Leash-related injuries associated with dog walking: an understudied risk for dog owners?

Rodrigo Rosa, MV, CVPP, MANZCVS, DABVP1*, and Richard E. Buckley, MD, FRCS2,3

1Columbia Veterinary Emergency Trauma and Specialty, Columbia, SC
2Foothills Medical Center, Calgary, AB, Canada
3University of Calgary, Calgary, AB, Canada
*Corresponding author: Dr. Rosa (rosamv@proton.me)

ABSTRACT
The topic of dog-walking injuries has recently gained notoriety through major media outlets in North America, including the Washington Post, NPR, and US News and World Report. In this review, we have compiled data from the main studies published in the past 2 decades that assess the incidence, demographics, and injury patterns related to dog leash walking. The available papers indicate that dog leash-related injuries have increased, particularly among women over 65. The most common causes of injury are dog-pulling behavior, which can result in tripping or tangling, with or without a fall, as well as upper extremity injuries. However, there is a lack of information regarding dog size, breed, training status, the type of leash used at the time of injury, and the role each factor may have in the incidence of injuries. The available data did not allow for evaluation of the impact of weather conditions on injury incidence. Information about the involved dogs, type of lead device, and weather conditions could be useful in identifying risk factors associated with dog ownership and guide prospective pet owners and their families to mitigate the risk of injuries.

Keywords: leash, injury, seniors, NEISS, leash-walking

Introduction
Numerous studies have indicated that physical inactivity increases the risk of noncommunicable diseases like type 2 diabetes, coronary disease, and breast and colon cancer.1,2 Human inactivity leads to shorter lives and contributes to the societal burden of healthcare costs.3,4 Regular physical activity has been strongly associated with improved overall health, greater life satisfaction, and happiness, an effect particularly pronounced with advancing age.5 Cultivating the habit of moderate-intensity exercise for 30 minutes daily can lead to measurable health benefits, both physical and psychological.6 Walking is an effective way to meet minimum physical activity goals.7 It is a popular and sustainable activity, traditionally associated with a low risk of injury.8 Despite the convenience of this form of exercise, most people in North America and the UK fail to remain physically active, creating the need for strategies that encourage physical fitness.6,8 Dog walking is 1 such activity and has been reported to increase short- and long-term daily exercise in a range of age groups, including older adults (> 65 years).4,8 Dog owners are reportedly more active than non-dog owners, and although the causality that directly links owning a dog with becoming healthier remains unproven, institutions like the Arthritis Foundation even recommend dog walking to relieve arthritis symptoms.9 According to the AVMA, there were between 83 and 88 million dogs in the US in 2022. The canine population increased by 6% compared to the previous estimate made in 2016. Forty-five percent of American households contained at least 1 dog, and an income above $100,000/year positively correlated with pet ownership. People between 25 and 54 are most likely to own a dog, and most dog owners are between 35 and 44.10 Among the reasons that motivate dog ownership, 1 report11 indicates that 89% of adoptees expected increased walking to be a main physical health benefit. Other health-related reasons included an increase in physical fitness (52%), a decrease in blood pressure (40%), and weight loss (30%).
Recent studies have highlighted the incidence of dog-walking injuries, particularly in the elderly.12 While most injuries are minor and treatable, others may lead to significant morbidity or even mortality.13 Inasmuch as this past research has brought to light

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an important topic, it is not common knowledge what potentially pertinent risk factors are associated with these dog-related incidents, typically only reporting the facts around humans. Recommendations meant to reduce the incidence of injuries often fail to consider animal-related factors such as dog size and temperament, leash-pulling behavior and its various causes, or the effect of associated gear like nylon webbing versus retractable leashes, harnesses, or weather conditions. Conversely, the health impact on dogs caused by inappropriate leash walking has received little attention. Leash pulling, for example, has been shown to increase the risk of permanent tracheal, laryngeal, esophageal, and ophthalmic damage in dogs. This might be particularly important to brachycephalic breeds like French Bulldogs and Pugs, which have gained popularity in the last few years.14

