Deployment morbidity among search-and-rescue dogs used after the September 11, 2001, terrorist attacks

Kimberly A. Slensky, DVM; Kenneth J. Drobatz, DVM, MS, DACVECC, DACVIM; Amanda B. Downend, BA; Cynthia M. Otto, DVM, PhD, DACVECC

Objectives—To determine characteristics, variables associated with deployment morbidity, and injuries and illnesses of search-and-rescue dogs associated with the Sept 11, 2001, terrorist attacks.

Design—Historical cohort study.

Animals—96 dogs.

Procedure—Data collected included previous medical or surgical history, physical attributes of dogs, type and number of years of training, site of deployment, shift and hours worked, and number of days deployed. Combined morbidity was defined as 1 or more abnormalities of body systems, including traumatic injuries.

Results—Handlers of 96 of the 212 dogs responded to the surveys. Fifty-nine dogs were deployed by the Federal Emergency Management Agency, 10 by police forces, and 27 as members of other search-and-rescue teams. Sixty-five dogs (incidence rate, 17 events/1,000 dog search hours) had combined morbidity during deployment. System-specific morbidity rates included gastrointestinal tract signs (5 events/1,000 dog search hours), cuts and abrasions mostly on the feet (5 events/1,000 dog search hours), fatigue (6 events/1,000 dog search hours), change in appetite (6 events/1,000 dogs search hours), dehydration (5 events/1,000 dog search hours), respiratory tract problems (2 events/1,000 dog search hours), heat exhaustion (2 events/1,000 dog search hours), and orthopedic or back problems (2 events/1,000 dog search hours). Dogs deployed to the World Trade Center were 6.6 times more likely to have combined morbidity, compared with dogs at the Pentagon.

Conclusions and Clinical Relevance—Injury and illnesses occurred in most dogs and affected several organ systems, but all were minor. (*J Am Vet Med Assoc* 2004;225:868–873)

The events of September 11, 2001, constituted the worst terrorist attack on American soil in history. A portion of the Pentagon was reduced to rubble, killing 189 people. An additional 2,829 lives were lost as a result of the collapse of the **World Trade Center (WTC)**,[1] an area of 16 acres. Approximately 11,000 firefighters and emergency medical personnel responded to the attacks.[2] Among the responders were an estimated 250 to 300 **search-and-rescue (SAR)** dogs and their handlers. These dogs were involved in SAR efforts at the WTC and Pentagon and search and recovery efforts at the Fresh Kills Landfill on Staten Island. The **Federal Emergency Management Agency (FEMA)** deployed 80 dogs as members of 20 certified urban SAR teams to support the rescue operation in New York. Five other FEMA teams responded to the Pentagon site. Police dogs and other organized SAR teams were also instrumental in the disaster response.

The Oklahoma City bombing disaster was the only occasion for similar use of dogs for SAR efforts. In the aftermath of the bombing, an epidemiologic study was conducted to determine the medical problems among the responding SAR dogs.[3] Because no man-made national disaster of the magnitude seen on September 11, 2001, has been described, information regarding the medical effects of such a disaster on dogs involved in the response is largely unknown. The purposes of the study reported here were to describe characteristics of the responding dogs, evaluate variables associated with morbidity of the dogs, describe canine injuries and illnesses that occurred during deployment, and offer recommendations to decrease morbidity in future response efforts.

Materials and Methods

Attempts were made to contact all dog handlers (identified by use of a list generated by the American Kennel Club) who participated in the rescue efforts of the WTC and Pentagon and in the recovery efforts at the landfill. The list included FEMA-deployed dogs and dog-handler teams who self-deployed or were members of other organized SAR teams. Additional individuals contacted the research group after hearing of the study through the media or other handlers. Of the 212 teams contacted, 96 (45%) completed a predeployment health survey and a deployment health survey. Only completed responses were included, and a signed consent form accompanied all completed surveys. Incentive for participation in the study included a health insurance policy for each dog.[a] Although present at the WTC, those dogs deployed primarily for therapy and stress relief of the rescue workers were not included in this study.

