

Wild Pig Attacks on Humans

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ABSTRACT: Attacks on humans by wild pigs (*Sus scrofa*) have been documented since ancient times. However, studies characterizing these incidents are lacking. In an effort to better understand this phenomenon, information was collected from 412 wild pig attacks on humans. Similar to studies of large predator attacks on humans, data came from a variety of sources. The various attacks compiled occurred in seven zoogeographic realms. Most attacks occurred within the species native range, and specifically in rural areas. The occurrence was highest during the winter months and daylight hours. Most happened under non-hunting circumstances and appeared to be unprovoked. Wounded animals were the chief cause of these attacks in hunting situations. The animals involved were typically solitary, male and large in size. The fate of the wild pigs involved in these attacks varied depending upon the circumstances, however, most escaped uninjured. Most human victims were adult males traveling on foot and alone. The most frequent outcome for these victims was physical contact/mauling. The severity of resulting injuries ranged from minor to fatal. Most of the mauled victims had injuries to only one part of their bodies, with legs/feet being the most frequent body part injured. Injuries were primarily in the form of lacerations and punctures. Fatalities were typically due to blood loss. In some cases, serious infections or toxemia resulted from the injuries. Other species (i.e., pets and livestock) were also accompanying some of the humans during these attacks. The fates of these animals varied from escaping uninjured to being killed. Frequency data on both non-hunting and hunting incidents of wild pig attacks on humans at the Savannah River Site, South Carolina, showed quantitatively that such incidents are rare.

Key Words: attack, boar, feral hog, *Sus scrofa*, wild pig

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INTRODUCTION

The reported ferocity of wild pigs (*Sus scrofa*) is legendary (Blansford 1891, Ricciuti 1976, Wilson 2005). Being capable of tenaciously defending themselves against natural predators and conspecifics, this aggressive behavior among wild pigs has also been documented to include attacks on humans under a variety of situations (e.g., including both hunting and non-hunting circumstances). Images of such attacks were depicted on prehistoric cave paintings (e.g., at Bhimbetaka, India) as early as 50,000 years BP (Kamat 1997). These incidents were described in writings produced in both the

ancient Greek and Roman empires (Ricciuti 1976). Fatal wild pig attacks on humans were recorded on headstones in the Severn Temple graveyard in England dating back to the 12th century (Severn Temple 2004). In the Western Hemisphere, accounts of such incidents date back to 1506, when introduced feral pigs were reported to have often attacked Spanish soldiers hunting rebellious Indians or escaped slaves on islands in the Caribbean, especially when these animals were cornered (Towne and Wentworth 1950). Reports of wild pig attacks on humans

have continued through the present (Mayer and Brisbin 2009).

In spite of the fact that such attacks have been known to occur, little information has been compiled to identify those traits that typify these incidents, the human victims or the animals involved. Aside from several articles (e.g., medical reports) describing mostly individual human victims and their injuries resulting from such attacks (e.g., Gubler 1992, Hatake et al. 1995, Memeloni and Chand 2002, Manipady et al. 2006, Shetty et al. 2008, Attarde et al. 2011), studies characterizing these incidents are lacking. In fact, the validity of such attacks has even been questioned recently (Goulding and Roper 2002, Wilson 2005). Therefore, the purpose of this study was to characterize wild pig attacks on humans. This entailed a categorization of the different aspects or parameters of these events. A characterization of this phenomenon could lend itself to a better understanding of this behavior and these incidents, and possibly enable the prevention of such attacks in the future by identifying at-risk behaviors.

METHODS

I compiled all available information or documentation that I could find on wild pig attacks on humans. This involved a search of both the scientific and popular literature, including newspapers and sport hunting magazines. Both unprovoked and provoked attacks were examined in an effort to assemble a complete picture of such incidents. For the purposes of this study, an attack is defined as a situation where a human was (1) charged/aggressively threatened, (2) chased, (3) treed, or (4) physically contacted/mauled by a wild pig. This study excluded any reports dealing with trapped, penned, captive or recently captured/held animals (e.g., by hand or using hunting dogs). Although attacks on humans, including injuries, have occurred under such conditions (e.g., San Antonio News 2006, BBC News 2007), this is a common hazard in dealing with large, potentially dangerous animals being kept or held under these conditions (Freer 2004).

The attack parameters examined included the following:

- Location - zoogeographic realm; country; state (United States only); native or introduced portion of species global range; general habitat category (i.e., rural, suburban, urban)
- Date/Time - year; month; season (adjusted for northern vs. southern hemisphere); general time of day (i.e., daylight, nighttime); time/hour of day
- Cause of Attack - unprovoked, animal threatened, sudden close encounter, wounded animal, unknown
- Attack Circumstances - non-hunting or hunting circumstances
- Attack Scenario -attack proximity (i.e., close rush from cover, close rush in the open, far rush in the open); attack duration (in sec or min); type of attack (single or multiple attack; see definition below); victim's defense [(i.e., escaped/fled, fought back alone, fought back aided by companion(s), fought back aided by companion(s) and dog(s), fought back aided by companion(s) and passer(s)by, fought back aided by dog(s), fought back aided by passer(s)by]
- Wild Pig - sex; reported body mass/weight (est. or actual); size description; general social grouping category (i.e., solitary or group); number of animals (i.e., both involved in attack and present at scene); fate of wild pig (i.e., escaped/uninjured, escaped/injured during attack, killed during attack, found/killed after attack, unknown)
- Human Victim - sex; age (in yrs); general age class grouping (i.e., neonatal - newborn infant, minor - post natal-10 yrs old, adolescent/teen - 11-19 yrs old, adult - 20-59 yrs old, senior - 60 yrs old+); transport mode (e.g., walking, cycling, horseback riding, etc.); social category (i.e., alone or in a group); victim's outcome (i.e., human charged/aggressively threatened, human chased, human treed, human physically contacted/mauled); nature of injuries [i.e., none, minor, serious (requiring hospitalization), fatal]; type of injuries

(e.g., lacerations/punctures, abrasions/bruises/contusions, fractured/broken bones, muscle/tendon strains or tears, etc.); injured portion of body (e.g., abdomen, arm, hand, head, leg, etc.)

