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TOXICOLOGY INVESTIGATION

Disaster Preparedness of Poison Control Centers in the USA: A 15-year Follow-up Study

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Abstract There is limited published literature on the extent to which United States (US) Poison Control Centers (PCCs) are prepared for responding to disasters. We describe PCCs' disaster preparedness activities and compare and contrast these results to those previously reported in the medical literature. We also describe the extent to which PCCs are engaged in disaster and terrorism preparedness planning and other public health roles such as surveillance. An electronic questionnaire was sent via email to the managing directors of the 57 member PCCs of the American Association of Poison Control Centers. Collected data included the population served and number of calls received, extent of disaster preparedness including the presence of a written disaster plan and elements included in that plan, the presence and nature of regular disaster drills, experience with disaster including periods of inability to operate, involvement in terrorism and disaster preparedness/response policy development, and public health surveillance of US PCCs. Descriptive statistics were performed on collected data. Comparisons with the results from a previously published survey were performed. A response was obtained from 40/57 (70 %) PCCs. Each PCC serves a larger population ($p<0.0001$) and receives more calls per year ($p=0.0009$) than the previous descriptions of PCC preparedness. More centers report the presence of a written disaster plan ($p<0.0001$), backup by another center ($p<0.0001$), regular disaster drills ($p<0.0001$), and comfort with ability to operate in a disaster ($p<0.0001$) than previously described. PCCs are involved in disaster (34/40, 85 %) and terrorism (29/40, 73 %) preparedness at the local, state, or federal levels. PCCs (36/40, 90 %) are also involved in public health functions (illness surveillance or answering "after hours" public health calls). Despite an increase in calls received and population served per center as compared to previous descriptions, more PCCs report the presence of a written disaster plan, backup by another center, regular disaster drills, and comfort in ability to operate in a disaster. PCCs are actively involved in terrorism and disaster preparedness and response planning and traditional public health responsibilities such as surveillance.

Keywords Poison Control Center · Disasters · Disaster planning · Terrorism · Mass casualty incidents

Abbreviations

PCCs	Poison Control Centers
AAPCC	American Association of Poison Control Centers
HAZMAT	Hazardous Materials Response

Introduction

Following natural disasters, calls to Poison Control Centers (PCCs) increase and may reflect disaster-related exposures that may be safely managed outside of healthcare facilities.

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In the 2 days following the 1989 Loma Prieta Earthquake, Nathan et al. demonstrated a 27 % increase in the number of calls received. Calls were predominantly to inquire after the safety of water and other environmental concerns [1]. More recently, Forrester reported an increase in the number of calls received following Hurricane Rita (2005) and Hurricane Ike (2008) concerning gasoline and carbon monoxide exposure [2, 3]. In all three events, many of the PCC calls did not require medical treatment. Following a disaster, in the absence of functioning PCCs, an increase in the number of individuals seeking information or care in a healthcare facility for potentially non-serious exposures could be anticipated. This may place additional stresses on an emergency care system already strained caring for non-poison related patients.

In 1996, Vilke et al. conducted a survey to assess the state of disaster preparedness activities of US PCCs [4]. Results from that questionnaire suggested that many PCCs were ill prepared for the effects of disaster. At that time, there were 96 operating PCCs. Seventy-six (79.2 %) centers responded to the questionnaire. Only 54 % (41/76) of responding centers had a written disaster plan, and only 25 % (19/76) of those centers with a plan conducted drills to practice the disaster plan. Backup coverage by another PCC was reported by 21/76 (27 %). Half (37/76) of the responding managing PCC directors felt confident that their center could meet the public's needs in the event of a disaster. No subsequent assessments of PCCs' disaster preparedness have been published since that time despite a number of large domestic disasters impacting dramatically on public health and highlighting the importance of disaster preparedness such as the attacks on the World Trade Center in 2001, Hurricane Katrina in 2005, and Hurricane Sandy in 2012.