Data collection began in October 2001 and ended June 2002. Predeployment surveys included questions regarding medical and surgical history, age, sex, breed, diet, and body weight. Deployment surveys included questions regarding deployment dates, site of deployment, shift and hours worked, and medical or surgical problems encountered during deployment. Additional information requested included state of origin for each dog-handler team, prior training, type of training, level of training, and years of active search. Morbidity was defined as 1 or more injuries or illnesses, including respiratory tract disorders, dehydration, weight loss, change in appetite, urinary tract problems, vomiting, diarrhea, cuts or abrasions, lameness or back problems, skin

From the Department of Clinical Studies—Philadelphia, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA 19104-6010.

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Address correspondence to Dr. Otto.

disorders, ocular or aural problems, and decreased physical stamina (tired easily, excessively tired, or heat exhaustion). Variables evaluated for association with morbidity included age, sex, breed, weight, medical or surgical history, deployment site, total hours spent in search, handler's medical problems during deployment, shift worked during deployment, years of training, years of active search, type of training, FEMA certification, and whether or not canine search was a full-time job.

Statistical analyses—Continuous variables were assessed for normality by visual inspection and the Shapiro-Wilks test. Mean ± SD or median (range) values were used to describe parametric or nonparametric continuous variables, respectively. Incidence rates were calculated from number of events that occurred divided by the number of dog hours spent in active search. Number of dog hours spent in active search was determined from the number of shifts worked by each dog and the mean number of hours worked per shift by each dog. All incidence rates are reported as number of events per 1,000 dog search hours. Poisson exact 95% confidence intervals for each incidence rate were calculated.

For comparing continuous variables other than incidence rates, the Wilcoxon rank sum test or the unpaired *t* test for equal variances was used, depending on data distribution. The Fisher exact test or Pearson χ^2 test was used where appropriate when comparing 2 proportions.

Logistic regression was used for the multivariate analysis. The outcome variable was morbidity (yes or no). A dog was considered to have a yes result for morbidity if it had any of the individual morbidities that were evaluated in the survey. Morbidity was considered a no result if the dog had none of the individual morbidities that were evaluated in the survey. Because of the limited number of outcomes, the most plausible independent variables (determined by the authors) that might be associated with outcome were included for initial model development. These independent variables included site, type of training, previous medical or surgical problems, FEMA certification status, sex, age, whether they had a live or cadaver find, and hours spent in active search. Hours worked and variables that had a coefficient that had an associated P value < 0.2 from this initial full model were entered into a second model. The final model was developed by retaining hours worked and eliminating any variables with coefficients that had $P \geq 0.05$. The fit of the resulting model was tested by use of the Hosmer-Lemeshow goodness-of-fit χ^2 statistic. All statistical evaluations were performed with a statistical software program.[b]

Results

Ninety handlers involved in the SAR or search and recovery efforts of September 11, 2001, completed surveys on 96 deployed dogs. The combined number of hours in active search was 3,709. Sixty-one (63.5%) of these dogs were deployed to the WTC, 23 (24%) to the Pentagon, and 12 (12.5%) to the landfill.

Signalment—Median age of the deployed dogs was 5 years (range, 1 to 11 years). The most common breeds deployed were German Shepherds (n = 31), Labrador Retrievers (n = 28), and Golden Retrievers (n = 12). Other breeds included mixed breeds (n = 8); Border Collies (n = 7); Australian Shepherds (n = 4) and 1 each of Belgian Tervuren, Doberman Pinscher, English Springer Spaniel, Giant Schnauzer, Beauceron, and Rottweiler. Dogs weighed 31 ± 7 kg (68 ± 15 lb). Fifty-four (56%) dogs were male (18 sexually intact and 36 castrated) and 41 dogs (43%) were female (2 sexually intact and 39 spayed); for 1 dog, the sex was not reported. Dogs had a median of 4 years' search experience (range, 0 to 12 years) and had a combined 486 years of training (median, 5 years; range, 1 to 12 years). Fifty (52%) dogs were deployed for the first time during this disaster.

Dogs and distribution among sites—Twenty-three dogs representing 4 states were deployed to the Pentagon, where they spent a median of 12 days (range, 1 to 13 days). The landfill site had 12 dogs deployed from 6 states for a median of 7 days (range, 1 to 12 days). The first canine-handler teams were on site at the landfill on September 17, 2001, 5 days after the first debris from the WTC arrived. The WTC site included 61 dogs from 16 states, deployed for a median of 10 days (range, 1 to 25 days).

