Training and Common Injuries of Urban Search and Rescue Dogs

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Abstract

A keen sense of smell, excellent balance, and a strong desire to please humans are characteristics that have made dogs invaluable for search and rescue (SAR) operations since World War I. The need for land-based SAR is growing rapidly due to an increasing number of natural and urban disasters. There also are increasing numbers of persons with Alzheimer's disease, autism, and dementia who may require the assistance of SAR dogs. For these reasons, making the most of these valuable canine resources is becoming increasingly important.

First, this article describes the skills of scent discrimination, tracking, trailing, or air scenting SAR dogs use to find people lost or in distress. Next is a discussion about SAR specialties and the rigorous physical and psychological abilities they require of canines. This is followed by the reasons Urban Search and Rescue (USAR) is considered the most elite SAR canine specialty and the veterinary care these dogs require for pre-deployment, common deployment injuries, decontamination, and post-deployment. After a discussion of reported mission-related injuries and illnesses, current research is presented.

Abbreviations: FEMA: Federal Emergency Management Agency; FSA: Foundation Skills Assessment; SAR: Search and Rescue; USAR: Urban Search and Rescue

The ability of a trained search dog to locate a missing person is far more effective than any current technology to date. Similarly, the ability of a dog to discern a trained odor from a background of confounding odors far exceeds any other tool that has been developed [1].

The use of dogs for search and rescue (SAR) operations was first documented in the late 19th century when they were used during wartime to locate wounded soldiers [2]. While canine SAR job descriptions have evolved over the last century, their objective has remained the same—to

search for and recover persons lost or in distress.SAR dogs, particularly urban search and rescue (USAR) dogs, receive highly specialized training and must respond reliably and rapidly. For this reason, only the strongest and most athletic dogs are chosen for these duties. Understanding how these dogs are selected, trained, and deployed can help veterinary professionals evaluate and care for them and communicate about their care to handlers or owners. This article includes a discussion about how dogs search different SAR specialties, SAR dog qualifications and screening, USAR as an elite specialty, caring for SAR dogs, and current research in the field of service and working dogs.

Search Methodology

SAR dogs can search via scent discrimination, tracking, or trailing [3]. While dogs generally specialize in one of these three methods, they may use more than one while on a deployment.

Scent Discrimination

This skill describes a dog's ability to distinguish and target a specific human odor to the exclusion of other human odors. While this skill is typically used by tracking and trailing dogs, it also is used by air-scenting dogs [4]. A scent-discriminatory dog is the desired resource to find a person who is lost in an urban environment that has an abundance of different human scents. Non-scent discriminatory dogs are used in disaster environments where many people are missing. These dogs are trained to indicate on any live human odor.

Tracking

Tracking involves the use of scent discrimination to find a person after being introduced to his or her scent article [4]. Tracking dogs are most effective when the missing person's last whereabouts are known [4]. The dog is then brought to that location to see if it can pick up the missing person's track [4]. Such dogs track with their noses to the ground, principally focusing on the person's scent found on crushed ground vegetation [4]. Tracking dogs normally work in a tracking harness and line [4].

Trailing

Like tracking dogs, trailing dogs also are scent-discriminating and therefore must be exposed to a scent article [4]. While these dogs follow a subject's scent, they do not necessarily follow each footstep [4]. As a person passes by, scents are known to travel slightly downwind and collect on nearby objects such as plants, fences, etc [4]. Therefore, these dogs follow the scent trail left behind by the subject, which often is beside or near their actual footpath [4]. They also usually are worked while wearing a harness and tracking line [4].

Air Scenting Dog

These dogs work by finding a primarily airborne human scent in a designated area and then following it to its source [4]. Such dogs are ideal q when any humans in wilderness area must be found [4]. Unlike tracking and trailing dogs, air scenting dogs work of lead and usually search a distance away from their handlers [4]. Therefore, handlers must maintain control of their dogs using verbal commands and hand signals [4]. Additionally, the dog must have a noticeable and deliberate alert and notify the handler of a find [4].

Search and Rescue Specialties

The SAR industry has become so extensive that sub-classifications have emerged to meet highly specialized needs. Some of the more common SAR classifications include mountain, ground, air and sea, combat, and urban. Generally, dogs are trained to either rescue persons or recover human remains, but not both. Mountain rescue may be the oldest form of SAR with the earliest dogs working in the Alps to find people stranded in the deep snow [5]. Mountain rescue dogs must navigate rough terrain, large search territories, and natural elements, such as wind; wild is cerning human scent from surrounding animals and plants.