We sought to describe current PCC disaster preparedness activities and compare these results to those previously reported by Vilke et al. [4]. We also sought to determine the degree to which PCCs are engaged in disaster and terrorism preparedness planning at local, state, and federal levels as well as other public health roles and responsibilities such as public health surveillance.

Materials and Methods

An electronic questionnaire was developed to determine the population served and the number of calls received, extent of disaster preparedness including the presence of a written disaster plan and elements included in that plan, the presence and nature of regular disaster drills, experience with disaster including periods of inability to operate, involvement in terrorism and disaster preparedness/response policy development, and public health surveillance of US PCCs (see Table 1 for survey). A computerized link to the online questionnaire and cover letter explaining the purpose of the study was emailed to the managing director of all 57 US PCCs. All 57 centers are certified by the American Association of Poison Control Centers (AAPCC). A statement assuring confidentiality and the voluntary nature of this survey was included. This study was approved by the Human Subjects Committee of our institution. Follow-up emails were sent at 1 month and 2 months to increase participation in the study. The survey was conducted between December 2011 and February 2012. Descriptive statistics (including 95 % confidence intervals) were performed on all data collected. Chi square or Fisher's exact statistic for categorical data (GraphPad Prism V4, San Diego, CA, USA) was performed on selected comparisons (population served, number of calls received per year, presence of written disaster plan, arrangements for backup coverage by another PCC, regular disaster drills, and comfort with ability to operate in disaster) between the results of the present study and that conducted by Vilke et al. [4].

Results

A survey response was received from 40/57 (70 %) PCCs in the present study. Our study achieved a response rate of 72 %, while the Vilke et al. study achieved a response rate of 79.2 % (not significant, Z test comparison of proportions) using a similar cohort of poison centers.

As compared to the survey conducted by Vilke et al. [4], more US PCCs respond to a population greater than 5,000,000 persons (14/40 vs 0/76, $p<0.0001$), and more centers receive more than 60,000 calls per year (22/40 vs 17/76, $p<0.0009$) (see Table 2).

A written disaster plan was reported by 100 % of the responding PCC (40/40) in the current study with 65 % of the centers (26/40) reporting regular disaster drills to practice and assess that plan. In contrast, only 41 out of 76 (54 %) surveyed centers reported the presence of a disaster plan ($p<0.0001$), and 19/76 (25 %) conducted regular disaster drills ($p<0.0001$) in the Vilke survey. Backup coverage by another PCC was also statistically significantly increased in the present study as compared to the previous (39/40 vs 21/76, $p<0.0001$). Other elements included in the disaster plan and aspects of reported disaster drills are included in Table 3.

Involvement in disaster preparedness and policy development at a local, state, or federal level was reported by 85 % of respondents in the present survey, while involvement in terrorism preparedness and policy development was reported by 73 %. Involvement in traditional public health surveillance including reportable illness, gastrointestinal illness, rabies calls, or “after hours” public health calls was reported by 90 %. Ninety percent of PCC (36/40) managing directors felt comfortable with the ability to operate in the event of a disaster as opposed to only 49 % (37/76) in the previous study ($p<0.0001$).

Table 1 Survey Questionnaire

1. What population does the poison control center serve?
_____<500,000 _____ 500,000-1,000,000 _____1,000,000-5,000,000 _____>5,000,000
2. What is the distance to the next nearest poison control center?
_____<100 miles _____100-250 miles _____250-500miles _____>500 miles
3. In the typical year, how many phone calls does the poison control center receive?
_____<25,000 _____25,000-60,000 _____>60,000

4. Please indicate which if any elements are included in disaster plan?(may choose more than one)

	physical plant damage	increased phone traffic	Loss of phone system	Loss of power	Computer Malfunction	Back up Generator	Uninterrupted Power Supply	Back up phone system	Backup coverage with another poison center	None of these are included
elements	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other (please specify)_____