Training and experience of dogs—Fifty (52%) deployed dogs were certified as urban SAR dogs by FEMA. These dogs were equally distributed between those with basic and advanced certification. An additional 9 (9%) dogs were affiliated with FEMA, but not certified. Those dogs trained to FEMA standards and were deployed prior to certification because of their recognized need during the rescue efforts. Police dogs (n = 10 [10%]) and members of other organized canine SAR teams (dogs and handlers) (n = 27 dogs [28%]) represented the non-FEMA certified responders. For 20 canine-handler teams, SAR was reported as a full-time occupation. Ninety-two (96%) of the dogs were trained to find live victims (live find), and 58 (60%) dogs were trained to find human remains (cadaver find). Of these dogs, 54 (56%) were trained for both live and cadaver finds (dual trained). Additionally, 16 (16.7%) dogs were solely trained for urban SAR, whereas 13 (13.5%) dogs were trained only for wilderness SAR. Sixty-seven (70%) dogs were trained for both urban and wilderness SAR.

Cadaver and live finds—Handlers reported that seventy (73%) dogs had positive cadaver finds and 4 (4%) dogs alerted for live finds. Live alerts (actions of the dog that indicate a find) were reported from the WTC and may have represented alerts on other rescue workers, because no live-victim finds by SAR dogs could be confirmed. Of the 70 teams reporting cadaver finds, 41 (58%) were located at the WTC, 18 (26%) were at the Pentagon, and 11 (16%) were at the landfill. Sixteen (18%) handlers did not report any cadaver finds, and 10 (9%) did not respond to the question. In general, the dogs signaled a live find with a bark alert. A more passive alert (sitting or scratching at the ground) signified a cadaver find. For all dogs, play (n = 85), food (22), or praise (12) was the reward for finds. Because many dogs were trained in live find and rewarded with play, efforts were made, when possible, to stage live finds in areas away from the actual work area to reinforce their training and reward their find.

Previous medical conditions—Previous medical conditions were described in 46 (48%) dogs. Among the most common complaints were musculoskeletal disorders (n = 21), atopy (11), and borreliosis (7). Only 2 dogs with previously described musculoskeletal

problems had recurrence of lameness while deployed. Twenty-nine (30%) dogs had 33 surgical procedures before deployment. Of those surgeries, 10 were orthopedic procedures and 23 were soft tissue surgeries (spays and castrations were not included).

Morbidity—Sixty-five (68%) dogs had morbidity during deployment for an incidence rate of 17 events/1,000 dog search hours (95% CI, 13 events/1,000 hours to 17 events/1,000 hours). System specific incidence rates ranged from 1 event/1,000 hours to 9 events/1,000 hours, and the overall incidence of morbidity at each site was also determined (Table 1). Thirty-four (35%) dogs had cuts or abrasions, including superficial cuts (n = 20), superficial abrasions (3), full-thickness wounds (6), punctures (5), or laceration (1), which comprised the highest morbidity incidence rate during deployment. Only 1 dog required sutures (for a laceration above the metacarpal pad); this was the only surgical procedure during deployment. Most wounds were located on the feet, footpads, or limbs (24/34 [70%]). Four of 9 dogs that wore foot protection had cuts and abrasions, 3 had injuries to the feet or pads, and 1 had a superficial cut on the mouth. No dogs deployed to the Pentagon wore foot protection. There was no significant difference in incidence of cuts and abrasions among sites. There was a higher incidence (not significant) of wounds in dogs that did not wear foot protection (10.2 events/1,000 hours; 95% CI, 6.8 events/1,000 hours to 14.0 events/1,000 hours) versus those that did wear foot protection (4.7 events/1,000 hours; 95% CI, 1.3 events/1,000 hours to 11.9 events/1,000 hours). Additionally, the overall incidence of wounds was most similar between the WTC (11.2 events/1,000 hours; 95% CI, 7.4 events/1,000 hours to 16.3 events/1,000 hours) and the landfill (8.9 events/1,000 hours; 95% CI, 2.4 events/1,000 hours to 22.7 events/1,000 hours). Other skin disorders reported were pruritus or erythema (n = 11), hair loss (2), and undescribed (1).