- Other Animals Present with Victims - species; fate of those animals (i.e., escaped/uninjured, injured, killed)

Single and multiple attacks (under Attack Scenario above) are defined as follows: a single attack is one in which one or more wild pigs attack one or more human victims at one location and time, at which point the incident ends; and, a multiple attack is where one or more wild pigs attack sequential human victims, the locations being separated by both space and time. This latter scenario can continue with several spatially separated attacks by the same animal(s) within the same general time frame of minutes up to a few hours.

Similar to comparable studies of large carnivore attacks on humans (e.g., Beier 1991, Cardall and Rosen 2003); data came from a variety of sources. The various data sources encompassed the following (number): scientific/medical literature (25); news media (377); popular books/magazines (57); organizational reports and files (39); facility/site reports and files (4); personal interviews/communications (15); and personal observations (4). Given the diversity of sources, only partial information regarding the aforementioned attack parameters was available on a number of these attacks. In spite of that, all available information was included to glean the maximum characterization detail possible for each parameter.

Although such attacks are typically reported to be rare, to date there are no data actually quantifying that probability. In an attempt to quantify the probability or potential frequency of such attacks, data from the Savannah River Site

(SRS), an 800 km² U. S. Department of Energy facility located in western South Carolina, were analyzed. These data were obtained from various SRS records and files, and included non-hunting and hunting circumstances. The two general frequencies/probabilities were simply based on the number of total documented employee or hunter manhours in the field versus the reported number of incidents.

RESULTS

A total of 412 attacks were compiled that collectively involved a minimum of 427 wild pigs and 665 human victims. The number of wild pigs is stated as a “minimum” since several of the attacks involved a group or sounder composed of an unreported number of animals. These attacks occurred between 1825 and 2012, with 70% having taken place between 2000 and 2012.

The attacks took place in all seven nonpolar zoogeographic realms (i.e., Australian – 33, Ethiopian – 1, Nearctic – 101, Neotropical – 1, Oceanic – 15, Oriental – 126, and Palearctic – 135), 47 countries and 21 US states. Most were located in the Northern Hemisphere (88%). The United States had the largest percentage of these incidents (24%), followed by India (19%), Papua New Guinea (6%), and England and Germany (each at 5%). The remaining countries individually encompassed less than 5% of the total. Of the 21 states, Texas (24%), Florida (12%) and South Carolina (10%) each had the largest percentage of attacks in the United States sample, with the rest each at less than 10%. The attack locations were mostly in the native portions of the species global distribution (63%), and overall, mostly in rural locations (73%), followed by suburban (22%) and urban (5%) settings. However, the numbers of attacks in suburban and urban areas have been increasing since the mid-1990s (Figure 1).

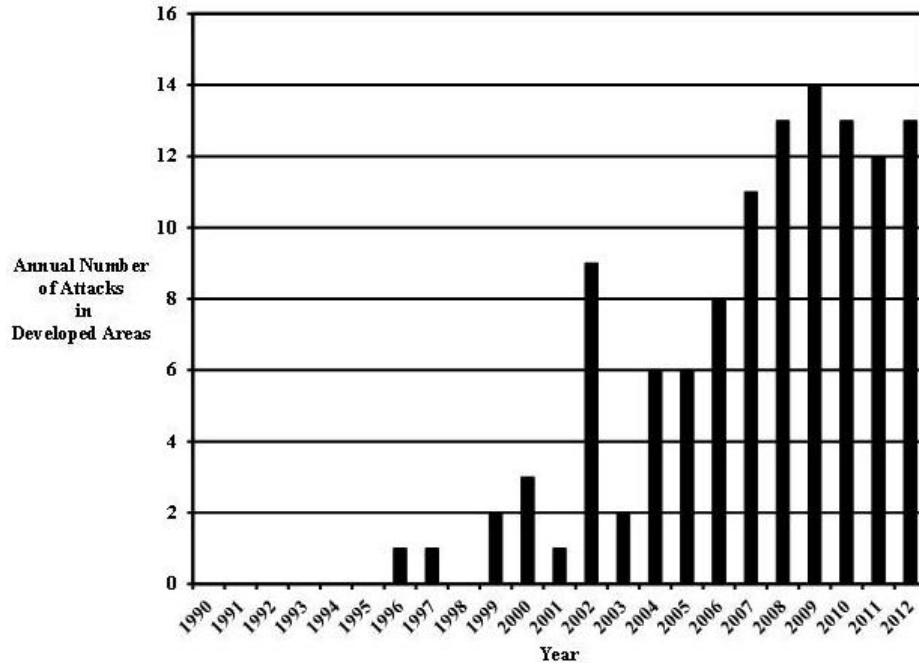


Figure 1. Annual number of wild pig attacks on humans in developed (i.e., suburban and urban) areas (N=110) between 1990 and 2012.