This review aims to approach the subject of dog-walking injuries considering both the human and the animal subject.15 Our objectives were to analyze the existing literature, report on the most salient findings, and identify gaps in the type and quantity of information collected during emergency room visits. Primary and secondary prevention strategies and the expected implementation challenges were identified. We predicted that the data obtained at human emergency-room facilities were incomplete regarding the dog involved in the incident, the type of lead gear being utilized, and the environmental conditions at the time. We hypothesized that most injuries occur because of dog behavioral disturbances, of which leash pulling may be a symptom; that older women are at risk; and that the number and pattern of injuries are reasonably consistent across recent literature given their overlapping data source.

Methods

We conducted this review and obtained articles from PubMed and Google Scholar using relevant search terms. Initially, we focused on human injuries while walking a dog, using dog walking and injury as our starting terms, resulting in 218 papers. The search was refined to eliminate bite injuries and reference section of each paper was scanned for further relevant literature. One of the referenced papers contained the only available data on how weather affects the incidence of injuries, but case-level data were unavailable.15 This prevented us from drawing conclusions about the effect of weather on injury incidence.

Results

Study types and data sources

Of the 8 studies reviewed, the authors defined 4 as retrospective cross-sectional analyses12,15,18,20 and 2 as retrospective epidemiologic studies.16,17 The 2 remaining studies were a prospective observational study19 and a retrospective cohort study.21 The data for 6 studies were obtained from the National Electronic Injury Surveillance System (NEISS), operated by the US Consumer Product Safety Commission and representing approximately 100 hospital emergency departments.12,13,16–18,20 One study21 utilized data from a hospital network encompassing 7 campuses across Pennsylvania and New Jersey. Another study19 compiled data obtained at the emergency department of a district general hospital in rural southeast England. The case report22 dealing with cutaneous injuries was not included in the demographic data because of its small sample. Still, it was used to support the discussion section of the present report.

Scope

The studies varied considerably in length, from 2 months13 to 20 years,17 broadly representing data collected from 2000 to 2020. The number of cases per study varied according to study design, ranging from 3719 to 9,244.12 It is important to note that the focus of the studies was not homogeneous. One study specifically evaluated the incidence of lower extremity injuries,17 while another covered exclusively hand and wrist injuries.21 All included studies were performed in North America or the UK. The mean age of patients ranged from 49.6 to 56 years, and females were consistently overrepresented.12,13,16–21 Age appeared to contribute to a higher incidence of fractures; the highest incidence of fractures was among individuals aged 65 and 75 years.12,18

Incidence, types, and causes of injury

Maxson et al12 report that annual dog-walking injuries increased more than 4-fold for all ages between 2001 and 2020. Specifically for people age ≥ 65, Perruccio et al13 report a roughly 2.5-fold increase between 2004 and 2017.13 The only exception was Forrester’s study20 evaluating the effects of the COVID-19 pandemic, in which injuries decreased between 2019 and 2020. Most injuries occurred at home, followed by the street or other public places.16,18,20 By contrast, according to the CDC, during 2017 and 2018, there were 1,035 emergency room visits for every 10,000 people due to all types of injuries.23 In 2018, there were 105 leash-related injuries/1 million people or approximately 1/10,000 individuals.16 These data indicate that the absolute risk of dog-walking injuries remains very low across the
entire emergency department caseload and is also relatively low among dog owners. Moreover, < 10% of cases presented to the emergency departments require hospitalization.\textsuperscript{12}

Musculoskeletal injuries represented over half of the reported cases.\textsuperscript{12} Two studies\textsuperscript{14,16} indicated that injuries were typically caused by the dog pulling on the leash, resulting in a fall in over 50% of cases. Two other studies,\textsuperscript{11,13} one specifically evaluating lower extremity injuries, reported that a trip or tangle accounted for 63.3% of incidents, with leash pulling accounting for 29.2% of cases. Many injuries were also caused by the human tripping on the dog or leash or getting tangled on the leash.\textsuperscript{16}