Ground SAR is the most common in suburban environments, in part due to the growing number of persons abducted or lost due to autism, Alzheimer's disease, or dementia. Air and sea deployments require dogs and handlers to travel in boats, helicopters, and planes. Each of these crafts may require rapid maneuvering in non-traditional transport modes such as being lifted or lowered from helicopters in baskets or harnesses. SAR dogs that perform combat rescue missions contend with distractions and hardships similar to those found in other rescue environments [6,7].

USAR dogs- one of the newest categories of working dogs- navigate debris, collapsed building structures, and twisted metal that are sometimes entangled with other objects such as trees, vehicles, or even water [2]. USAR is dangerous work with a high risk of injuries including

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exposure to toxicants [8]. Each USAR deployment presents unique challenges for working dogs. Additionally, USAR requires extremely athletic dogs and skilled handlers who are able to manage their dogs in high stimulus environments. Further, the dog and handler must be able to perform this job at a distance from one another as these dogs often work independently and out of sight from their handlers while encountering various types of unstable debris. These dogs are accustomed to working in areas not safe for humans. These environments offer many distractions including odors, auditory stimuli, and visual distractions from animals, humans, and equipment.

USAR dog and handler teams work with police, fire, and emergency medical professionals in complex deployments. USAR dog teams also work with the U.S. Coast Guard and National Guard during air and water SAR missions. As a whole, USAR is a highly specialized and technical field. Some of the most notable missions include the Oklahoma City bombing, the 9/11 collapse of the World Trade Center Twin Towers, and the Pentagon attack. More recently, dogs have served during Hurricanes Katrina and Sandy, earthquakes in Haiti, widespread tornados (in Alabama, Missouri, and Oklahoma), Washington mudslides, Colorado floods, and the Nepal earthquake [9].

Qualifications and Screening

Dogs working in any SAR specialty must meet rigorous physical and psychological criteria including being in excellent physical condition, structurally sound, of calm demeanor, and highly social. These dogs also must be highly motivated to perform for a reward, such as a toy or ball, and usually begin their training at 12 to 18 months of age. SAR dogs may be selected as puppies or young adults. Selecting a puppy supports more options for breeds and the sex of the dog. In addition, selecting a puppy helps the trainer control its earliest training and socialization while giving the young dog early exposure to SAR environments. Alternatively, selecting a young adult reduces training time and allows the dog to be screened immediately for physical problems.

Determine an adult dog's qualification using standardized selection and screening criteria helps reduce training time and increases certification success rates [10]. While the screening process does not guarantee a dog's success, it helps eliminate dogs that do not meet the SAR requirements, thereby saving programs'

time and money. Since the screening form is based on physical abilities and stability in new environments, any dog breed may qualify.

The initial health screening includes a complete orthopedic exam and blood work analysis along with an eye exam, urinalysis, and fecal exam. Dogs should be free of any potential genetic disorders, eye problems (including cataracts), congenital or developmental disorders, and tick-borne illnesses. During the performance screening, dogs must be at ease with other animals and people in a variety of unfamiliar settings. They also must be able to recover quickly from unexpected stimuli such as loud noises or quick movements. During the screening, each dog's drive is examined. An ideal SAR dog will have a strong hunt or play drive in all environments, with unfamiliar people, and on unstable surfaces, as well as being free of aggression towards people or other animals.

Urban Search and Rescue: An Elite Specialty

Of all specialties, USAR is the most elite branch of the canine SAR industry. USAR is the most physically demanding, requires the most varied skill set, and involves the most complex training program. While searching for surviving humans, USAR dogs must endure many distractions-such as noises, food, human-scented clothing, displaced animals, deceased animals and humans, and unstable surfaces-while differentiating between rescuers and victims. Dogs in this classification often are considered the "Olympians" of the canine SAR world. Moreover, dogs trained for USAR often can perform many other types of SAR missions. For these reasons, USAR programs should be considered the gold standard for all working dog specialties.

Certification

FEMA classifies federal canine search teams into five types-I, II, III, IV, and other-based on their capabilities [11]. Type I teams have the highest qualifications and are the only teams deployed on the federal level.[11]USAR certification occurs in several, sequential stages. First, the dog handler should be affiliated with a task force and be certified as a Canine Search Specialist. Next, the dog must complete a *Foundation Skills Assessment* (FSA) [12] before the team is eligible to be certified as a Type I canine search team. Certification does not guarantee that a team will be deployed.

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The first certification, the FSA, requires the dog to be tested for temperament, obedience, agility, direction, control, and alertness. For the FSA, dogs must perform a rubble search in a specified time and offer a bark alert when victims are located. During this testing phase, dogs are not subjected to any other distractions. The testing of the dog and handler team demonstrates that the team has the basic skills and knowledge needed to conduct an USAR mission. Some state USAR teams may be deployed after the FSA certification but states using the FSA standard must recertify their teams every two years.