Twenty-one of the 96 (22%) dogs had gastrointestinal tract signs while deployed, including vomiting and diarrhea. Sixteen (17%) dogs had diarrhea and 5 (5%) dogs accounted for 6 episodes of vomiting. Weight loss was documented in 22 (23%) dogs during deployment and was the second most common problem, with an overall incidence rate of 6.3/1,000 hours. Dogs that lost weight weighed significantly ($P = 0.003$) more (median weight, 33 kg [73 lb]; range, 25 to 51 kg [55 to 112 lb]), compared with dogs that did not lose weight (median weight, 30 kg [66 lb]; range, 17 to 50 kg [37 to 110 lb]), and most dogs with weight loss had a concurrent decrease in appetite. Of the 22 (23%) dogs with a reported change in appetite, only 3 dogs had an increased appetite.

Eighteen of 19 dogs with dehydration were treated with 38 doses of fluids administered SC (n = 16) or IV (2). Dehydration was not related to total number of hours searching through the rubble, shift length, shift worked (day, night, or both), or the number of days deployed. Incidence rates of vomiting, weight loss, and change in appetite were greater in dogs that were dehydrated (3 events/1,000 hours [95% CI, 0.6 to 8.6 events/1,000 hours]; 7.8 events/1,000 hours [95% CI, 3.4 to 15.5 events/1,000 hours]; and 12 events/1,000 hours [95% CI, 6 to 20 events/1,000 hours], respectively) versus those that were not dehydrated (0.4 events/1,000 hours [95% CI, 0.01 to 2 events/1,000 hours]; 5.3 events/1,000 hours [95% CI, 2.8 to 9.1 events/1,000 hours]; and 3.7 events/1,000 hours [95% CI, 1.6 to 6.9 events/1,000 hours], respectively), although differences were not significant. The incidence of dehydration was significantly greater in dogs deployed to the WTC (7.6 events/1,000 hours; 95% CI, 4.5 to 12 events/1,000 hours) than dogs deployed to the Pentagon (0.0 events/1,000 hours; 1-sided 97.5% CI, 0.0 to 4.3 events/1,000 hours), but there was no significant difference between the WTC and the landfill (2.2 events/1,000 hours; 95% CI, 0.06 to 12.4 events/1,000 hours).

Table 1—Incidence rates (No. of morbidities/1,000 dog hours of searching) for various morbidities in search-and-rescue dogs at the World Trade Center (WTC), the Pentagon, or a landfill for debris from the WTC collapse of September 11, 2001.

Morbidity	Site	Incidence rate/1,000 dog search hours	95% CI
Cuts/abrasions/ punctures	WTC	11.2	7.4–16.3
	Pentagon	3.5	0.7–1.0
	Landfill	8.9	2.4–22.7
	Overall	9.2	6.4–12.8
Weight loss	WTC	7.8	4.6–12.4
	Pentagon	3.7	0.8–10.8
	Landfill	2.5	0.06–14.1
	Overall	6.3	3.9–9.5
Dehydration	WTC	7.6	4.5–12.0
	Pentagon	0.0	0.0–4.3*
	Landfill	2.2	0.06–12.4
	Overall	5.2	3.1–8.1
Change in appetite	WTC	7.5	4.4–11.8
	Pentagon	1.2	0.03–6.6
	Landfill	6.6	1.4–19.4
	Overall	5.9	3.7–8.9
Tires easily/ excessively tired	WTC	5.8	3.2–9.9
	Pentagon	4.7	1.2–12.1
	Landfill	7.6	1.6–22.2
	Overall	5.7	3.6–8.8
Gastrointestinal problems	WTC	5.8	3.2–9.8
	Pentagon	3.5	0.7–10.3
	Landfill	6.9	1.4–20.2
	Overall	5.4	3.3–8.4
Orthopedic problems	WTC	3.3	1.4–6.5
	Pentagon	0.0	0.0–4.3*
	Landfill	2.2	0.06–12.4
	Overall	2.4	1.1–4.6
Heat exhaustion	WTC	2.1	0.7–4.8
	Pentagon	0.0	0.0–4.3*
	Landfill	2.2	0.06–12.4
	Overall	1.6	0.6–3.5
Urinary tract problems	WTC	2.1	0.7–4.8
	Pentagon	0.0	0.0–4.3*
	Landfill	0.0	0.0–8.2
	Overall	1.3	0.4–3.1
Respiratory tract problems	WTC	2.0	0.7–4.8
	Pentagon	1.2	0.03–6.5
	Landfill	4.4	0.5–16.0
	Overall	2.2	0.9–4.2

*One-sided 97.5% confidence interval (CI).