Most injuries involved the upper extremities, including the fingers, wrist, upper arm, shoulders, and head.\textsuperscript{12,13,16,18,20} Among the group of patients requiring hospitalization (roughly 7.2% of cases), fractures were the most common type of injury, followed by sprains or strains, contusions, and abrasions.\textsuperscript{12,13,16,18} One study\textsuperscript{12} listed traumatic brain injury as the second-most-common injury. Among lower extremity injuries, the most common affected body parts were the knee, ankle, and lower leg.\textsuperscript{12} Hip fractures occurred in roughly 20% of cases requiring hospitalization.\textsuperscript{12,13} Only Forrester\textsuperscript{16} mentioned the temporal patterns associated with dog-walking injuries, reporting that injuries were least likely to occur during the winter months (December through February) and most likely to be treated between Saturday and Monday.\textsuperscript{16}

Discussion

When evaluating the likelihood of injury associated with certain physical activities, like walking a dog on a leash, it is crucial to consider absolute and relative risk concepts. In the medical field, time is of the essence, and the amount of effort required to implement a preventative measure must be balanced against the absolute risk posed by the activity. There is very little prospective, solid knowledge in this area, especially considering that dog walking is a very common activity worldwide. We have included 8 studies from the past 20 years that examined the frequency of injuries related to walking dogs on a leash and the types of injuries sustained. Our data analysis shows that accidents have increased roughly 2.6-fold between 2004 and 2017, but the likelihood of getting injured while dog walking remains very low.\textsuperscript{12} To be precise, dog-walking injuries represented only 0.04% to 0.06% of all injuries reported in the emergency room in 2018. This estimate is admittedly simple and based on a comparison between the data provided by Forrester and that available from the CDC for emergency room visits during the period of 2017 to 2018. However, it helps to put the issue of dog-walking injuries into perspective and balance the notion that it represents a major public health concern. It appears most injuries may have resulted from dogs pulling on leashes, but the tripping hazard represented by the leash itself remains unclear. The relative risk for women over 65 appears to be higher than for men of similar age. The pattern of injuries remained similar across studies, particularly involving injuries to the upper extremities.

There are multiple reasons for these results, and we cannot claim that our interpretation is conclusive. We need to consider different hypothetical situations due to the lack of information about the dogs involved, the type of leash used, and the conditions surrounding the incidents. Firstly, it is essential to note that elderly people are naturally more susceptible to falls. Approximately 30% of people over the age of 65 who live in community-dwellings report experiencing a fall at least once a year. Some of the identified risk factors contributing to this tendency include having a history of falling, osteoarthritis, impaired mobility or balance, and muscle weakness.\textsuperscript{24}

Women may be particularly predisposed to serious injuries, such as fractures, due to decreased bone mineral density, possibly making them more prone to dog-walking injuries regardless of the dog’s size, training status, or lead device.\textsuperscript{25} Secondly, it is possible that senior citizens may own dogs of size incompatible with their physical capabilities, and dogs may be prone to leash pulling when excited or nervous. This may create a scenario where the dog pulls on the leash and suddenly overpowers the handler, leading to forward falls. Lastly, it is possible that long or extendable leashes create enough distance between the dog and the handler to generate considerable forward momentum, predisposing the handler to upper extremity injuries or forward falls. However plausible, these hypotheses remain unproven until further data are available.