Attacks occurred throughout the year and 24-hour daily time period (Figure 2). Seasonally, most (33%) of these attacks occurred in the winter, with the fewest taking place in the summer (17%). January, October, April and November were the peak months. Most attacks (91%) occurred during daylight hours, with peaks primarily in the mid-morning and secondarily in the late afternoon.

The attacks took place mostly under non-hunting circumstances (76%). As might be expected, no attacks under hunting circumstances took place in either suburban or urban habitats. Overall, the most common identifiable cause of these attacks was the animal being threatened (41%). However, within the two circumstance subsets, causes in non-hunting situations were mostly unprovoked (49%), while wounded animals were the most common cause within the hunting subset (48%). The majority of attacks

that occurred at night (52%) were the result of the animals either being threatened or involved in a sudden close encounter with the victim. Most were single attacks (94%). However, multiple attacks occurred more frequently (21%) in developed areas (i.e., suburban or urban) compared to rural locations (3%). The most common attack proximity was a close rush in the open (67%), indicating that the human victim saw the animal before the attack. The least common attack proximity was a distant rush in the open (12%); most of these (52%) resulted in the victims being charged, chased or treed. Most attacks took place in less than a minute, with reported durations ranging from 15 seconds up to a combined total of 5.5 hours for one protracted multiple attack that occurred in a developed area. During the 5.5 hour-long multiple attack, five victims were successively attacked by one wild pig in a large suburban area.

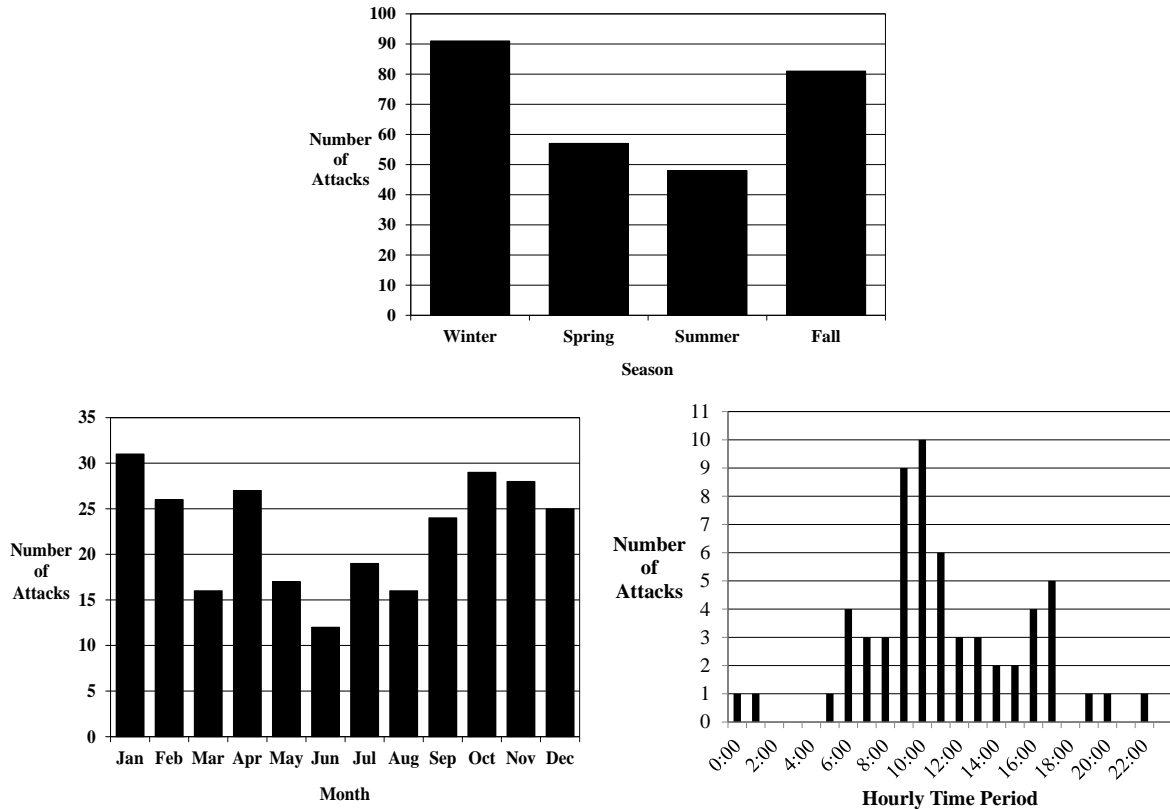


Figure 2. Seasonal (N=277), monthly (N=270) and hourly (N=60) frequencies of the number of wild pig attacks on humans.

Most victims fought back alone (39%), were aided by companions (30%) or escaped/fled (21%) from the attacking animal. Overall, 36% of the victims were aided in their defense by other people (i.e., companions, passersby or both). The remaining defenses each constituted less than 5% of the total.

