases/References	2%	$2.7
Telephone	1%	$1.4
Education & Outreach	2%	$2.7
Travel	1%	$1.4
Rent	2%	$2.7

Expenditure Type	%	Amount in 2011 (in millions)
All Other Expenses	16%	$21.8
Total	**100%**	**$136.0**

B. Baseline Poisoning Statistics

The Centers for Disease Control and Prevention (CDC) estimate in 2009, there were 41,593 poisoning deaths of which 31,758 were attributable to unintentional poisonings.[8] Poisoning-related deaths were named as the second highest cause of unintentional injury deaths in all ages in the same year. In recent years, the numbers of poison-related deaths have increased fourfold due to the misuse and abuse of prescription medications, specifically opioids (*e.g.*, methadone). Poisonings also accounted for 438,244 hospitalizations, 749,061 emergency department visits not resulting in a hospitalization, and 1.4 million physician and outpatient clinic visits (specific data sources are shown in Exhibit 3). A number of sources were used to assess this most recent data regarding encounters with the health care system due to poisonings. These data sources included:

- Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP)
    - 2010 National Inpatient Sample (NIS)
    - 2009 AHRQ Nationwide Emergency Department Sample (NEDS)
- 2006 -2009 Medical Expenditure Panel Survey (MEPS)

HCUP is a nationwide information resource on patient-level health care made possible by a federal, state, and private industry collaborative effort supported by AHRQ.[10] The NIS is a part of HCUP and is an inpatient health care database that contains information on hospital stays from US hospitals in states representing 96% of the US population. The NIS includes information for all patients including those covered by Medicare, Medicaid, and private insurance, and those patients who are uninsured. Data collected through the NIS can be weighted to produce national estimates.[11] The NEDS is another resource in HCUP that contains nationwide information on emergency department visits. Information on emergency department visits includes health care encounters that do and do not result in hospital admission.[12] MEPS is a collection of family, individual, medical provider, and employer surveys on the utilization and cost of health care and insurance coverage. The household component of the MEPS data was used to collect information for the current study.[13] Exhibit 3 displays baseline statistics for poisonings and Exhibits 4 and 5 shows the amount of medical spending for poisonings by medical setting and source of payment, respectively.

Exhibit 3. Baseline Poison Statistics

Poison Statistic	#	Source
Total Number of Cases Managed by Poison Centers	3,952,772	2010 NPDS Annual Report
Total Number of Human Exposure Cases Managed by Poison Centers	2,384,825	2010 NPDS Annual Report
Deaths	41,592	2009 CDC Fact Sheet
Inpatient admissions	438,244	2010 AHRQ - NIS
Inpatient days	1,532,523	2010 AHRQ - NIS
Emergency department visits without inpatient admission	749,061	2009 AHRQ - NEDS
Physician office visits without hospital inpatient admission	1,395,127	2006-09 MEPS*

*2006 -2009 MEPS data was "pooled" in order to increase sample size for poisoning cases.

Exhibit 4. Baseline Medical Spending for Poisonings (in millions)

Medical Setting	Associated Costs
Emergency Departments	$554.6
Office/Outpatient Visits	$200.5
Hospitalizations	$3,706.0
Total	$4,461.1

Exhibit 5. Baseline Poison Statistics (in millions)

Source of Payment	Associated Costs
Family Out of Pocket	$191.4
Medicare	$1,171.1
Medicaid	$1,465.2
Private Insurance	$1,396.9
Other Public Coverage	$236.5
Total	$4,461.1

To estimate how much was paid for medical encounters due to poisonings and the sources of payment, we used the MEPS data for 2006-2009. These data provide detailed information on payments by source (family out-of-pocket, Medicare, Medicaid, private insurance, Veterans, TRICARE, Worker's Compensation, other public and private sources). Using these data, we computed the average payment per service and the distribution of payments by source separately for hospital inpatient, emergency department, and physician office visits for encounters related to poisonings. However, for hospital inpatient services, we used the average cost per hospital day of $1,910 (American Hospital Association (AHA) Annual Survey 2010). The average payment per service and the distribution by source of payment was multiplied by the number of services for each service type presented above. Finally, we inflated the spending estimates to 2011 using per-capita spending growth estimates from the Centers for Medicare and Medicaid Services National Health Expenditure projections through 2011.

III. Methodology and Results

The literature review revealed several trends regarding cost efficiencies offered by poison centers, including:

- Savings due to avoided medical utilization
- Savings due to reduced hospital LOS
- Savings due to in-person outreach services
- Savings due to reduced work-loss days.

An analysis based on each of these trends was conducted to estimate poison centers' savings attributable by medical setting and source of payment. Current analyses are based on the results of previous peer-reviewed research examining the contributions of the poison center system. The methods and results of the analysis are described in the following sections.

A. Savings Due to Avoided Medical Utilization

One of the primary benefits of the poison center system is that it enables people to treat poisonings at home and avoid unnecessary medical utilization. This avoided medical utilization produces cost efficiencies. A study conducted by Phillips *et al* found that instead of resolving county funding shortages, the elimination of poison center access actually resulted in higher levels of expense than those expenses required to fund the preventive services offered by the poison center.[14] Health care cost savings are shared by hospitals, insurers, taxpayers, and government health care funding agencies such as Medicaid, Medicare, and the State Child Health Insurance Program (SCHIP).[3]

Multiple studies have found that when poison center services are unavailable or not utilized, individuals seek more costly alternative methods for actual or suspected poisoning-related incidents. Lovejoy and Chafee-Bahamon found that of parents who did not call their poison center, 44% visited the emergency room compared to less than 1% of those parents utilizing poison center services.[15] Schleich and McIntire found that 85% of individuals would have gone to the emergency department if a poison center had not been accessible.[16] King and Palmisano examined the influence the Louisiana poison center closure had on the neighboring poison center in Alabama. The authors noted that 63.3%of parents of young children would have utilized emergency medical services in the absence of a poison center.[17] In a statement made in 1994 by Ted Miller to a subcommittee of the U.S. House of Representatives, Miller reported that after the interruption of poison center services in Louisiana, Michigan, and California, the number of medically treated poisonings and hospitalizations collectively rose by 37% and 16% respectively. Kearney *et al* found that 79% of poison center callers would have used emergency services in the absence of a poison center.[18] In a recent study, an analysis conducted by Miller and Lestina showed that poison centers reduced unnecessary hospitalizations by 12% and medically treated outpatient services by 24%.[19]

The above studies indicate that the availability of poison control centers reduce unnecessary medically treated outpatient poisonings by 24% - 37% and 12 – 16% for unnecessary

hospitalizations related to poisonings. The current analysis uses the mid-point of these ranges to estimate the savings attributed to poison centers due to avoided medical utilization using the most recent baseline statistics collected on emergency department visits, in-patient hospitalization, and out-patient visits. Based on these study results, we estimated $752.9 million savings due to avoided medical care. Exhibit 6 illustrates the savings in terms of medical setting and Exhibit 7 illustrates the savings in terms of payment source.