In a study by Hunter et al.,\textsuperscript{26} the authors concluded that dogs, compared to horses, can generate much higher loads in relation to their body mass. The effect of such load transferred to the handler will vary according to direction, the modulus of elasticity of the leash material, and the handler’s body weight and physical strength. When walking a dog, the handler must hold onto the leash, requiring the dog walker to position their shoulder forward with internal rotation and flex their elbow and wrist with ulnar deviation. This stance can increase the risk of shoulder injury if the dog suddenly pulls or changes direction. One study\textsuperscript{27} has shown that female military dog handlers are more likely to sustain upper extremity injuries due to this position. A study by Shih et al.\textsuperscript{28} demonstrated that larger and heavier dogs generate greater leash tension, requiring stronger and steadier handlers to maintain control. In agreement with Pirruccio et al.,\textsuperscript{13} we hypothesize that smaller dogs may be more suitable for senior-aged handlers, but further research and data collection are necessary before this can be concluded.

The dog’s natural behavior, age, training status, and size must also be considered. From the dog’s perspective, pulling on the leash can be explained by the desire to sniff ahead and interact with people and other dogs.\textsuperscript{29} Public places offer a wide range of sensory stimulation, including olfactory, visual, and auditory, although fear and anxiety are also possible causes.\textsuperscript{29} While the use of a leash has been shown to
decrease antagonistic interactions between dogs, leash-pulling behavior to reach a desired location is considered self-reinforcing and requires proper training techniques to correct, such as loose leash walking. Shih et al demonstrated that young dogs are more active and less predictable and, therefore, more frequently pull on the leash. The same study determined that both maximal and mean leash tension were lower for dogs rated as better behaved during walks, highlighting the importance of professional training before adoption. Primary prevention efforts, therefore, are best promoted by veterinarians. Keeping in mind the time constraints of primary veterinary practice, we hypothesize that the creation of brochures to highlight the potential risks of leash walking a dog might be a way to gently approach the subject during puppy visits. During subsequent exams, the inclusion of dog behavior questions in the clinical history, specifically highlighting basic skills like leash walking, sitting, and returning on command, might prompt a discussion of behavioral traits and training status. This interaction may allow the veterinarian to make recommendations for secondary prevention on a case-to-case basis, including a consultation with a behavioral specialist or qualified trainer. We anticipate that the physician’s role will likely remain in tertiary prevention, focused on mitigating further consequences of an accident.

Concerning lead devices, both the device itself and the attachment method must be considered. Numerous leash styles are commercially available, the two most common being the nylon web short leash and the extendable leash. In a Westgarth et al study, 58.1% of dog owners walked their dogs using a short leash, while 25.8% used extendable leashes. According to Isaac Newton’s second law, force equals mass times acceleration. We reason that extendable leashes may allow the dog to gain speed quickly, magnifying the force transferred to the handler as the leash runs out. For this reason, we postulate that extendable leashes may increase the chances of injury in senior-aged dog handlers. This remains a hypothesis, however, and further research is necessary before extendable leashes can be directly implicated in a higher incidence of injuries.

Dog attachment methods may include neck collars, chest harnesses with back and front attachments, and head harnesses. Neck collars may also vary, including nylon webbing, cloth, prong, and choke designs. The effects of these devices on the dog’s health and its tendency to pull have been evaluated. Choke and prong collars have been associated with more pronounced behavioral indicators of stress and lower owner satisfaction with the dog’s lead-walking behavior. These devices also carry a potentially higher risk of nerve and skin damage to the dog and are discouraged. Body harnesses with either front or back attachment points have been experimentally shown to affect shoulder expansion, potentially predisposing dogs to tendinopathies after prolonged use. Furthermore, Shih et al demonstrated that dogs pull significantly harder using back connection harnesses than neck collars. Head harnesses may be an option for owners of large dogs that tend to pull but require appropriate training for desensitization. In light of their unique health needs, particularly for eye and respiratory health, we recommend using chest harnesses for brachycephalic breeds. That said, it appears more likely that the level of training, the behavioral status and well-being of the dog, and the skill of the handler are more important than the attachment method itself. This highlights the importance of the veterinary team as educators of pet owners when it comes to primary and secondary prevention of leash-related injuries.