The wild pigs involved in these attacks were mostly solitary animals (82%); however, groups or sounders of 2 to 20 animals were also reported attacking humans. Typically, only one or two of the animals in these larger social groupings were involved in the attack. In 15 incidents the entire group of animals was involved in the attack; this included the sounder of 20 wild pigs. However, the largest group size in which all of the pigs were involved in physical contact/mauling was six animals. The other larger groups were only involved in attacks in which the human victim was charged/aggressively threatened, chased or treed. For the wild pigs with a reported or discernible sex (e.g., based on

the canine morphology of yearlings through adults in photographs taken following the attack; see Mayer and Brisbin 1988), most were males (81%). Of the 92 wild pigs that were verbally described by victims or witnesses, most (87%) were described as being physically large animals (e.g., “big,” “huge,” “immense,” “heavy,” “enormous”). Of the 65 animals for which an estimated or actual total body mass was reported, the mean weight was 129 kg, with a range from 33 to 499 kg. Overall, most wild pigs escaped uninjured following the attack (60%), with the same being true under the non-hunting circumstances (73%). In contrast, under hunting circumstances, most of the attacking animals were killed during the attack (49%), with the next most common fate being escaped/uninjured (21%). Within the developed locations (i.e., suburban or urban), a higher percentage (40%) were killed (i.e., either during or after the attack) as compared to the same fate at the rural sites (28%).

The human victims involved in these attacks were mostly males (78%), with 99% in the hunting circumstances. Most victims were adults (82%), with 93% under the hunting circumstances. Males also were more common in the rural (81%) and suburban (75%) locations compared to the urban sites (54%). Of the 212 victims for which a specific age was known, the mean was 41 yrs, and ranged from a neonate up to two 80-yr olds. The neonate was born to a pregnant woman from a remote village in Papua New Guinea who went into labor in a rural location in 1985. While the mother was recovering from the delivery, the newborn was attacked and fatally injured by a wild pig before the baby's mother could intervene (Barss and Ennis 1988). Of the two 80-year olds, the first was a woman in England who was attacked in 2007 while walking her dog; she successfully repelled the three attacking wild pigs by fighting back (Morris 2007). The second was a man in South Korea who was fatally attacked in 2006

by a wild pig while walking along a suburban street at night (Kim 2008). The mean age varied among the three general habitat types as follows: rural – 40 yrs. old; suburban – 45 yrs. old; and urban – 31 yrs. old. The lower mean for the urban attacks may have been due to the small sample size of known-aged victims (N=7) rather than an actual younger average age. The most frequent age group was people in their fifties (Figure 3). Of the various transportation modes used by the victims (N=661), traveling on foot was the most frequent (i.e., walking – 93.2%, cycling – 2.3%, horseback – 1%, golf cart/ATV/utility vehicle – 0.6%, ox cart – 0.6%, sleeping/reclining – 0.6%, dugout canoe– 0.5%, motorcycle – 0.5%, automobile – 0.2%, camel-back – 0.2%, combine harvester – 0.2%, cross-country skiing – 0.2%, wheelchair – 0.2%). Collectively, the most common human victim of wild pig attacks was an adult male in his fifties who was traveling alone and on foot.

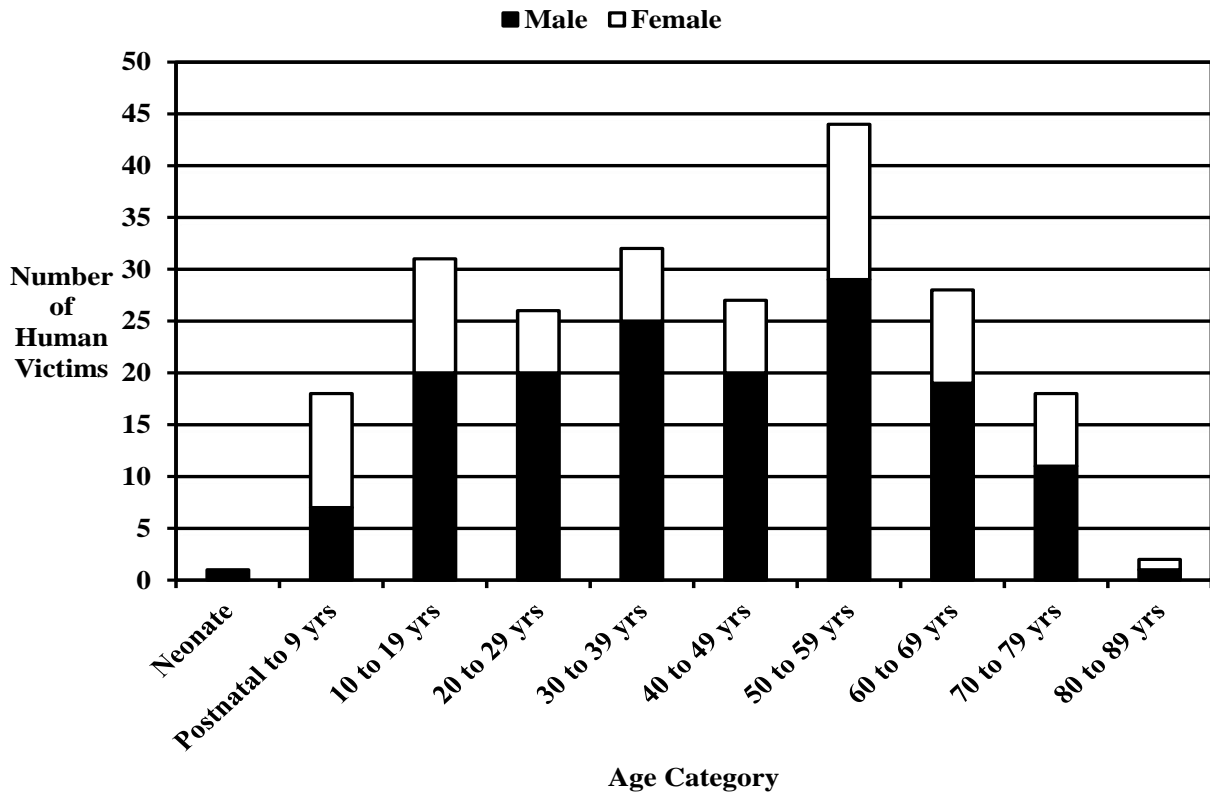


Figure 3. Age class (decades in years) frequency of female and male human victims (N=227) of wild pigs attacks.