Exhibit 6. Savings Attributable to Poison Centers Due to Avoided Medical Utilization by Medical Setting

Medical Setting	% of Savings Attributable to Poison Centers	Savings in Dollars per Year (in millions)
Emergency Departments	31%	$171.9
Office/Outpatient Visits	31%	$62.2
Hospitalizations	14%	$518.8
Total		**$752.9**

Exhibit 7. Savings Attributable to Poison Centers Due to Avoided Medical Utilization by Payment Source

Source of Payment	Savings in Dollars per Year (in millions)
Family Out of Pocket	$47.1
Medicare	$176.9
Medicaid	$214.7
Private Insurance	$271.6
Other Public Coverage	$42.7
Total	**$752.9**

B. Savings Due to Reduced Hospital Length of Stay

In addition to avoided utilization of emergency room and physician services, poison centers have been found to reduce the LOS for hospitalizations due to poisonings when a poison center is consulted by the provider. The reason for this is that many health care providers access poison centers to assist in determining the type and effects of poisoning and the recommended treatment protocol. Treating poisoning patients requires extensive specialized knowledge that not all physicians can be expected to possess and maintain. Poison centers give providers an independent source of technical information on the effects of poisonings and the best practices for treatment.

In an effort to determine the effects of poison center consultation on hospital LOS, Vassilev and Marcus examined New Jersey Health Department and poison center data on all poisonings reported to the New Jersey Poison Information and Education System (NJPIES) in 2002. They found that with the assistance of a poison center, LOS was reduced by approximately 3 days.[20] In 2011, Galvao *et al* conducted a similar study which examined the medical records of poisoned patients in Manaus between 2005 and 2007. They compared this information to local poison center data to determine which patients utilized poison center services. Patients using poison center services experienced on average a 3.43 day shorter LOS than those who did not use the

poison center prior to seeking medical attention.[21] This analysis uses the mid-point between these two estimates (*i.e.,* 3.2 day reduction) to estimate savings attributable to poison centers due to reduced hospital LOS for poisonings.

This analysis also assumes that poison centers are consulted on 12% of hospitalizations related to poisonings. This assumption uses a mid-point based on two studies. Vassilev and Marcus matched poisonings reported to the New Jersey Poison Information and Education System to hospital admissions to New Jersey Hospitals. The authors identified a sample of 31,052 hospitalizations, of which 1,719 (6%) were matched to a NJPIES case.[20] Bunn *et al* compiled a study sample of 6,249 hospitalizations in Kentucky hospitals associated with accidental poisonings. In total 1,102 patients (18%) were identified as receiving poison center consultation originating from the hospital.[22]

Based on the results of these studies, we estimated savings of $441.1 million attributed to reduced LOS when a poison center is consulted by the provider. Exhibits 8 and 9 show the results of this analysis by medical setting and source of payment respectively.

Exhibit 8. Annual Savings Attributable to Poison Centers Due to Reduced Hospital Length of Stay by Medical Setting

Medical Setting	% of Savings Attributable to Poison Centers	Savings per Year (in millions)
Emergency Departments	N/A	$0.0
Office/Outpatient Visits	N/A	$0.0
Hospitalizations	Reduction of 3.2 days * 12% of hospitalizations	$441.1
Total		**$441.1**

Exhibit 9. Savings Attributable to Poison Centers Due to Reduced Hospital Length of Stay by Payment Source

Source of Payment	Savings per Year (in millions)
Family Out of Pocket	$8.6
Medicare	$130.3
Medicaid	$167.7
Private Insurance	$113.0
Other Public Coverage	$21.4
Total	**$441.1**

C. Savings Due to In-Person Outreach Services

Another important function of poison centers is to provide educational programs for both lay persons and medical professionals. For example, many poison centers provide education to school teachers and parents on how to avoid poisonings for children. They also provide formal education and training to physicians and other health care workers on the more technical aspects of diagnosing and treating poisoning. These services help to reduce the incidence of potential poisonings in the community while improving medical response. Poison prevention education and outreach, whose value is not easily quantified, is another societal benefit offered by poison centers. Understanding the additional community benefits provided by poison centers are important at this time because members of Congress have argued for consolidating the 57 poison centers into a single national call center. Consolidation would eliminate all of the community outreach and education conducted by the poison centers within their own communities. The available research on poison centers and public health interventions suggests that the savings from these outreach activities exceed the cost of providing the outreach services. Consolidation would eliminate the net benefit of these activities.[23, 24]

The only study evaluating the ROI in poison center education and outreach was conducted by Fisher and Van Buren in Monroe County, New York. The authors found that over a four-year period, educational interventions (*e.g.*, school seminars, retailer outreach, distribution of educational materials, and mass media) decreased medical spending by $3 dollars for every dollar contributed to education and outreach.[19, 25] This 3 to 1 return on investment was used in the current analysis.

AAPCC surveyed poison centers in June 2012 to determine their investments (including personnel costs) in education and community outreach. These data provided information on the percentage of the poison center budget that was dedicated to each specific educational outreach activity described in more detail in Exhibit 10. A total of 29 poison centers responded (22 poison centers identified themselves) resulting in a 51% response rate. Data from 20 poison centers provided adequate information for the analysis.