Twenty-three (24%) dogs had fatigue. Handlers reported that their dogs had 28 episodes of fatigue (either excessively tired or tired easily), with an incidence rate of 5.7/1,000 hours. Six dogs were described as having heat exhaustion. Median time spent in search for the dogs that had heat exhaustion was 11 hours (range, 1.5 to 60 hours), compared with dogs that did not have heat exhaustion (median, 29 hours; range, 0.75 to 264 hours). Although clinically important, this difference was not significant. Three of the 6 dogs with heat exhaustion worked for only 1 day. One of the dogs was FEMA-trained and certified; this dog remained at the WTC for 14 days. Five of 6 dogs with heat exhaustion were deployed to the WTC.

Eight (8%) dogs were reported to have lameness described as a slight limp with activity (n = 4), a noticeable limp with rest (3), and a noticeable limp with activity (1). Three of these dogs were treated with carprofen[c] for pain management. Three of 4 dogs with reported back problems had lameness in both hind legs. One of these dogs had possible intervertebral disk disease immediately prior to deployment.

Eight percent of the dogs in this study had respiratory disorders during deployment. Five of the 8 dogs with respiratory problems were deployed to the WTC, although the highest incidence rate was at the landfill (4 events/1,000 hours; 95% CI, 0.5 to 16 events/1,000 hours). Of the dogs at the WTC, 2 dogs had an increase in respiratory effort, whereas the remaining 3 had increases in respiratory rate in addition to coughing and sneezing. All of the dogs deployed to the WTC that developed respiratory problems were deployed in the first 2 days of operation. Two of those dogs were deployed for only 1 day. Median search hours spent for the dogs that had breathing problems was 17 (range, 3.5 to 264 hours), compared with dogs that did not have breathing problems (median, 26 hours; range, 0.75 to 238); although clinically important, this difference was not significant. No handler who completed the survey information had a dog that required oxygen therapy. However, 1 dog whose handler did not fully complete the survey information and was not included in the analysis was known to have aspirated large amounts of dust at the WTC and required evacuation and oxygen therapy. This dog was treated on site by 1 of the authors (CMO).

Five (5%) dogs had urinary tract problems, including hematuria (n = 2), straining to urinate (1), polyuria (1), and infection (1). Ocular problems occurred in 8 (8%) dogs and included redness (n = 4), mild discharge (4), and squinting (3). Of the 8 dogs with ocular problems, 4 had bilateral involvement.

Medications were given to 37 of 96 (38.5%) dogs during deployment. The most commonly reported medications were antimicrobials for skin lesions (n = 11), metronidazole[d] for gastrointestinal tract signs (6), and carprofen[c] for musculoskeletal disorders (5). Two dogs received levothyroxine sodium[e] for previously diagnosed hypothyroidism, and 3 others received glucosamine-chondroitin for previously diagnosed joint disease.

Although not significant, it was interesting to note that dogs belonging to handlers who had medical problems had a higher incidence of medical problems (26.3 events/1,000 hours; CI, 15.6 to 41.6 events/1,000 hours) than dogs of handlers who did not have medical problems (15.3 events/1,000 hours; CI, 11.1 to 20.6 events/1,000 hours). Additionally, handlers at the WTC (21/57 [37%]) were found to have more medical problems than those deployed to the Pentagon (2/22 [9%]; $P = 0.002$). This could not be adjusted for total search hours because some handlers worked with more than 1 dog during deployment.

Multivariate analysis—Nearly all variables dropped out of the initial full model. Remaining variables for the second model included training for live finds and site. Training for live finds was eliminated from the second model ($P = 0.117$), which left total hours and site as the remaining variables in the final model. The final model was based on 90 observations. The overall χ^2 of the model was 13.31 (3 *df*) and was significant ($P = 0.004$). The *P* value for the Hosmer-Lemeshow goodness of fit was 0.2397, which indicated an adequate fit to the data.

Dogs were 6.6 times (95% CI, 2.2 to 20 times) as likely to have morbidity at the WTC, compared with the Pentagon, when controlling for other sites and total dog hours of active search. There were no significant differences among any of the other sites. Total hours were not significantly associated with morbidity (OR, 1.007; 95% CI, 0.99 to 1.02).