5. Please indicate the nature of drills to practice disaster plan and frequency of exercises?

	Monthly	Quarterly	Biannually	Yearly
Table Top Exercises	____	_____	_____	_____
Moulage Scenario	____	_____	_____	_____
HAZMAT exercises	____	_____	_____	_____
Other	____	_____	_____	_____

6. In the last 5 years, has the poison control center been involved in a declared county, state, or federal disaster? (may choose more than one)

	Earthquake	Major Fire	Hurricane	Flood	HAZMAT	Industrial Accident	Other	No
Disaster	_____	_____	_____	_____	_____	_____	_____	_____

# of disasters in last 5 years_____

7. Has there been any period of time in last 5 years in which your poison control center was unable to operate? why? (If multiple times unable to operate, please indicate longest period of inability to operate and reason)

Duration of inability to operate
___<1h ___ 1-12h ___ 12-24h
___ 1-7d ___ >7d
Other
Number of times unable to operate_____

Reason for inability to operate
___Loss of Power ___
Loss of computer ___Loss of physical plant
___Loss of personnel ___

8. Does your poison control center have the capability to communicate directly with HAZMAT in the field during an exposure disaster?
In the last five years has the Poison Control Center been involved in any of the following activities at the local,state, or federal level? (may choose more than one)?

	HAZMAT Communication in field.	Terrorism Preparedness/Response Policy Development	Disaster Preparedness/Response Policy Development	Public Health Calls (reportable illness, gastrointestinal illness, rabies calls, or "after hours" public health calls)
Yes	☐	☐	☐	☐
No	☐	☐	☐	☐

9. Do you feel comfortable with the ability of the poison control center to operate during a disaster
___Yes ___No

Discussion

Between 1996 and 2011, there have been closures of 39 PCCs (41 % decrease in the number of operating PCC). With the closure of 39 PCCs, the remaining centers serve a larger population with a similar increase in the number of calls received per year (see Table 2). A loss of PCC function in a disaster could impact neighboring PCCs with call volumes that

Table 2 Characteristics identified by standardized survey in 1996 and 2011 of US Poison Control Centers (PCCs)

	1996 Number	Percentage of centers (95 % CI)	2011 Number	Percentage of centers (95 % CI)	*p* value
Respondents to survey	76		57		
PCC at time of survey	96		40		
Response rate (%)	79.2		70.2		NS
Population served					
<500,000	11	14(8–24)	0	0(0–10)	
500,000–999,999	4	5(2–13)	0	0(0–10)	
1,000,000–5,000,000	57	75(64–83)	26	65(49–78)	
>5,000,000	0	0(0–6)	14	35(22–51)	<0.0001
Distance to next nearest PCC					
<100 miles	29	38(28–49)	12	30(18–46)	
100–249 miles	28	37(27–48)	18	45(31–60)	
250–500 miles	12	16(9–26)	6	15(7–29)	
>500 miles	3	4(1–11)	3	8(2–21)	
Calls received in typical year					
<25,000	23	30(21–41)	0	0(0–10)	
25,000–60,000	32	42(32–53)	18	45(31–60)	
>60,000	17	22(14–33)	22	55(40–69)	0.0009

NS no statistical significance

may overwhelm their capability if appropriate backup systems are not in place. This effect has previously been reported [5].

On January 26, 2006, the New York City PCC experienced 4 h loss of telephone service resulting in an unexpected increase in the number of calls received by the neighboring New Jersey Poison Information and Education System (NJPIES). Compared to the same day in the preceding week, the NJPIES received a 148 % greater number of calls with a concomitant decrease in the number of calls answered. The number of calls abandoned (never answered) was as high as 62 % [5].