Exhibit 10. Percentage of Poison Center Education and Outreach Budget Spent Annually by Specific Service

#	Education/Outreach Activity	Average % of Poison Center Education and Outreach Budget
1	*Training new generations of pharmacy, medical, toxicology and other health professional students.*	7.2%
2	*Providing education and outreach to the nonprofessional community with the goal of preventing poisoning and/or raising awareness of the Poison Help number.*	5.8%
3	*Working with allied health personnel to build awareness, recognition and/or response appropriate to a poisoning incident.*	2.3%
4	*Disaster and public health related services*	1.6%
5	*Medication take back programs*	0.9%
6	*Other types of services that must be performed in person*	1.7%

Estimates from the survey were used on the percentage of poison center budget spent on educating non-professionals in the community regarding poisoning prevention and awareness of the Poison Help number (education/outreach activity #2). These data indicate that 5.8% of poison centers budget ($136M * 5.8% = $7.8M) is attributed to these activities, which results in savings of $23.9 million assuming the 3 to 1 return on investment. Exhibit 11 shows these savings by medical setting and in Exhibit 12 by source of payment.

Exhibit 11. Savings Attributable to Poison Centers Due to Education/Outreach Activity by Medical Setting

Education/Outreach Activity	Medical Setting	% of Savings Attributable to Poison Centers	Savings per Year (in millions)
Providing education and outreach to the non-professional community with the goal of preventing poisoning and/or raising awareness of the Poison Help number.	*Emergency Departments*	$3 savings per $1 spent on outreach	$3.0
	Office/Outpatient Visits		$1.1
	Hospitalizations		$19.8
Total			**$23.9**

Exhibit 12. Savings Attributable to Poison Centers Due to Specific Education/Outreach Activity by Payment Source

Education/Outreach Activity	Medical Setting	% of Savings Attributable to Poison Centers	Savings per Year (in millions)
Providing education and outreach to the non-professional community with the goal of preventing poisoning and/or raising awareness of the Poison Help number.	*Family Out of Pocket*	$3 savings per $1 spent on outreach	$1.0
	Medicare		$6.3
	Medicaid		$7.8
	Private Insurance		$7.5
	Other Public Coverage		$1.3
Total			**$23.9**

D. Savings Due to Reduced Work-Loss Days

It is very difficult to objectively assess all of the societal benefits that can be attributed to poison center services due to the preventive nature of their activities. In addition to medical costs for treatment, poisonings can result in loss of part or all of a victim's productivity potential. Productivity losses related to fatalities represent the value of goods and services never produced due to the poisoning-related premature death and estimated based on remaining lifetime earnings. Nonfatal poisonings may result in both short-term productivity losses as well as lifetime productivity losses primarily due to lost work days resulting from the injury.

To estimate the amount of lifetime productivity losses due to poisonings that occurred in 2011, we updated estimates produced by Finkelstein on lifetime productivity losses for poisonings

occurring in 2000.[26] The 2000 estimates were inflated to account for change in incidence of poisonings as estimated above and general inflation as measured by the Consumer Price Index (CPI) for all urban consumers between 2000 and 2011.

We estimated the impact that avoided medical care attributed to the effort of poison centers would have on productivity loss and lost work days. We assume that if inpatient and outpatient medical encounters for poisonings are avoided, then the amount of work productivity loss should be reduced in proportion. We estimate that the effect of poison centers on avoiding medical care reduced work productivity losses by $603 million in 2011. Exhibit 13 displays the savings attributable to poison centers due to reduced work-loss days.

Exhibit 13. Savings Attributable to Poison Centers Due to Reduced Work-Loss Days

Category	Incidence	Lifetime Productivity Loss 2011 (in millions)	Savings per Year (in millions)
Deaths	41,592	$61,019	N/A*
Hospitalizations discharged alive	434,738	$1,060	$148
Non-hospitalizations without hospital admission	2,153,360	$1,472	$454
Total	**2,629,690**	**$63,551**	**$603**

*The savings attributable to poison centers due to reductions in mortality was not examined in the current study because information on the influence of poison centers on mortality was not identified in peer-reviewed literature.

E. Savings Summary

The comprehensive four-part analysis described above outlines savings attributed to poison centers due to avoided medical utilization, reduced hospital LOS, in-person outreach, and reduced work-loss days. Exhibit 14 provides the total amount of savings compared to total funding by source.

Exhibit 14. Total Estimated Direct Medical Care Savings Attributable to Poison Centers by Medical Setting

Funding Source	Total Poison Center Funding in 2011 (in millions)	Estimated Medical Care Savings and Reduced Productivity Loss per Year (in millions)	Medical Care Savings and Reduced Productivity Loss per Year per Dollar of Funding
Federal Government	$17.1	$662.8	$38.74
State and Local Government	$83.8	$284.2	$3.39
Private	$35.1	$873.4	$24.86
Total	**$136.0**	**$1,820.5**	**$13.39**

As described above, we estimated that poison centers result in savings totaling $1,820.5 million per year compared to $136 million received in funding in 2011. These savings are shared by the federal government (through Medicare, TRICARE, Veterans Affairs, and part of Medicaid), state

and local governments (through Medicaid, Worker's Compensation and other state and local health programs) and private sector (through family direct payments for care and private insurers).[3] These data suggest that the efforts of poison centers save $13.39 for every dollar spent on them.

The value of the poison center system is also described in terms of the cost relative to the population served. The savings and cost to fund poison centers relative to the population served (i.e., which includes 315,771,469 residents of the United States, Puerto Rico, US Virgin Islands, American Samoa, Micronesia, and Guam) are $5.77 per year and $0.43 per year per resident respectively.

IV. Feedback from a Sample of Poison Centers

A. Methods

As a part of the analysis, during the period between June 27, 2012 to July 5, 2012, directors and other leadership from five poison centers were invited to offer additional information on the specific issues relevant to poison centers. Interview questions were developed in conjunction with AAPCC (interview/focus group questions can be found in Appendix A). Interviews were conducted through teleconference and lasted 45 minutes to one hour. Participants were provided the interview questions prior to the interview. Interviewees were asked about their host institution, funding, staff and other resources, partnerships, poison center utilization, education and outreach services, and best practices. Information gathered from the interviewees was not attributed to any specific poison center in order to protect the confidentiality of the poison center being interviewed. The qualitative data was analyzed by categorizing interview responses into observable themes outlined below.