Federal FEMA teams use the FSA as a standardized screening process to determine those handlers and dogs that are sufficiently competent to advance to the next level of certification, the *Canine Evaluation,* or *Type 1* test. Unlike state teams, federal teams are not permitted to deploy on an FSA certification alone. Once a team completes the FSA, the team has six months to challenge the Canine Evaluation. This certification tests the handler using criteria related to pile size, search time, search markings, distractions, false responses, interviews, and search markings.

For Type I certification, handlers are tested with both limited access and full access debris piles.[11]In a limited access search, the handler stays in a designated spot until the dog indicates it has located a live human scent in a debris pile. The handler is then given access only to the specific location the dog indicated while the dog continues searching. This exercise allows the evaluator to monitor the dog's ability to search effectively independent from the handler in conditions where structural integrity is compromised [11]. This searching method helps prevent handlers from being injured in building collapses while still allowing the search for victims to continue. In a full access search, the handler can start anywhere and move freely about the search area with the canine partner [11]. The handler is able to execute the search strategy he or she believes is most likely to locate trapped victims. This exercise allows the team to be evaluated as a unit. All teams are expected to maintain proficiency in all Type I skills throughout the three-year period. If the team is not meeting expectations, it may not be deployed.

Training and Fitness Testing Requirements

The training requirements for USAR dog/handler teams are rigorous. The teams are tested on criteria related to training hours, frequency, locations, and conditions; roles; travel flexibility; access to skilled assistants; creativity; air and helicopter training; and lifting/lowering. The demands of canine USAR are so strenuous that the USAR Veterinary Group asked two experts in canine health and performance to help them develop the measures used to determining a dog's fitness for such duties. Robert Gillette (previous Director) and Craig Angle (Associate Director), both from the Animal Health and Performance Program at Auburn University's College of Veterinary Medicine, assisted with this task [13].

During fitness testing, the weather conditions are recorded over a two-day period. The dog's vital signs are recorded at rest (baseline), during the activity's anticipation stage, at one minute immediately following the activity, and then every 10 minutes until the dog's heart rate, temperature, and breathing becomes steady. During the first morning of training, the dog and handler engage in a two-mile endurance test at a speed of at least six miles per hour. The handler uses a bicycle, golf cart, or all-terrain vehicle to maintain consistent speed during the testing. During the second day of testing, the dog sprints a total of 250 yards (four repetitions of retrieving at 50 yards each) on a flat surface during the afternoon hours.

To maintain a state of readiness and fitness for USAR, dogs must have a regular exercise and a training program. The schedule should include core-building exercises, stretching and balancing exercises, climbing, running (endurance and sprinting), swimming, shallow water retrieving, tugging/pulling games, and hunting in grass and on a variety unstable surfaces such as in sand pits and on sand dunes. Dogs should be exercised at least three to five times a week, rotating through the various exercises.

Available Teams

Only a limited number of canines are qualified to perform USAR. At the federal level, the number of certified dogs in the entire U.S. generally is around 250 [14]. In comparison, other canine detection disciplines often have a similar number of qualified dogs in a single state. The federal number is low, in part, because there are only 28 Federal USAR task forces and each task force can have only a limited number certified canine teams [14]. There may be additional qualified dogs not represented in this subcategory because they are not affiliated with one of the 28 federal task forces.

The number of certified USAR dogs at the state level is more difficult to determine. Each state operates their USAR resources independently. Some states do not include USAR canines in their programs. The non-profit State Urban Search and Rescue Alliance (SUSAR) give participating states information-sharing capabilities for all aspects of USAR [15].

Caring for Urban Search and Rescue Dogs

USAR dogs require specific veterinary care throughout their working careers. There are specific concerns and requirements associated with each time point that need to be addressed to help to protect this important asset and ensure a long, successful SAR career.

Pre-deployment

Prior to USAR deployment, all canines must have a pre-deployment health screening [16] conducted by a licensed veterinarian. The screening must be conducted within a 10 days of the dog's departure. Obviously, this time constraint is a challenge since deployments usually are urgent and unpredictable. For this reason, most task forces have an agreement with a licensed veterinarian to provide these services during the personnel check-in at the departure point. Dogs that fail the screening are not allowed to deploy. This practice protects the team's resources; both human and animal, from illnesses that may be transmitted by the dog. In addition, dogs are screened by the handler, a veterinarian, or a qualified medical professional before and after each operational period during the deployment.