While no observable difference in the number of responding centers with disaster plan provisions for increased phone traffic, physical plant damage, loss of phone service, computer malfunction, backup generator, and backup phone service was identified, more centers in 2011 report arrangements for backup coverage by another PCC than previously observed. Backup coverage by another PCC represents an attractive option to maintain PCC services without increased costs associated with improving existing infrastructure or infrastructure sustainment. However, as evidenced by the New York City/New Jersey experience, backup coverage by another center alone does not guarantee that all calls will be answered or that the public will be appropriately served in the event of disaster.

The present study demonstrates a statistically significant increase in the number of centers self-reporting the presence of a written disaster plan compared to previously reported by Vilke et al. [4]. The reasons for an increased number of centers with a written disaster plan and arrangements for backup coverage by another center were not explored in the present study. This observed difference may represent selection bias in that smaller, less disaster-prepared centers may have been those affected by PCC closure between 1996 and 2011. Vilke et al. [4] did not differentiate disaster preparedness characteristics between those centers in 1996 that were AAPCC certified and those that were not. In the present study, all centers were AAPCC certified.

Since 1998, the AAPCC has included requirements for disaster response in the application for accreditation as a regional Poison Control Center. However, these requirements are not well defined or specified. Page 7, Table four, question 7 of the current application requests that applicants "briefly describe the arrangements for disaster response." The word disaster does not appear again in the application [6]. The 1998 and 2005 criteria for certification of Poison Centers and Poison Control Systems similarly offer little in terms of specific requirements or guidance. The criteria states that "a plan to provide Poison Center services in response to natural and technological disasters must be in place." The word disaster does not appear again in the criteria. The nature of this plan, specific required components, or nature and regularity of disaster drills are not delineated [7, 8]. More centers may have a written disaster plan in 2011 as compared to 1996 in fulfillment of AAPCC requirements; however, the presence of a plan alone does not imply preparedness or the ability to adequately provide services to the public in the event of a disaster.

Authors have noted the dangers associated with the absence of regular rehearsal of a plan. One of the greatest impediments to disaster preparedness is the tendency to believe that it can be accomplished merely by the completion of a written plan [9].

Table 3 A comparison of disaster preparedness characteristics identified by standardized surveys in 1996 and 2011 of US Poison Control Centers (PCCs)

	1996 Number	Percentage of responding centers (95 % CI)	2011 Number	Percentage of responding centers (95 % CI)	*p* value
Presence of a disaster plan	41	54(43–65)	40	100(90–100)	<0.0001
Elements included in disaster plan					
Physical plant damage	41	54(43–65)	34	84(72–96)	
Increased phone traffic	49	64(53–75)	29	73(59–87)	
Loss of phone services	69	91(85–97)	38	95(88–100)	
Loss of power	76	100(94–100)	38	95(88–100)	
Computer malfunction	65	86(76–92)	37	92(83–100)	
Backup generator	65	86(76–92)	30	76(62–90)	
Backup phone service	41	54(43–65)	27	68(53–83)	
Backup coverage by another PCC	21	27(17–37)	39	97(92–100)	<0.0001
Regular disaster drills	19	25(15–35)	26	65(50–80)	<0.0001
Nature of disaster drill					
Table top	21	28(19–39)	18	45(31–60)	
Moulage	17	22(14–33)	13	33(20–48)	
HAZMAT	25	33(23–44)	10	25(14–40)	
Other	16	21(13–32)	10	25(14–40)	
Experienced disaster in the last 5 years	36	47(37–58)	22	55(40–69)	
Nature of disaster					
Earthquake	5	7(3–15)	2	5(1–17)	
Fire	16	21(13–32)	3	8(2–21)	
Hurricane	14	18(11–29)	11	28(16–43)	
HAZMAT	22	29(20–40)	6	15(7–29)	
Industrial	14	18(11–29)	6	15(7–29)	
Flood	24	32(22–43)	11	28(16–43)	
Unable to operate in the previous 5 years	14	18(11–29)	29	73(57–84)	
Duration of inability to operate					
<1 h	51	67(56–77)	9	23(12–38)	<0.0001
1–12 h	25	33(24–44)	17	43(29–58)	
12–24 h	0	0(0–6)	1	3(0–14)	
1–7 days	0	0(0–6)	2	5(1–17)	
>7 days	0	0(0–6)	0	0(0–10)	
Reasons for inability to operate					
Loss of power	28	37(27–48)	3	8(2–21)	
Loss of computer	36	47(37–58)	6	15(7–29)	
Loss of physical plant	4	5(2–13)	6	15(7–29)	
Loss of personnel	4	5(2–13)	2	5(1–17)	
Other	4	5(2–13)	12	30(18–46)	
Involvement in disaster preparedness/policy	NA	NA	34	85(71–93)	
Involvement in terrorism preparedness/policy	NA	NA	29	73(57–84)	
Public health calls	NA	NA	36	90(76–97)	
Able to communicate with HAZMAT	43	57(45–67)	34	85(71–93)	
Comfort with ability to operate in disaster	37	49(38–60)	36	90(76–97)	<0.0001
Respondents to survey	76		40		
PCCs at time of survey	96		57		
Response rate (%)	79.2		70.2		NS