B. Overview

All directors reported an extensive tenure (≥ 12 years) with their poison center and retained significant historical information on the issues being discussed. The roles of poison center directors include but are not limited to: managing staff, program administration, and the securement of funding. The five poison centers represented in these interviews served an average of 14.5 million people (range 3 – 37 million) and staffed between 7.8 and 38.6 full-time employees. All poison centers reported approximately 80% utilization by the general public and 20% utilization by health care providers. Staff titles included: medical director, poison information specialists, epidemiologists, financial manager/bookkeeper, registered/ critical care nurses, education and emergency preparedness coordinators, media specialists, and administrative assistants. The host entity of poison centers varies throughout AAPCC's membership. Several of the poison centers that were interviewed reported an association with a university, school of medicine or pharmacy, similar educational institution, or a stand-alone entity. All those interviewed, with the exception of one poison center, described the relationship between the poison center and the host institution as amicable. The dissenting poison center described the relationship with its host as anything but "kind and friendly." All poison centers reported having "good" or "symbiotic" relationships with their state departments of public health.

C. Funding Restraints

Although each poison center reported the receipt of in-kind services (*e.g.,* physical facilities, custodial services) and cost-sharing partnerships, all poison center managers reported budget deficiencies and shared concerns about the elimination or reduction in services that occur if funding issues were not adequately addressed. One poison center serving a major metropolitan area expressed significant distress about the real possibility of closing their poison center in the next six months if additional funding was not identified and secured. Poison center directors discussed a variety of strategies they employed to obtain funding for the administration of their poison centers, including:

- Charging hospital membership fees and/or encouraging hospital cost sharing
- Soliciting insurance company or insurance association contributions

- Petitioning state government
- Expanding the role of the poison center (*e.g.*, emergency preparedness, drug monitoring programs)
- Sharing responsibilities with other poison centers in state network (*e.g.*, the development of marketing materials)
- Instituting train-the-trainer models (*i.e.*, training public health volunteers to provide poison information)
- Seeking new partnerships and partners to advocate on their behalf (*e.g.*, State Environmental Protection Agency, State Association of Health Plans, Pharmacy Associations)
- Revisiting the budget and conducting cost effectiveness studies for their poison center in order to demonstrate the ROI.

In light of recent funding reductions, the poison centers that were interviewed reported that they were required to scale-back services across the board and specifically to the areas of hospital preparedness, environmental disease detection, personnel, travel, and education and outreach services and materials. One poison center interviewed reported improvements in state funding.

When asked to describe the education and outreach activities in which their poison centers engaged, interviewees reported the following: school lectures for pre-K – 12 children and senior citizen education; pharmacy, medical, and nursing student, resident, and fellow training; media requests; rural health centers; health fairs; state injury prevention efforts; bioterrorism training and emergency preparedness. Poison centers also report working with the federal and state governments on environmental issues of national concern (*e.g.*, H1N1, the Gulf oil spill, and the Japanese earthquake). It was reported that the general public is the primary user of these services.

The interviews demonstrated that despite their varying nature, poison centers share many commonalities in regard to administration and funding challenges. All of the interviewees advocated complete transparency of budget-related information and future research needed to show cost efficiencies provided by poison centers.

V. Discussion

This white paper describes the value of the poison center system. The analyses confirm the overwhelming ROI that the poison center system contributes to the nation as a whole. The savings attributed to poison centers for avoided medical utilization, reduced hospital LOS, in-person outreach, and reduced work-loss days are: $752.9, $441.1, $23.9 and $603 million per year, respectively. In total, the poison center system saves over $1.8 billion per year in medical costs and productivity. The ROI is $13.39 for every dollar invested in the poison center system. The savings and cost to fund poison centers relative to the population served (i.e., which includes 315,771,469 residents of the United States, Puerto Rico, US Virgin Islands, American Samoa, Micronesia, and Guam) are $5.77 per year and $0.43 per year per resident respectively. These savings are shared by the federal and state and local governments and the private sector. Current analyses are based on the results of previous peer-reviewed research examining the contributions of the poison center system outlined in the Literature Review in Appendix B.

In 1997, Miller and Lestina found that each call to a poison center prevented $175 in other health care spending.[19] In 2008, Artalejo reported that for every dollar invested in the poison center system, $7 was saved in health care costs.[3] Our estimates of savings are higher than those previously reported because our analysis is comprehensive and includes all of the four most commonly referred to savings metrics (*i.e.*, savings due to avoided medical utilization, reduced hospital LOS, in-person outreach, and reduced work-loss days). Please note we did not attempt to quantify the value of other recognized benefits of the poison center system, which include but are not limited to the provision of surveillance data to Federal agencies, toxicology training of health care professionals, and involvement in local, State, and Federal emergency preparedness and response. Future research should explore the influence of poison center services on mortality.

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Appendix A – AAPCC Interview Questions

1. What entity (or entities) hosts your poison center?
2. What is the approximate number of individuals your poison center serves within your designated geographic service area?
3. How many full-time and part-time employees work for your poison center? What is your ideal level of staffing?
4. If you are willing to share this information, can you give me an approximation of your yearly budget?
5. What is your primary source of funding? Secondary sources? In-kind or shared resources? What is your ideal level of funding?
6. Has your poison center experienced any reductions in funding recently? If so, in what areas? Were these areas of your choosing or were they mandated in the funding reduction by an outside party?
7. Please describe your relationship with your State and/or local department of health.
8. Has your poison center arranged any special relationships or agreements to more efficiently share the costs of poison center operation?
9. Are there any public health and medicine partners that might be useful in bolstering up poison centers?
10. What entities (e.g., private citizens, health care providers, and government agencies) utilize your services the most?
11. Please describe the in-person educational/outreach services that your poison center offers to its surrounding community.
12. What entities (e.g., private citizens, health care providers, and government agencies) utilize your in-person educational/outreach services the most?
13. Have funding restraints affected the administration of in-person community educational/outreach services? If yes, how so?
14. How would centralization affect your center? How would centralization affect the provision of in-person services and other functions?
15. Has your organization identified any exemplary practices that may be useful to other poison centers?
16. Do you have any other comments that you would like to share relevant to this study?

Appendix B – Literature Review

The LEWIN GROUP®

HEALTHCARE AND HUMAN SERVICES POLICY, RESEARCH, AND CONSULTING — WITH REAL-WORLD PERSPECTIVE.