Of the 665 human victims, the most common outcome was being physically contacted/mauled (69%), followed by those victims that were charged/aggressively threatened (17%), treed (9%) and chased (5%). Overall, most of the victims had at least some injuries (69%). Among the injured victims, the severity of the wounds varied from minor to fatal, with most being classified as serious (63%). A small percentage of the victims (3%) who were either charged, chased or treed also sustained injuries (four minor; one serious), mostly through falls sustained in trying to escape/evade the attacking animal(s). Fatalities were reported in 15% of the attacks where physical contact/mauling occurred, and were twice as high for victims who were traveling alone. The percentage of fatalities was more than double in hunting (28%) vs. non-hunting (12%) circumstances. Similar to the general tendency, the most common human victims (43%) involved in the fatal attacks were adult males who were walking alone. Based on attacks between 2003 and 2012, an average of 3.8 persons was fatally injured each year global-

ly due to wild pig attacks (annual range of 0 to 11). Only four fatal wild pig attacks have ever been reported in the United States, three of these resulting from attacks by wounded animals during hunting circumstances. The most recent occurred in Texas in 1996. Most victims sustained injuries to a single part of their body (61%), typically the lower part of the body from the waist down (56%). The legs/feet were collectively the most frequent part of body injured (39%), followed by abdomen (12%), equally by thorax, arms and hands (each at 11%), head/neck (8%), buttocks (5%) and groin (4%). Leg wounds were often on the posterior thigh. Age variation occurred with the two general body regions (i.e., upper/waist up and lower/waist down), with mostly upper body for minors (80%) and adolescents/teens (56%), and mostly lower body for adults (58%) and seniors (56%) (Figure 4). Collectively, the victims who were “treed” sought escape/refuge up in trees (58%), on top of vehicles (4%), up on buildings/structures (10%), and up on miscellaneous objects (28%; e.g., dumpster, furniture, large boulder, tall fence).

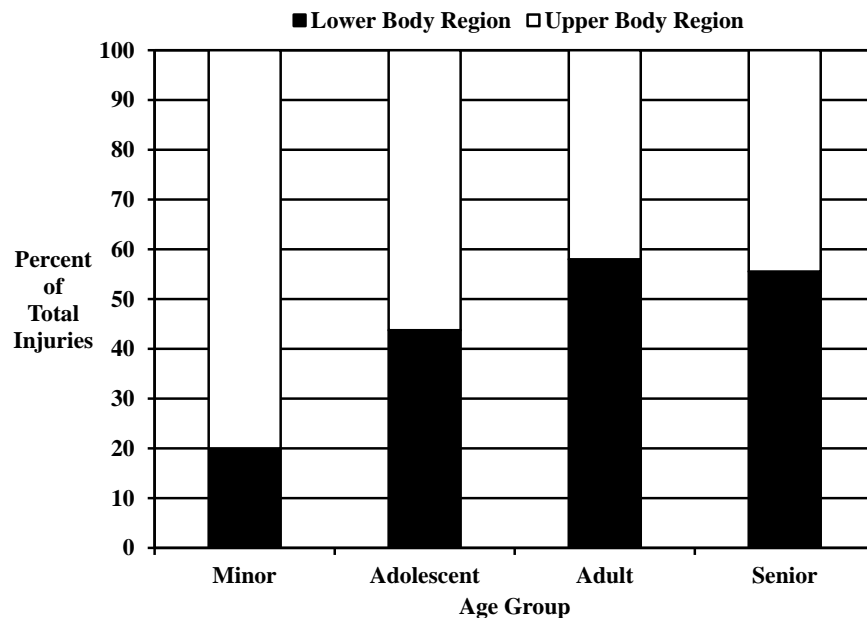


Figure 4. Age variation in the occurrence of injuries among 244 human victims in the two general body regions (i.e., upper/waist up and lower/waist down).

The nature of injuries sustained by the human victims included lacerations/punctures (75%), abrasions/bruises/contusions (15%), fractured/broken bones (9%), and muscle/tendon

strains or tears (1%). In general, injuries caused by wild pigs are characterized as multiple penetrating wounds caused by the teeth (i.e., primarily the canines, but can include the incisors and

premolars). Such penetrating wounds in the form of punctures can be 1 to 5 cm in depth and 1 to 3 cm in width, while longitudinal lacerations can be up to 20 cm in length with depths comparable to or exceeding those of the puncture wounds. The edges of these lacerations/punctures were described as ragged or not clean cut (Manipady et al. 2006). One laceration on a victim's posterior calf required more than 100 stitches to close (Horansky 2011). The lower canines can result in punctures typically between 1 to 3 cm in depth, while the incisors and upper canines tend to cause only abrasions, bruising/contusions and shallow punctures. The depth and extent of extreme longitudinal lacerations (number of victims) can even result in pneumothorax/sucking chest wounds (7), disembowelment/intestinal prolapse (11) and dismemberment (4). Some tissue loss due to very aggressive bites also occurred. Blunt force trauma was also caused by the attacking animal's head/snout and hooves, with some victims being brutally butted/rammed or trampled during the