NS denotes no statistical significance, *NA* not applicable

This "paper-plan" syndrome results from individuals not being familiar with what is actually contained in the "plan" or the inappropriateness of the plan to the situation. A Washington State University study conducted following the Mt. St. Helen's eruption in 1980 demonstrated that the majority of the 26 communities directly affected by the eruption did not use the plan as written. Officials found that the plan did not directly address their immediate needs [9].

More recently, Klein reported the impact on PCC operation of the largest geographical power failure in US history in 2003. Despite the presence of a written disaster plan, Klein observed the vulnerability of PCC operations to interruptions in the power supply, lack of redundant communication methods, staffing challenges, and exclusion of PCC staff from hospital disaster plans despite co-location [10]. Many of these obstacles to effective PCC disaster operations may be identified and remedied by regular disaster drills. More centers in 2011 as compared to 1996 report at least yearly drills with many centers reporting quarterly or even monthly disaster drills. However, some centers still lack regular disaster drills or rehearsals and may suffer from the paper-plan syndrome previously described. While not a solution to all the challenges associated with disaster, the presence of a written plan and regular disaster drills to challenge that plan suggest the potential for a better disaster response then the absence of these elements.

Statistically significantly, more managing directors reported comfort with the ability to provide services to the public in the event of a disaster in 2011 as compared to 1996. However, not all directors felt that their center could provide services in the event of a disaster. Reasons for an increased comfort or lack of comfort were not directly addressed by the present study. However, all of the PCCs reporting lack of comfort with disaster also reported the absence of regular disaster drills.

PCCs are involved in terrorism and disaster preparedness and response policy development at the local, state, and/or federal level. The present survey results are similar to published literature demonstrating the increased role and involvement of medical toxicologists and PCCs in what has been traditionally a public health role. Sutter et al. [11] demonstrated that 77 % of surveyed PCCs were involved in terrorism preparedness and response policy development. PCC databases similarly provide early syndromic surveillance that trigger warnings to public health officials about potential outbreaks and represent a potential option in monitoring for and responding to biological or chemical terrorism threats [12].

Involvement in illness-surveillance and reporting was reported by 89 % of responding centers in the present study. However, involvement in reportable illness surveillance and reporting was noted in only 42 % of responding centers in the Sutter study [11]. The reasons for this difference were not explored in the present study. While not traditionally considered part of explicit disaster planning or the role of PCCs, illness outbreaks have the potential to adversely affect the ability of PCCs to provide poison control services to the public as providers may be among those afflicted. Increasing reliance of public health departments on PCCs for illness surveillance and reporting may similarly leave jurisdictions without sufficient resources to provide public services in the event of disaster.