Literature Review on the Value of Poison Control Centers

Prepared for: **American Association of Poison Control Centers**

Submitted by: **The Lewin Group, Inc.**

September 26, 2012

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Executive Summary

There are many direct and indirect benefits of poison centers. The actual value attributable to poison centers is very difficult to quantify due to the preventative nature of their services. The influential role poison centers play in the US health system has largely gone unrecognized although poison centers provide value in a number of areas. Multiple studies have documented the cost efficiencies provided by poison centers to the health care industry. These cost efficiencies present themselves through decreased hospital stays and reductions in unnecessary use of emergency medical ambulatory services; emergency department visits; outpatient service utilization; and injury prevention, among other metrics. Although some studies are older and in need of updating, the available literature provides the following evidence of savings:

- **Reduced Medically Treated Poisonings:** poison centers reduce the number of poisonings that are "medically treated" resulting in fewer emergency room visits, fewer physician visits and reduced hospital stays. This evidence includes:
    - A study of a lapse in poison center coverage in Michigan in 1993 showed that treated poisonings increased by 33 percent (16 percent inpatient; 35 percent outpatient).
    - A study of a lapse in poison center coverage in Louisiana showed that the number of medically treated poisonings increased by 42 percent.
    - Based on these and other studies, Miller estimated that the average call to a poison center prevented $175 in medical costs.
    - In a study of a period of restricted access to poison centers in California found that 14 percent of callers with restricted access were treated in an inappropriate location, resulting in added medical costs of $33 per blocked call.
    - Using decision analysis techniques, one study found that the cost-effectiveness of treatment for poison exposures is about half as great without a regional poison center.
- **Reduced Hospital Length of Stay for Poisonings:** Hospital length of say is reduced for those admitted for poisonings in cases where physicians consult with poison control centers. Available evidence includes:
    - In a study of Uniform Billing data from the New Jersey Health Department showed that the median length of stay for patients where the physician consulted with the local poison center was two days compared with a median offive days for patients where the physicians did not consult with the poison center.
    - A study of poison control centers in Brazil showed that patients hospitalized for poisonings had a reduced length of stay of 3.4 days in cases where the physician received poison center consultation.
- **Education and Outreach:** In a study of public education and outreach efforts in schools and in the media, these poison center activities saved $3 for every dollar invested, stressing the importance of local initiatives.

- **Reduced Work-loss Days and other Social Costs:** Articles have suggested that reductions in trips to health providers due to poison centers avert work-loss days for workers and working parents of affected children.

Understanding the additional community benefits provided by poison centers are important at this time because members of Congress have argued for consolidating the 57 poison centers into a single national call center. Consolidation would eliminate much of the community outreach and education conducted by the poison centers within their own communities. The available research on poison centers and public health interventions generally suggests that the savings from these outreach activities exceed the cost of providing the outreach services.

List of Acronyms

AAPCC	American Association of Poison Control Centers
CDC	Centers for Disease Control and Prevention
ED	Emergency Department
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
HHS	Department of Health and Human Services
HSPD-21	Homeland Security Presidential Directive 21
IOM	Institute of Medicine
MEPS	Medical Expenditure Panel Survey
NPDS	National Poison Data System
NHDS	National Hospital Discharge Survey
PAHPA	Pandemic All-Hazards Preparedness Act
SCHIP	State Child Health Insurance Program
TESS	Toxic Exposure Surveillance System

I. Introduction

The American Association of Poison Control Centers (AAPCC) is a non-profit organization that was established in 1958 to support local poison centers in the United States. Currently, the AAPCC provides support to 57 poison centers that offer free, 24-hour, over the phone, expert consultation by professionals specially trained in poison prevention and treatment. Healthcare providers and the public are able to obtain life-saving information on a number of toxicological agents through poison centers serving their communities. The AAPCC collects and aggregates data from poison centers to inform and update the only national database that maintains detailed information on poisonings. Poison centers also provide educational outreach to their communities regarding poison prevention and safety as well as offering information on a number of current events in which the public may have interest (*e.g.*, the Gulf oil spill, bath salts and button batteries).[1, 2]

Multiple studies have documented the cost effectiveness of the poison center programs. Cost efficiencies result largely from enabling people to treat potential poisonings at home without accessing costly health services such as emergency room and physician office visits. For those who are medically treated for poisonings, poison centers provide physicians with a reliable source for information on specific poisons and appropriate treatments, which has been shown to reduce hospital length of stay. Poison centers also provide education and community outreach that reduces the incidence of poisonings that has also been shown to be cost effective. Despite their accomplishments in the past 50 years, poison centers are being targeted for significant reductions in federal funding (36%). This comes at a time when poison centers are under severe financial strain as they experience a number of financial reductions in state support and other resources.[2]

In light of potential funding cuts for poison centers, it is important to understand the cost-effectiveness of services these organizations provide to communities. A number of studies have demonstrated that poison centers reduce health spending and that the amount of these health care savings far exceeds the cost of providing poison center services. In fact, one study shows that 20% of these reductions in health spending are savings to the federal government for people covered under Medicare and Medicaid, even though only about 6% of poison center funding comes from the federal government.[22]

In this report, we provide a review of the literature on the cost-effectiveness of the poison center program nationwide. We present these results in the following sections:

- Background;
- Reduced medical treatment for potential poisonings;
- More efficient care for those hospitalized for poisonings;
- Savings from community education and outreach;
- Other societal benefits; and
- Data collection and research.