Common Deployment Injuries

During operations, standard policies and procedures require canines to be free of equipment that could cause them to become trapped by snagging on debris. Therefore, SAR dogs do not wear vests, collars, or any other equipment while they are actively searching. For this reason, these dogs must be dependably obedient and respond reliably to a command to return to their handler or stop in place at a distance from their handler.

The most commonly documented operation-related injuries area brasions, punctures, or lacerations to dogs' paw pads. Booties are not a reliable solution for most operations, as dogs need to spread their toes and use their toenails to grip while climbing or balancing on debris. Booties are used primarily when dogs are searching on hot surfaces such as asphalt roofing shingles or pavement. Booties also can be used to protect a previous foot injury.

The second most common health issue for USAR dogs is dehydration, often associated with hyperthermia. Handlers and trained medical personnel manage these health issues in several ways. Most handlers carry an ample water supply during operations. However, there are times when carrying water may become a reason for displaced and shocked victims to assault a handler to obtain this coveted resource. One method of preventing dehydration is preloading dogs with subcutaneous fluids prior to operations. Unfortunately, this is not always a viable option. Search zones often have hazardous materials or toxins and any broken skin, such as the skin puncture needed to provide subcutaneous fluids, gives these toxins a potential entrance point into the dog's blood stream. While handlers may carry oral hydration supplements in their canine first aid packs, the effectiveness of such products is unknown. The Penn Vet Working Dog Center conducted a study examining the effectiveness of different hydration methods in dogs in hot, humid conditions [17].

Hyperthermia is always a risk, especially in humid climates, where most missions occur. A dog's core temperature rises more rapidly while they are searching on debris. USAR dogs are usually worked in 20-minute increments to ensure they are appropriately rested and searches are as effective as possible. Most operational periods occur during daylight hours with shifts averaging 8 to 12 hours. Because of the high risk for entanglement-on rebar, steel, metal, or wood scraps-dogs are not permitted to wear cooling vests.

Decontamination

All USAR dogs require decontamination at the end of each search day as well as at operation completion. Decontamination ranges from a handler wiping down the dog with cleansing wipes to full-scale decontamination using soap and water with complete submersion and rinsing prior to entering the team's campsite. The mission dictates the type of decontamination procedures that will be used. The most important aspect of decontamination is ensuring that dogs do not transfer contaminates to other dogs, rescue personnel, or equipment. Failure to decontaminate a dog properly could be catastrophic to the entire team and literally wipe out the necessary resources needed for a disaster response.

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Post-deployment

Caring for dogs after a deployment is just as important as caring for them before and during deployment. Upon return from a mission, all dogs, injured and uninjured, must be examined by a licensed veterinarian and receive a complete physical including a complete blood count; a chemistry profile including liver, renal, and electrolyte assessments; a urinalysis; and a fecal exam both at 30 and 60 days post mission. Of course, any injured dog should receive immediate care from its primary veterinarian. While the level of care depends on the injury, care should continue until the injury is completely healed. Dogs exposed to chemicals or biohazards may need additional tests and treatments.

Injuries and Illnesses Reported in Recent Operations

Disasters from terrorist attacks-such as bombings, chemical warfare, or the destruction of large structures-are considered the most dangerous missions. The debris, particulate matter, dust, and noxious odors can be overwhelming for dogs and handlers. Handlers protect their respiratory systems with respirators but dogs cannot use such devices as they use their olfactory system for searching. Disaster site fumes and exposures can create challenges during search operations, interfere with the dog's potential to locate victims, and cause debilitating illnesses.

During the 1995 Oklahoma City bombing, 19 of 74 dogs suffered injuries mostly paw pad injuries. Of the dogs that became ill, 19 were fatigued, 12 had decreased appetite, three suffered vomiting, and three had diarrhea [18]. Other conditions included hypothermia, allergic reactions, respiratory difficulties, cough, and eye irritations. Behavior changes including anxiety, increased alertness, hiding, and increased sleeping were noted [18].

After the Haitian earth quake of 2010, heat was detrimental to the dogs' health and stamina. Dogs worked night shifts to combat the heat [19]. Despite these precautions, the two most commonly reported illnesses on a survey completed by handlers were dehydration (30%) and wounds (26%) [19].

Fourteen SAR canines were deployed after the F5 tornado that left a path of destruction in Joplin, Missouri in 2011. The team of working dogs included Labrador Retrievers, Belgian Malino is, and one of each of the following breeds: Dutch Shepherd, Border collie, Red Bone Coonhound, American Bulldog Mix, and Labrador Shepherd Mix. Of these dogs, 64 % sustained injuries, 29% exhibited lameness, and 21% experienced dehydration and skin irritation [20].