Discussion

Sixty-five dogs had morbidity during deployment to the WTC, the Pentagon, or the landfill. Given the mass destruction and intensity of the working environment, it is surprising that most injuries and illnesses were minor and did not detract from the SAR or recovery operations. Those dogs deployed to the WTC had significantly more injuries than those at the Pentagon. Deployment to this site was the only variable significantly associated with outcome. This site-dependent effect was considered plausible because the collapse of the towers and adjacent structures was dissimilar to the damage at the Pentagon and resulted in an enormous disaster zone. The initial respondents were exposed to a variety of particulate matter that was airborne as a result of the strength of the towers' collapse, in addition to explosions, fire, and falling debris.[2]

Although the overall incidence rates for individual morbidities were low, the potential clinical implications of the described morbidities were important. Some of the reported illnesses did lead to early departure from the sites for the canine-handler teams. These illnesses included heat exhaustion and respiratory difficulty. Although these illnesses were reported infrequently among handlers who responded to the surveys, it appears that they occurred early in the deployment period and some dogs did not return to searching as a result. The respiratory difficulty seen in this population of dogs was much less severe than has been described in humans in the immediate aftermath of the collapse and the 12-month period after the collapse. During the 48 hours after the attacks, approximately 90% of the rescue workers reported an acute cough,

often accompanied by nasal congestion and tightness or a burning sensation in the chest.[2] Of rescue workers at the WTC at the time of collapse, 8% had a disabling persistent cough associated with decreased lung function and 23% had bronchial hyperresponsiveness.[4] Within the first 2 days after the collapse, 3% of the workers had the same type of cough and 8% had bronchial hyperresponsiveness.[5] Respirators were worn by only 7% of the firefighters on the day of the collapse and increased in use to 65% by the second week.[5] Because none of the dogs wore any respiratory protection, a higher incidence of reported respiratory difficulty than was described was anticipated, given the identical working conditions. However, none of these dogs were present during the collapse of the towers, when the concentration of airborne particulate matter was highest.

Fatigue was commonly described in this population of search dogs. Most dogs had periods of tiring easily or becoming excessively tired. Only a small percentage of dogs had heat exhaustion. Few dogs worked < 60 minutes before resting during their shift, and many dogs worked > 8 to 12 hours. This long work schedule prevented adequate rest time for the dogs and the handlers. The FEMA recommendations include a shift length of 12 hours, and for every 20 to 45 minutes of work, rest is recommended for an equal period of time.[6] From the survey data, it is clear that few handlers, either FEMA or non-FEMA, followed a set shift length or rest schedule. Given the intensity of the environment at the disaster sites and the recognized need for dogs in the recovery efforts, they may have worked for longer periods of time without adequate rest. However, strict shift and rest schedules should be enforced to allow needed recovery time, improved search efficiency, and safety. Results of a recent study[7] support this recommendation because dogs become less efficient and accurate in their ability to detect scent after strenuous physical activity.

Weight loss was reported with a frequency second only to cuts and abrasions. Most dogs with weight loss had decreased appetite. The extended shifts worked without adequate periods of rest as well as the intensity and stress of the working environments likely led to decreased food and water intake, undoubtedly contributing to dehydration in some dogs. Additionally, dogs may require a more nutrient-dense food to meet the added energy requirements of work. This is supported by the fact that larger dogs (ie, dogs that weighed more) were more likely to lose weight throughout deployment than smaller dogs (ie, dogs that weighed less). Mainly on the basis of results of studies[8] performed in racing Greyhounds and sled dogs, energy intake should be increased by 40% to 50% for 1 day of work. This energy most often should be supplied as protein, rather than carbohydrates.[8] Relative to body size, dogs metabolize free fatty acids at a higher rate humans do. Dog muscle is therefore more adapted to use fat than human muscle is,[9] making the ideal diet for endurance work a high-protein, high-fat, low-carbohydrate diet. Endurance dogs may benefit from carbohydrate supplementation immediately after exercise to help maintain adequate muscle glycogen stores.[10] Although most of the dogs involved in SAR are not typically considered endurance athletes, they are exposed to similar stresses, both organic and behavioral, that affect their state of nutrition.[8] It may be possible therefore to extrapolate the results obtained from sled dog nutrition studies[9] to SAR dogs.