attack. Such trauma was reported to be manifested as severe internal injuries/bleeding and concussions. Specific fractures/broken bones (number of victims) included the crania/frontal bone (1), crania/zygomatic bone (1), mandible (1), cervical vertebrae (2), clavicle (1), thoracic vertebrae (1), ribs (2), arm bones/unspecified (1), radius (2), ulna (2), hand/unspecified (1), lumbar vertebrae (1), pelvis (1), leg bones/unspecified (3), femur (1), and tibia (2). One thoracic fracture resulted in the victim being paralyzed below the upper chest. In addition, serious infections or toxemia can result from penetrating injuries sustained during a wild pig attack. Such infections resulting from pig bites/goring can be caused by a variety of pathogens (Table 1). Fatalities among the human victims were primarily due to exsanguination; but in three cases, death was individually diagnosed as being due to toxemia/septicemia, craniocerebral injury (in the form of a deep penetrating fracture) or a heart attack.

Table 1. Listing of pathogens associated with puncture wounds inflicted by domestic or wild pigs.

Pathogens Isolated from Victim's Wounds	Description of Attack	Description of Injury	Description of Human Victim	Reference
<i>Streptococcus agalactiae</i> (Lancefield group B, type II)	gored by a boar's tusk	6 cm laceration with deep penetration to the posterior aspect of the lower thigh	50-yr old male	Barnham 1988
alpha-haemolytic <i>Streptococcus milleri</i>	lacerated hand while cutting teeth from piglets	lacerated hand	20-yr old male	Barnham 1988
<i>Streptococcus equisimilis</i> (Lancefield group C, T-antigen non-typable)	gored by a boar	puncture wound on the back of the thigh	29-yr old female	Barnham 1988
<i>Pasteurella aerogenes</i> <i>Proteus</i> sp.				
<i>Bacteroides</i> sp. coagulase-negative <i>Streptococcus</i> <i>Pasteurella multocida</i>	bitten by a pig	deep laceration 5 cm wide on the thigh	32-yr old male	Barnham 1988
gram-negative bacteria	gored by a pig	laceration on leg	25-yr old male	Barss and Ennis 1988

Table 1. Listing of pathogens associated with puncture wounds inflicted by domestic or wild pigs. (Continued)

Pathogens Isolated from Victim's Wounds	Description of Attack	Description of Injury	Description of Human Victim	Reference
antibiotic-resistant <i>Staphylococcus aureus</i>	pig bites/gorings	no details	no details	Barss and Ennis 1988
gram-negative organisms	pig bites/gorings	no details	no details	Barss and Ennis 1988
<i>Flavobacterium</i> group lib-like isolate	pig bite	bite wound on hand	51-yr old female	Goldstein et al. 1990
<i>Pasteurella multocida</i> <i>Bacteroides fragilis</i>	bitten and gored by a boar	bite wound on right knee, lacerations on left thigh and forearm, fragmented tibial fracture of right knee	24-yr old female	Gubler 1992
	bitten and gored by a boar	bite wound on right knee, lacerations on left thigh and forearm, fragmented tibial fracture of right knee	24-yr old female	Gubler 1992
<i>Actinobacillus suis</i>	pig bite	bite wound on knee	37-yr old male	Escande et al. 1996
<i>Staphylococcus</i> spp.	pig bites	no details	no details	Gundez et al. 2007
<i>Streptococcus milleri</i>				
<i>Streptococcus sanguis</i>				
<i>Streptococcus suis</i>				
Diphtheroides	pig bites	no details	no details	Gundez et al. 2007
<i>Pasteurella multocida</i>				
Other <i>Pasteurella</i> spp.				
<i>Haemophilus influenzae</i>				
<i>Actinobacillus suis</i>				
<i>Flavobacterium</i> lib-like organisms	pig bites	no details	no details	Gundez et al. 2007
<i>Bacteroides fragilis</i>				
other anaerobic gram-positive bacilli				

In 18% of these attacks, other animals (i.e., including dogs, camels, domestic pigs, horses and oxen; totaling 70 individuals) were accompanying and/or present with the human victims at the scene. Dogs were the most common species overall (71%), as well as in both non-hunting (54%) and hunting (89%) situations. The breakdown of the fate of these animals was as follows: uninjured or escaped - 79%, injured - 12%, and killed - 10%. All of the fatalities were dogs, mostly occurring under the hunting circumstances (71%). Dogs assisted in defending the human victims in 49% of these attacks.

Based on data from the Savannah River Site, South Carolina, the probability or potential frequency of being attacked by a wild pig was determined under both hunting and non-hunting circumstances as follows: hunting - 1 hunter in-

jured in over 1.5 million hunter manhours; and non-hunting - 3 remote workers attacked (i.e., 2 charged/aggressively threatened and 1 treed) in over 3.9 million remote worker manhours. Under both sets of circumstances, the probability or potential frequency of such an attack would be less than a one in a million chance of occurrence. This is by definition a rare event.