II. Background

The first poison center came about after the American Academy of Pediatrics commissioned the Committee on Accident Prevention to explore methods to reduce injury to young children. The Committee determined that many childhood injuries were related to accidental poisonings. In an effort to establish a single source of information for physicians attempting to treat toxicological exposures, they established the first Poison Information Center in Chicago, Illinois in 1953. The formation of this center was made possible when one of the Committee members, seven hospitals, and the Illinois Health Department pooled their resources to fund this initiative.[3]

The success of the first Poison Information Center led to the establishment of other poison centers throughout the US. In an effort to standardize the flow of information received and provided by poison centers, in 1957, the now defunct National Clearinghouse for Poison Control Centers was designated as the entity responsible for providing information to and collecting data from poison centers.[3,4] In an effort to further improve the quality of services offered, the AAPCC was created in 1958 and continues to evaluate and certify poison centers. Improvement to the poison center system included streamlining the then 661 local and regional operating poison centers to provide more skilled staff, better data collection services, and targeted community education and outreach.[3, 5]

In 2006, the Institute of Medicine (IOM) in their report, "Forging a Poison Prevention and Control System," urged poison centers to continue efforts to improve services that would lessen the economic burden of poisonings to the health care system. In 2006, this burden was estimated to be $12.6 billion. In addition, the IOM made 12 recommendations to the poison control system including strengthening the nation's emergency preparedness capabilities, maintaining a vital network of regional poison centers, and revising legislation to ensure sufficient funding for the maintenance and expansion of the poison control system.[6] Today, there are 57 poison centers mostly located in the Southern US region which field on average 45,189 calls per fiscal year per center. Some large centers may receive on average 74,576 calls per fiscal year while small centers on average may receive as few as 32,672 calls per fiscal year.[7]

There are many direct and indirect beneficiaries of poison centers. The actual value attributable to poison centers is very difficult to quantify due to the preventive nature of their services. The influential role they play in the US health system has largely gone unrecognized although poison centers provide value in a number of areas including direct consultation to the public and health care providers (both human and veterinary); law enforcement; product manufacturers; insurers; and local, state and federal governments. In addition to direct consultation, poison centers provide real-time surveillance data allowing for the identification and tracking of public health and environmental threats. They also provide educational services for not only their employees but also other health professionals and the community at large.[8-10]

The provision of patient health care has been a fundamental part of poison center services. In many ways, poison center professionals serve as primary health care providers for the home management of suspected poisonings and as toxicology consultants for health care providers and hospitals. In less than a few minutes, callers are connected to specially trained individuals knowledgeable of the treatment, prevention and safety measures that should be taken to prevent injury from a number of hazardous materials. This rapid early intervention often limits morbidity

and prevents mortality. Poison center staff follow-up each case of suspected or known poisoning in order to access the effects of treatment, to advise on continuing care and to collect data on the occurrence. In addition, poison centers have emerged as a useful asset in the response to local, state, national, and international emergencies by providing up-to-date information to the public and the media specifically targeting the communities they serve.[8, 9] The services offered by poison centers are available in over 150 languages and are accessible to those who are deaf and others who may have hearing disabilities. Poison centers do not charge the public a fee for any of the services they provide.

III. Avoided Medical Treatment of Potential Poisonings

One of the primary benefits of the poison center system is that it enables people to treat many potential poisonings at home without going to an emergency room or other health provider. The avoidance of unnecessary medical treatments for potential poisonings has been cited as one of the major impacts attributable to poison centers. Specifically, consultation with poison centers has been shown to reduce unnecessary emergency department visits for suspected and actual poisoning incidents. A number of studies document cost-saving reductions as a result of poison center consultation and other benefits such as ease of mind parents and other caretakers receive that cannot be fully quantified.[9, 10] Health care cost savings are shared by hospitals, insurers, taxpayers and government health care funding agencies such as Medicaid, Medicare, and the State Child Health Insurance Program (SCHIP).[8]

A. Loss of Poison Center Service

One study conducted by King and Palmisano had the unique opportunity to observe the behaviors of residents living in areas served by a Louisiana poison center prior to and after losing access to poison center service. The authors compare the effects the Louisiana poison center closure had on the neighboring Alabama poison center during the same time. Prior to the loss of poison center access in Louisiana, Louisiana and Alabama had very similar poison exposure triage patterns. When Louisiana residents lost access to their poison center services, the researchers noted that less than half of Louisiana residents managed poison exposures at home when compared to Alabama residents. Louisiana residents sought the services of health care facilities more than four times that of residents in Alabama who had access to a poison center. The authors noted that a number of parents (63.3%) of young children would have utilized emergency medical services in the absence of a poison center. This would translate to a range of 3,614 and 15,757 unnecessary visits per year to emergency departments resulting in $315,350 and $1.4 million (1991 figures) of unnecessary medical costs.[11]

A similar study conducted by Phillips *et al* found that an additional cost of $33.14 (1998 figures) encompassing charges related to health care resources was incurred in the absence of poison center service. In this study, callers were electronically restricted from using poison center services in California and instead routed to 911 who had access to poison center service if needed. This study found that instead of resolving county funding shortages by restricting poison center service, the elimination of poison center access actually resulted in higher levels of expense than required to fund the preventive services offered by the poison center.[12]

B. Alternative Services Choices in the Absence of a Poison Center

Lovejoy and Chafee-Bahamon conducted a study to determine the necessity of emergency room care for pediatric poisoning patients. They found that the majority (63%) of patients did not need emergency care and the majority of parents (95%) did not utilize poison center services. Of the parents who did not call their poison center, 44% visited the emergency room compared to less than 1% of those parents utilizing poison center services. In this study, the regional poison center was found to be significantly effective in reducing unnecessary hospital visits.[13] A similar study conducted by Schleich and McIntire sought to determine the cost-savings of a Nebraska poison center by identifying alternate actions that would have been taken in the absence of the poison center. The authors also looked at the entity that would have been responsible for paying those

costs. The authors found that 84.6% of individuals would have gone to the emergency department if a poison center had not been accessible. Assuming an average call would take 10 minutes to address, the authors concluded that the poison center avoided 2,257 hours of health care provision. They identified the beneficiaries of poison center service as physicians, their staffs, emergency departments, other health care clinics and insurers.[14]

In 1994, a study performed by Mvros and colleagues demonstrated the cost-savings associated with unnecessary emergency department visits due to poison center closure. Based on previous studies, the authors assumed that at least 60% of patients would go directly to the emergency department to seek care if no poison center existed. Callers to a poison center were surveyed on the existence and type of health insurance coverage. It was determined that without a center, the state would incur fees ranging from $1.27 to $2.20 million per year and private insurers $4.58 to $7.93 million per year. These estimates include emergency department fees only and not the cost of associated hospital admissions. The authors assert that poison centers are cost-effective mechanisms that prevent unnecessary medical utilization.[15] Kearney *et al*, also inquired of poison center callers what alternative services they would utilize in the absence of poison centers. They found that 79% of callers would have used emergency services that would have been primarily paid for by private insurers. The costs associated with seeking emergency medical services were estimated to be more than five times the actual operating costs of the poison center.[16]