This study is an observational and descriptive study of disaster preparedness of US PCC in 2011. A comparison of PCC characteristics to a previous survey by Vilke et al. [4] was performed. A response rate of 70 % (40 of 57 total PCCs) was achieved in the present study. The presence or absence of a written disaster plan and experience with disaster of the remaining 17 centers were not included in the present study due to lack of completion of the questionnaire by these centers. The reasons for lack of completion were not addressed by the present study. If these PCCs do not have a written disaster plan, the data presented may reflect an inappropriately positive skew toward PCC disaster preparation than that which truly exists. However, given the previously discussed AAPCC requirements, the absence of a disaster plan in is highly unlikely. PCC characteristics including number of calls received may similarly be skewed.

In 1996, Vilke et al. [4] surveyed both AAPCC certified and uncertified PCCs to determine disaster preparedness characteristics. A response rate of 79.2 % (76 of 96 centers) was achieved. Differentiation in PCC disaster preparedness characteristics between certified and non-certified centers was not performed at that time. The difference in the response rates between the present survey and that conducted by Vilke et al. is not statistically significant. The present survey queried only AAPCC-certified centers representing a slightly different population than that previously studied. Additionally, in the light of recent natural and terrorism-related disasters, disaster preparedness is increasing in the national consciousness and conversation. This was not necessarily the case in 1996. Thus, direct comparisons between PCC characteristics in 2011 and 1996 must be interpreted cautiously. Reasons for the differences in results were not directly explored in the present study.

Conclusions

Despite a 41 % reduction in the number of PCCs nationwide between 1996 and 2011, with a corresponding increase in the number of calls received per year and population served by each PCC, more centers report the presence of a written disaster plan, arrangements for backup coverage by another PCC, regular disaster drills, and increased comfort in providing PCC services in the event of disaster. PCCs are actively involved in disaster and terrorism preparedness, response planning, and public health measures such as surveillance and reporting.

References

1. Nathan AR, Olson KR, Everson GW et al (1992) Effects of a major earthquake on calls to regional poison control centers. West J Med 56:278–280
2. Forrester MB (2008) Impact of Hurricane Rita on Texas poison center calls. Prehosp Disaster Med 233:256–262
3. Forrester MB (2008) Impact of Hurricane Ike on Texas poison center calls. Disaster Med Public Health Prep 3(3):151–157
4. Vilke et al (1996) Disaster preparedness of poison control centers in The United States. Clin Toxicol 34(1):53–58
5. Vassilev ZP, Kashani J, Ruck B, Hoffman RS, Marcus SM (2007) Poison control center surge capacity during an unusual increase in call volume–results from a natural experiment. Prehosp Disaster Med 22(1):55–58
6. AAPCC (2008) Application for accreditation as a regional poison control center. Available via https://aapcc.s3.amazonaws.com/pdfs/member-resources/Accreditation_Application_6-3-08.pdf. Accessed 28 Nov 2012
7. AAPCC Board of Directors (2005) American Association of Poison Control Centers: criteria for certification of poison centers and poison center systems. Available via https://aapcc.s3.amazonaws.com/pdfs/member-resources/Certification_Criteria__rev__7_2005.pdf. Accessed 28 Nov 2012
8. American Association of Poison Control Centers (AAPCC) (1988) Criteria and certification as a regional poison center. Vet Hum Toxicol 30:385–387
9. Auf der Heide, E. Disaster response: principles of preparation and coordination. Available via http://aresalaska.org/docs/Disaster_Response_Principals.pdf. Accessed 27 March 2012
10. Klein KR, Herzog P, Smolinske S et al (2003) Demand for poison control center services "surged" during the 2003 blackout. 2007. Clin Toxicol (Phila) 45(3):248–254
11. Sutter ME, Bronstein AC, Heard SE et al (2010) The role of clinical toxicologists and poison control centers in public health. Am J Prev Med 38(6):658–662
12. Wolkin AF, Patel M, Watson W (2006) Early detection of illness associated with poisonings of public health significance. Ann Emerg Med 47(2):170–176