DISCUSSION

Wild pigs normally show little to no aggression toward man, and typically try to flee when they encounter humans (Goulding 2003, DEFRA 2004, Manipady et al. 2006, Kose et al. 2011). In places where wild pigs are not persecuted, humans reportedly can safely walk very close to these animals (Galhano-Alves 2004). In spite of that, wild pigs do have the potential to

be dangerous (Goulding et al. 1998, Wilson 2005). This is typified by the news media, which generally portray these animals as “primarily dangerous and destructive.” The single most frequently cited issue concerning wild pigs in the press in England is the fear that these animals will attack humans (Goulding and Roper 2002). Although not the extreme threat as implied by the British news media, both provoked and unprovoked attacks by these animals on humans do occur. Under hunting circumstances, provoked attacks are often reported as the consequence of the animal being wounded by the hunter (Rappaport 1968, Barss and Ennis 1988, Gundeuz et al. 2007). Unprovoked attacks by wild pigs have been reported on non-hunters who were merely walking through or working in areas inhabited by these animals (Hatake et al. 1995, Gundeuz et al. 2007, Shetty et al. 2008). In general, such attacks by wild pigs on humans are anecdotally reported to be rare (Wilson 2005, Kose et al. 2011); this is especially true for unprovoked attacks (Rappaport 1968).

The general geographic and habitat locations of the attacks are consistent with where this species occurs in the wild. The higher proportion within the native range is consistent with the more widespread distribution in those areas compared to the introduced portions of the species global range (Tisdell 1982, Lever 1985). The high number of attacks in the United States was likely the result of my proximity and access to news sources. Wild pig attacks on humans in India, England and Germany are all considered newsworthy, and are frequently reported in the press. This is especially true in India, where victims are paid compensation for such maulings or loss of life due to a wild animal attack (Tribune News Service 2008, The Hindu 2009). The two US states (i.e., Texas and Florida) with the highest numbers of attacks also have the largest estimated populations of these animals. The high number in South Carolina is likely the result of my proximity/access to news sources. Given the wild pig’s habitat preferences (Mayer and Brisbin 2009), confrontations between this species and humans are rare (Kose et al. 2011). Most of these attacks took place when the humans entered natural or undeveloped habitats occupied by wild pigs. This higher number in rural areas follows the higher numbers/densities

of these animals found in those habitats compared to developed areas (Mayer and Brisbin 2009). Chauhan et al. (2009) found similar results for wild pig attacks in five Indian states, with most of the attacks (95%) occurring in forests and cropland versus that for villages (5%). Anecdotal accounts from other sources corroborate the higher incidence in rural areas (e.g., Manipady et al. 2006, Gundeuz et al. 2007).

In contrast to the prevalence of these attacks in rural areas, a number of attacks did occur in developed areas (i.e., suburban and urban habitats); including 15 solitary wild pigs that each entered occupied buildings prior to attacking the victims. Based on the attacks included in the present study, there has been an increase in the frequency of these incidents in developed areas over the past decade (Figure 1). This increase in the numbers of attacks in suburban and urban areas has been concurrent with the globally observed increase in the overall numbers of wild pigs in these developed areas (Kim 2008, Massei 2010, Céline et al. 2012, Cahill et al. 2012, Feral Hog COP 2012). These growing numbers have resulted in more encounters between wild pigs and people. This problem is exacerbated by people who intentionally feed wild pigs. Many of these animals had reportedly initially wandered into the developed area looking for food (e.g., Higashinada Ward Office 2003, The Independent 2004, Asia Pacific News 2007, Cihan Media Services 2010). The presence of food in the form of either handouts from humans or uncovered edible garbage would be a sufficient incentive for these animals to return to these developed areas to forage. The mere presence of wild pigs in unfamiliar surroundings in which these animals encounter buildings, traffic and large numbers of humans may be sufficient to make them feel threatened. Several of these animals also were found to have been injured in vehicle collisions just prior to the reported attack on one or more humans. A number of urban areas both in the United States and other countries have reported such attacks taking place, with the highest incidence of attacks compiled in this study being in Berlin, Germany. Since the fall of the Berlin Wall, the German capital has had numerous problems (e.g., attacks on humans, vehicle collisions, rooting and property damage) with its urban wild pig population, re-

ported to be as large as 10,000 animals being found within the city limits (BBC News 1999, Walker 2008, Mangasarian 2010).

The seasonal increase in attacks during the fall and winter months most likely coincides with wild pig breeding and farrowing activities, respectively. Increased aggression has been observed in mature males during the breeding season and in sows after farrowing (Eguchi et al. 2001, Manipady et al. 2006, Gundež et al. 2007, Mayer and Brisbin 2009, Kose et al. 2011). Both circumstances could potentially result in these solitary animals attacking people encountered during these periods of time. Attacks by groups of animals increased slightly in the spring, which coincides with when sows would be moving around foraging with their young. Sows are protective mothers, and readily defend their unweaned litters of piglets against any perceived threat (Goulding 2003). Chauhan et al. (2009) similarly found peaks for attacks during the fall and winter months.

In areas where wild pigs are relatively undisturbed, these animals tend to be diurnally active. However, intense hunting pressure or human activity during the day will drive wild pigs to become more nocturnal in their activity patterns (Mayer and Brisbin 2009). The higher frequency of attacks during daylight hours may reflect the activity patterns of the human victims rather than those of the wild pigs. Such encounters may be the result of the victims blundering upon the wild pigs either in their bedding sites or escaping another disturbance that caused the animals to flee their beds. Chauhan et al. (2009) also found that most attacks occurred during daylight hours (95%).