A study by LoVecchio *et al* estimated savings of more than $33 million (2008 figures) based on the assumption that without poison center service, 75% of surveyed callers would have visited an emergency department. For each dollar invested into poison center services, a low estimate of $36 is saved by avoiding unnecessary medical utilization and managing poisoning cases at home.[17] Another study utilizing telephone surveys focused on callers in South Carolina. This study explores the value of poison centers in the same way, by analyzing the cost-benefit of avoided medical utilization. The authors estimate a benefit-to-cost ratio of 7.67%. This translates to a savings of $7.67 for every dollar spent to fund this particular poison center.[18] Spiller and Singleton also recognized the availability of poison center services contributed to reductions in hospital utilization in instances of poisonings when compared to other injuries.[19]

C. Medical Treatment Versus Poison Center Utilization

While the majority of studies focus on alternative choices taken by residents in the absence of poison centers, a few studies examine the relationship between hospital utilization related to poisoning and poison center utilization. Zaloshnja *et al* examined the rates of poison center calls compared to hospital utilization rates. The authors noted that in the rural counties examined, a 1% poison center call rate was related to a 0.19% lower hospitalization rate in those seeking emergency care for poisoning. They recognized a net cost savings of $7,321 (2006 figures) for those counties with poison center accessibility.[20] A similar study, conducted two years later by the same authors looked at the association between poison center usage and non-admitted poisoning cases. They recognized almost identical findings and assert a probable association between the two.[21]

In what is perhaps one of the most comprehensive cost-benefit analysis of poison centers, Miller and Lestina used National Medical Expenditure Survey, US Vital Statistics, National Hospital Discharge Survey and AAPCC data to measure financial savings attributable to poison centers. Their analysis shows that poison centers reduced unnecessary hospital utilization by

approximately 24% and poison-related hospitalization by 12%. This resulted in savings of $355 million compared to the $65 million needed to support poison center operation (1992 figures). This translates into an average of $175 saved per poison center call. Those who benefited from these savings included hospitals, third party payers (private insurers, workers' compensation, health maintenance organizations), and state and federal governments.[22]

IV. More Efficient Care for Those Hospitalized for Poisonings

In addition to avoided emergency room and physician services, poison centers have been found to reduce the length-of-stay costs for poisonings serious enough for the patient to be hospitalized. The reason for this is that many health care providers will access poison centers to assist in determining the type of poisoning and the recommended treatments. Treating poisoning patients requires extensive specialized knowledge that not all physician can be expected to possess and maintain. The poison center gives providers an independent source of technical information on effects of poisonings and best practices for treatment. The ability to both assist patients and health care providers is a unique element of poison centers.

Harrison *et al* estimated the direct costs associated with treatment options for the four most common types of poisonings. In each case and regardless of outcome, the utilization of poison center services was found to be significantly and consistently more cost-effective than treatment without poison center consultation. Specifically, the cost of patients treated with out poison center consultation was almost double the cost of those utilizing poison center services. Bunn *et al*, through the examination of AAPCC and hospital discharge data, found that poison center consultation is highly correlated with reductions in the length of stay and hospitalization fees for patients (controlling for age and gender) with and without preexisting medical conditions.[24]

In an effort to determine the effects of poison center consultation on hospital length of stay, Vassilev and Marcus examined New Jersey Health Department and poison center data on all poisonings reported to the New Jersey Poison Information and Education System in 2002. They found that with the assistance of a poison center, hospital stays ranged from 0 to 126 days compared to 0 to 220 days for patients who did not use poison center services.[25] In 2011, Galvao *et al* conducted a similar study which examined the medical records of poisoned patients in Manaus between 2005 and 2007. They compared this information to local poison center data to determine which patients utilized poison center services. Patients using poison center services experienced on average a 3.43 day shorter stay than those who did not use the poison center prior to seeking medical attention.[26]

V. Savings from Community Education and Outreach

Another important function of the poison centers is to provide educational programs for both lay persons and physicians. For example, many poison centers provide community education to school teachers and parents on how to avoid poisonings for children. They also provide training to physicians and other health workers on the more technical aspects of diagnosing and treating poisoning. These services help to reduce the incidence of potential poisonings in the community while improving medical response. Poison prevention education and outreach is another societal benefit that's value is not easily quantified.

Poison prevention education, as described by the IOM, consists of two distinct kinds of activities: primary education, which focuses on poison prevention, and secondary education, which attempts to reduce the adverse effects of poisonings by raising awareness of poison centers. poison center educators disseminate poison prevention and preparedness information specifically targeted for the communities in which they serve. This information may come in the form of fliers, bulletins, brochures, website postings, warning labels, public service announcements or other similar distribution methods. In many cases, poison centers collaborate with other entities (*e.g.*, health departments, hospitals, schools, and the CDC) to further the impact of their efforts. The goals of educational outreach are to stimulate health behavior changes among the vulnerable populations and to encourage the use of poison centers.[6, 9, 10]

Understanding the additional community benefits provided by poison centers is important at this time because members of Congress have argued for consolidating the 57 poison centers into a single national call center. Consolidation would eliminate much of the community outreach and education conducted by the poison centers within their own communities. The available research on poison centers and public health interventions generally suggests that the savings from these outreach activities exceed the cost of providing the outreach services. Consolidation would eliminate the net benefit of these activities.[6, 36]

A. Poison Prevention

There are only a few studies that specifically examine the influence of educational outreach on poisoning events. One of the first studies on the subject was conducted by Maisel and colleagues in 1967. The authors sought to determine if a large poison prevention campaign decreased the numbers of accidental poisonings within a certain geographic area. The educational campaign proved to be successful in effectively reducing the amount of accidental poisonings during the intervention timeline as reported by the National Clearinghouse for Poison Control Centers. These declines ranged from 23-29% over the intervention period.[29]

Nixon *et al* call for additional studies on the subject. In their systematic review of community-based injury prevention programs to prevent poisonings, they cite a study conducted by Krug *et al*. In this study, the influence of child resistant closures on paraffin packages was examined in South Africa. The researchers noted that the educational outreach and public health intervention program yielded a 47% reduction in the incidence of poisonings for this community when compared to the control community.[30]