Few dogs had foot protection during deployment. Despite this finding, serious wounds were uncommon, with surgery required in only 1 dog. However, superficial cuts and abrasions were common and had the highest incidence rate of any morbidity. Most of the cuts and abrasions were on the feet or footpads of the dogs, and there was a higher incidence (although not significant) of wounds in those dogs that did not have foot protection, indicating that foot protection may be beneficial in reducing the incidence of injuries. Concerns voiced by handlers and FEMA regarding this issue are similar to those reported in the epidemiologic study[3] of the Oklahoma City bombing disaster site. According to the FEMA Web site dedicated to the events of September 11, 2001, dogs often need to perform a soft walk and splay their paws for maximum traction. In addition, booties can sometimes add to the risk of searching in tight or obstructed spaces.[6] Perhaps a type of foot protection can be developed that will combine needed traction and workability with desirable safety.

The similarities between the WTC and landfill sites may help explain the high incidence of superficial wounds among dogs deployed to these sites. A large amount of debris, mostly scrap metal, from the WTC was searched at the landfill. As such, the dogs were exposed to similar hazards and had similar wounds.

Recommendations made here are based on the descriptive information provided in this report. Many of these recommendations are similar to those made as a result of the Oklahoma City bombing.[3] The number of dogs at the disaster sites could only be estimated. There was no central station for registering dogs and handlers, which made it possible for people to self-engage in the disaster response. Lack of verification of experience and training likely put those dogs and handlers at increased risk. A central registration facility should be established to ensure that all known participants in the disaster response are appropriately trained and accounted for. A master schedule should be devised and enforced to provide adequate shift coverage and enforce important rest periods. There should also be a central treatment facility, similar to what was provided by Suffolk County, the Long Island Veterinary Medical Association, and Veterinary Medical Assistance Teams,[11] to address the medical needs of the dogs. Such a facility would allow adequate records to be generated on each dog treated so that injuries and illnesses can be recognized and appropriate follow-up care could be provided as needed.

Animal care needs to be integrated into the disaster response. Although most of the injuries and illnesses reported here were minor and likely did not detract from the search, the number of morbidities emphasizes the need for veterinary care in SAR dogs. Veterinarians should be members of SAR teams or, alternatively, these teams should have preexisting relationships with

the Veterinary Medical Assistance Teams to provide their dogs with proper medical care during a disaster response. Local veterinary resources should also be identified, incorporated, and used, particularly for any extended, surgical, or intensive care.

An off-site respite area should be designated for the dogs and their handlers to use between shifts. This space would serve as a rest area for the dogs. It was undoubtedly difficult for the dogs to eat, drink, and sleep among the activity of the rescue operations, and this was reflected in some of the reported morbidities. The rest site should be situated away from other rescue workers to help keep stress and activity to a minimum. A set sleep-wake schedule (shift schedule) should be developed to encourage longer periods of sleep and less disruption to sleep-wake cycles, which is beneficial in urban dogs engaging in shift work.[12]

This study investigated a limited population of dogs and handlers. Handlers may have been more likely to respond to the surveys if they were deployed as members of organized SAR groups and, as such, considered legitimately deployed. Those individuals were more easily identified and contacted than those who self-deployed. In addition, handlers who were not qualified may have been reluctant to participate in this study. Our population may also have been influenced by the health insurance incentive offered for participation in the study. Handlers whose dogs had medical problems during deployment may have been more likely to respond, given this incentive. If our interpretation is correct, we may have overestimated the number of dogs that developed morbidity during deployment. Nonetheless, our limited sample size may have restricted our ability to detect significance with regards to individual morbidities and, therefore, underestimated the importance of the described injuries and illnesses.

The information was provided in survey form and, as such, allowed for interpretation of questions and answers. Some of the surveys were not completed until almost 1 year after the tragic events of that day. It is possible that some information would have been represented or remembered differently immediately after the attack. However, the information was valuable in creating profiles of the deployed dogs and making recommendations for their use in future disasters.

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[a]Veterinary Pet Insurance Co, Brea, Calif.
[b]Intercooled Stata for Windows, version 7.0, College Station, Tex.
[c]Rimadyl, Pfizer Inc, Exton, Pa.
[d]Flagyl, Sidmak Laboratories Inc, East Hanover, NJ.
[e]Soloxine, Daniels Pharmaceuticals, St Petersburg, Fla.

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