During the 9/11 World Trade Center collapse, dogs suffered illnesses and injuries at alarming rates [21,22]. In a study conducted by Fox and colleagues, 18 dogs had injuries within one week including corneal lacerations, fatigue, respiratory complications, lameness, dehydration, skin problems, and others [23].

The deployment after Hurricane Sandy (October 2012) resulted in fewer canine injuries. Only three of the 33 canines suffered injuries: one bite, one laceration, and one paw irritation [20]. Only two dogs suffered illnesses: one had vomiting and the other had diarrhea and dehydration [20]. Compared to other natural disasters, dogs were used less frequently at this deployment, resulting in fewer canine injuries and illnesses.

Moore Oklahoma experienced tornado damage in May 2013 that required the help of canine resources. Both FEMA and Oklahoma State USAR dogs were used during this mission. Seven of the 16 FEMA dogs experienced paw pad lacerations or punctures, while two of the seven state USAR dogs experienced injuries [20]. Four FEMA dogs suffered dehydration, and only one state USAR dog suffered diarrhea [20].

Of the 23 canines responding to the September 2013Colorado floods, only three (13%) had an injury (one paw/nail wound, one abrasion, and one snake bite) [20]. Four (17%) experienced illness (one case of dehydration, one urinary illness, and one skin infection [20]. Of the 12 canines deployed after the April 2015 earthquake in Nepal, one became dehydrated, one damaged a knee ligament, and one had a paw laceration.

Based on the survey data from the six deployments reported here, veterinarians can expect to observe the same common canine injuries and illnesses after working dog deployments: pad injuries/lacerations, dehydration, respiratory disorders, diarrhea, and a decrease in appetite.

Current Research

Research on SAR dogs is expanding. The Penn Vet Working Dog Center has four important research projects

that will benefit future working dogs. In the *9/11 Medical Surveillance* project, the health and behavior of 911 canine responders are being monitored in order to prepare future canine teams as well as anticipate possible effects on humans working in the same environments [24]. Researchers participating in the *AKC Reunite DNA Databank* project seek to crack the genetic code of successful detection dogs in order increase the number of dogs that can be deployed to serve their communities [25]. In *the Puppy Foundational Program*, researchers are working towards first breeding the best and healthiest working dogs, then enhancing their potential for success through a scientifically designed foundation training program [26]. Finally, in the *Hydration Strategies* project, researchers gathered data to determine the effect of three pre-hydration strategies-water, an oral electrolyte solution, and subcutaneous fluids-on detection dogs working in hot and humid environments [17].

After each federal and state disaster response, the Urban Search & Rescue Veterinary Group collects data from canine handlers about pre-deployment health exams, post deployment health exams, and illnesses and injuries experienced during missions. This information is compiled and summarized in *After Action Reports*, which are submitted to participating handlers and their perspective task forces. These reports enable all responsible parties to take appropriate actions to maximize the canine's health and performance capabilities before, during, and after each mission. Best practice recommendations and sample documents are available online from the USAR veterinary group's website [13].

A recent study conducted at the University Of Tennessee College Of Veterinary Medicine evaluated the incidence of musculoskeletal disorders in working dogs, not exclusive to SAR dogs. Thirty-four working and service dogs were evaluated, none of whom had a history of lameness. Orthopedic examination and force plate gait analysis were performed on all dogs with asymmetry consistent with lameness present in approximately 20% of cases. The most common conditions diagnosed were cranial cruciate ligament rupture, hip joint laxity, and lumbosacral pain, all of which could inhibit a working dog's ability to perform duties effectively. The high incidence of subclinical orthopedic disease in working dogs found in this study highlights the need for more proactive screening of working dogs for orthopedic disease. Early diagnosis may lead to exclusion of dogs from training prior to investing the cost associated with

intensive training, or may simply allow for earlier therapeutic intervention. A thorough orthopedic exam annually by an experienced veterinarian, board certified veterinary surgeon or board certified veterinary sports medicine and rehabilitation specialist is recommended for all working and service animals.

Conclusion

While the work performed by service dogs is vital for disaster response, it would not be possible without the services of well-trained veterinarians who care for these athletic dogs who endanger their health each time they are called to duty. Handlers and veterinarians have learned a great deal from the long history of the working dog. The service dog world has gathered data about the risks, common illnesses, and injuries associated with this work. Despite these lessons, much is still unknown about the long-term effects disaster work has on canines. With the assistance of veterinarians and scientists dedicated to advancing the knowledge of working canines, the care of existing working dogs can be improved to help secure the future of these valuable resources that aid human kind in such a selfless manner.

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