Another study conducted by Krenzelok, Mrvos, and Mazo determined the effectiveness of a combined primary and secondary passive education initiative to increase poison center awareness

through the use of "Poison Help" stickers. The stickers contained the national toll-free poison center telephone number and were distributed by the Pittsburgh Poison Center along with a quarterly publication from the Children's Hospital of Pittsburgh. Copies of this publication were circulated to 19 counties in western Pennsylvania. The results were measured in terms of call volume within the poison center's service area. Volume increased by an average of 8.8% from the counties where at least 5% of residents received the mailing. The authors noticed a modest positive impact (5%) on poison center call volume for those residents that were targeted and recommend collaboration with other public health entities to improve the effects of educational interventions.[31]

B. Evidence on Other Public Health Education

Other studies related to this topic focus on general injury prevention and are not exclusively focused on poison prevention. Guyer *et al* studied community-based injury prevention campaigns (that included poison prevention) focused on children from birth to 5 years. The study incorporated the use of control communities to determine the influence of educational interventions. The authors estimate that 42% of targeted households were exposed to at least one of the programs during the two-year period. They found that exposure to the program was positively correlated with poison-related safety behaviors (*i.e.*, participation in safety programs, increased knowledge).[32]

Lindqvist *et al* use a cross sectional data set from two municipalities in Sweden, pre and post implementation of the World Health Organization Safe Community model to explore its effect on injuries in children. They found that the risk of child injury decreased more in the intervention community than in the control community over the period studied; minor injury probability was reduced slightly, moderately severe injury probability was reduced by almost half, and probability of severe injury remained constant.[33]

VI. Other Societal Benefits

It is very difficult to objectively assess all of the societal benefits that can be attributed to poison center services due to the preventive nature of their activities. These societal benefits include but are not limited to the following:[8, 10, 22]

- Reduction in patient and family anxiety
- Reduction in emergency department overcrowding
- Reduction of burden in the overall medical system
- Avoidance of trauma, injury, or death
- Provision and impact of outreach and educational services for the public and health care provider community
- Identification of micro-epidemics
- Improved quality of care
- Increase in consumer knowledge
- Efficiencies in treatment (time-savings)
- Reduction in disability/quality of life losses
- Reduction in work-loss days.

The benefits listed above are not tangible and thus not easily quantified. In an effort to analyze the cost of poisonings, Miller and Lestina included future earnings and quality of life estimations in their calculations in addition to the most common variable used, medical payments. Future earnings include a person's salary lost to injury, fringe benefits, and household work. Quality of life estimates the cost of pain, anguish, and loss of quality of life for patients and their affected family members and encompasses what economists define as the average cost society is willing to spend to save one life. The authors estimate that poisoning incidents cost the nation $50 billion in 1992. This includes $12 billion for lost wages/household work, $35 billion in loss of quality of life, and $3 billion in medical spending (1997 figures).[22]

Schleich and McIntire examine alternative treatment decisions residents would have made if poison centers were not available. This study uniquely examines the efficiencies in treatment (time-savings) gained through the utilization of poison center services. The results of the telephone survey indicated that poison centers generate significant time-savings for health care providers by providing more concise treatment regimens. The authors estimate that if each poison exposure call was only 10 minutes in duration, this individual poison center would have saved 2,257 man-hours for local clinics, physicians, and emergency departments.[14]

There are several studies that examine facilitators and barriers to poison center utilization. Kelly *et al* explored utilization rate differences by demographic variables. The authors found that those with prior knowledge of poison centers were more likely (92% vs 68%) to call a poison center before seeking medical help than those without. In addition, callers were more likely (39% vs 19%) to have their poison center's number posted or easily accessible within the home than those not using poison center services.[34] In a similar study, Kelly and Groff used focus group data from

women attending an urban clinic. The group was composed of 43 women, 21 Spanish speaking and 22 English speaking, who participated in seven groups. The study found that those women using poison center services exhibited higher levels of poison prevention knowledge and behaviors when compared to those not utilizing poison center services.[35] Both of these studies call for increased educational intervention efforts to target underserved populations, particularly African Americans and Spanish-speaking residents.[34, 35]

Litovitz *et al* used 2001 data from the National Poison Data System to identify factors that influence "poison center penetrance," or the number of human poison exposures reported to a poison center per 1,000 population. The authors found that lower poison exposure rates were positively associated with higher numbers of health educators, although race, language and distance serve as barriers to their utilization.[36] Many other studies cite the benefits and cost-effectiveness of public health interventions. Their effectiveness has been demonstrated repeatedly through the use of community health workers and other community health interventions addressing diabetes, influenza, AIDS, asthma and childhood injury prevention programs.[37 - 44]

VII. Data Collection and Research

Poison centers offer additional benefits to society through the collection of detailed data on poisoning occurrences throughout the US. The AAPCC collects and aggregates data from individual poison centers into the National Poison Data System (NPDS). The NPDS has been in use since 2006 when it replaced the system previously used to collect poisoning data, the Toxic Exposure Surveillance System (TESS). The NPDS includes data previously collected by TESS, is accessible to authorized users through the Internet, and allows for data sharing between authorized entities. Granular information from each call is collected including demographic information (*e.g.*, age, gender, weight, and ZIP code), type of exposure, and details of clinical management and outcomes.[27]

The NPDS collects data almost instantaneously and serves as a surveillance system for public health and environmental toxins. The NPDS has been used to track outbreaks including selenosis in dietary supplements and *Salmonella typhimurium* in peanut butter and has been used to identify clinical effect anomalies. This capability allows allow poison centers to alert the proper authorities if a micro-epidemic is observed in one of their communities. Other benefits of NPDS include but are not limited to:[9, 27, 28]

- Providing direction to new research
- Prompting improvements or alterations to current clinical therapies
- Stimulating development of new medical products
- Providing insight into the efficacy of product safety measures
- Improving and monitoring consumer safety
- Minimizing injury or risk through the examination of safety data
- Demonstrating the level of safety associated with pharmaceutical and other medical products
- Contributing to regulatory reporting requirements
- Reducing the amount of animal testing for new products.

Many federal agencies use this data including the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA). The NPDS also serves as a national biosurveillance tools as indicated in the Pandemic All-Hazards Preparedness Act (PAHPA) and Homeland Security Presidential Directive 21 (HSPD-21).[27]

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