It is widely accepted that regular exercise can help seniors maintain their physical and mental functions, allowing them to remain independent and mobile. Studies have demonstrated that regular physical activity is safe for healthy and frail seniors and can help reduce the risk of major cardiovascular and metabolic diseases, obesity, cognitive impairment, osteoporosis, and falls. Women who have gone through menopause and own dogs are likelier to walk for more than 150 min/wk and are less likely to be inactive than those who don’t. Although the study documenting this fact didn’t find a link between physical activity and meeting activity guidelines, the authors suggested that this may be due to differences in walking intensity. Elderly women may walk at a lower intensity to socialize or avoid potential injuries caused by their dog’s leash-pulling behavior. Other studies have documented an association between dog walking and meeting physical activity guidelines. Inasmuch as this link between walking and improved health appears well established, the association between dog ownership and walking is not as strong as we anticipated. According to Christian et al, about half of all dog owners do not walk their dogs. This estimate is based on a meta-analysis of studies performed in the US and Australia and includes all age ranges, but regional and age-group differences also exist. Donoghue et al reported that 77.6% of Irish men and women over 50 walk their dogs at least 3 times weekly. As people get older, women are more likely to walk their dogs than men. In fact, 83.5% of men between the ages of 65 and 74 walk their dogs, whereas only 66.5% of men between the ages of 50 and 64 do so. On the other hand, 4 out of every 5 women, regardless of age, walk their dogs at least thrice weekly. On the other hand, dog ownership tends to decline by around 50% between the age groups of 50 to 64 and 75 and over. These data suggest that the correlation between owning and walking a dog is not as high as expected. Further studies could be performed to evaluate potential causes and barriers to more frequent walking among dog owners.

In dogs, regular physical activity and weight management have been shown to increase life span and reduce the incidence, severity, and clinical signs of osteoarthritis. An interesting study by Duncan et al utilizing wearable health-tracking devices demonstrated that a veterinary-prescribed 8-week exercise plan significantly increased health metrics for both dogs and owners. Conversely, it is also known
that canine osteoarthritis can negatively affect the distance, duration, and pace of walks, diminishing the physical and psychological benefits to the dog and the owner.\textsuperscript{13} Based on the available evidence, it is recommended that humans and dogs engage in regular walking to promote their health. Regular veterinary screening and appropriate therapy are necessary to maintain canine mobility and manage osteoarthritis, particularly in older dogs. The available data are often incomplete, but the evidence suggests that most injuries occur at home while leaving, returning from a walk, or interacting with a dog in the yard.\textsuperscript{17} It is important to note, however, that the location and the circumstances of the accidents were often not recorded, sometimes in roughly a third of the cases.\textsuperscript{20} One paper offers seasonal information on the frequency of injuries, which appear less common during winter, possibly because people may be less inclined to take their dogs for walks in cold weather.\textsuperscript{16} It is important to note that the information provided by the NEISS database should be interpreted with caution. While it gives an estimate of national statistics, it does not provide case-level data, making it difficult to assess the specific risk posed by various weather conditions.

\textbf{Limitations}

This study is not prospective or comparative but merely a review of previous papers published in the last 20 years. The available data do not include dog size, breed, training status, or temperament information. The data also do not specify the type of leash, ground conditions, or weather at the time of the accident.

\textbf{Summary and Conclusion}

This review supports our hypothesis that dog-walking injuries have increased in the last few years, although the absolute injury numbers across the human population remain low. The pattern of injuries remained similar across studies, which is not surprising given the overlap in the data source most frequently utilized (NEISS). The most serious injuries occur in people over 65, particularly women. While we hypothesize on the benefits of expanding the NEISS database to include information about dog size, breed, training status, the type of leash being used, and the circumstances surrounding the injury, we recognize that the practical aspects of this approach may not be realistic. Primary and secondary prevention methods are best implemented by the veterinary profession, beginning with appropriate screening during wellness visits and consulting with behavior specialists on a case-to-case basis. This information may be used to better understand the risks of dog walking and provide safety guidelines for dog ownership, especially for seniors.

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\textbf{References}