These animals are intelligent, alert and easily startled (Barss and Ennis 1988). Sudden encounters do occur between humans and wild pigs where the person is within that animal's flight-or-fight threshold, the result being that the pig poses a defensive attack at the person (Manipady et al. 2006). For example, Phillips (1935) noted that wild pigs in the tea districts of Sri Lanka sometimes lie up in the tea fields, and workers, who inadvertently stumble upon these animals, are occasionally injured by them. Similar circumstances have been recently reported for attacks around sugar cane fields in India (Das 2004). In instances where the humans es-

caped the attack by climbing up out of the animal's reach (e.g., up a nearby tree, on top of a vehicle, etc.), the attacking animal typically turned and left the scene having dealt with the apparent threat.

Barss and Ennis (1988) reported that 23% of wild pig attacks were unprovoked. Although the general occurrence of wild pig attacks on humans is indisputable, the causes of these incidents are not always clear. From the perspective of the victim, an attack may appear to have been unprovoked. However, the wild pig in question may have been previously threatened, chased or injured immediately prior to happening upon that victim. Still feeling threatened or suffering from injuries, the animal then defensively attacked the next person it encountered. Several of the attacks reviewed in this study were known to be the result of such *a priori* circumstances. One case involved two teenaged girls who were the victims of an apparent unprovoked attack by a wild pig in Spain. It was learned later that the wild pig had been attacked by several dogs immediately prior to its encounter with the two teens (Costa Tropical 2007). Other attacks reviewed involved wild pigs that had been previously injured by explosive devices (e.g., a land mine, "flower ball" explosive baits used by Pakistani farmers to kill wild pigs depredating crops), collisions with vehicles or encounters with hunters. In each of these cases, the wounded animals attacked the next human they came into close contact with. With these cases, the animals in questions were identified as having been injured prior to the attack. Undoubtedly, other cases exist where the animals involved in such attacks had been previously injured, but that fact was unknown to the victims, companions or passersby of the incident. Given the lack of information, these attacks would most likely be classified as unprovoked.

The fact that most of the wild pigs involved in these attacks were solitary (82%), male (81%) and large (87%) is consistent with the social unit behavior of mature boars in this species (Mayer and Brisbin 2009). Of the attacks involving groups of wild pigs, the attack was typically carried out by only one or two animals. Several these animals were specifically described as being the "biggest one in the group." Since most sounders of wild pigs are composed of single or

multiple family groups (Mayer and Brisbin 2009), it would follow that the largest animals in such social units would be the maternal females. As previously noted, such females are reported to be very aggressive in defending their young (Goulding 2003), which could account for the resulting attack if these animals felt threatened. Overall, the total body weights reported for the wild pigs involved in these attacks were generally in the extreme upper end of the range for this species (Mayer and Brisbin 2009). It is conceivable, though, that such estimates were exaggerations given the traumatic circumstances associated with these incidents.

The human victims represented a widely diversified but decidedly male and older population component. Although unknown, this is likely indicative of the human demographic present in the areas where the attacks took place. Unlike the reported attacks by large carnivores on humans (e.g., Beier 1991), the goal of a wild pig attack is typically defensive rather than predatory. Therefore, children would not be more vulnerable than adults to wild pig attack under most conditions. In the Indian sample, Chauhan et al. (2009) reported that most of the victims were male (68%) with the highest age grouping (32%) in the 41 to 50 yr. old category. The percentages decreased in both the older and younger age class categories in that study. A higher percentage of males was also found in the forested and cropland cases compared to the attacks located in villages (Chauhan et al. 2009).

The fact that most of the victims were physically mauled in these attacks seems biased toward the severe extreme of the outcome of such incidents. However, this should not be unexpected given that most (69% news media) of the source documents were predisposed toward a greater severity of such incidents (i.e., being more “newsworthy”). As such, care should be taken with respect to the use/interpretation of such information provided by these documents. However, the information is still useful in characterizing the parameters/variables of these attacks, especially since the human outcome was negative. Conversely, victims who were charged/aggressively threatened, chased or treed, but did not suffer any physical injuries, would be less likely to report the attacks. Wilson (2005) reported that only 2 of 12 attacks

over an 8-year period in England involved physical contact between the pig and the victim.

Wild pig attacks on humans are typically not fatal, but such maulings can result in severe injuries to the victim. In the more serious attacks, the wild pigs knock the human to the ground and then maul the prostrate victim. Such victims tend to sustain injuries to multiple parts of their bodies compared to the victims who were able to remain standing/upright. In some cases, the wild pig attacks the victim, retreats and then returns attacking again, which continues until the victim is completely incapacitated (i.e., no longer presents a perceived threat). The consequences of such repeated attacks are typically extensive multiple injuries over the victim’s entire body (Manipady et al. 2005, Gundež et al. 2007).

Wounds inflicted by a wild pig have a high risk for infection (Freer 2004), which can occur even for victims who have been hospitalized (Rajendra and Chandru 2011). As such, most mauling victims in wild pig attacks are treated with various antibiotics (e.g., Barss and Ennis 1988, Gubler 1992, Gundež et al. 2007, Attarde et al. 2011, Kose et al. 2011). Although a virus that is rarely reported in this species (Morehouse et al. 1968), some victims were also given vaccinations against potential rabies infection (e.g., Gubler 1992, Gundež et al. 2007, Kose et al. 2011).

Although not common (e.g., 4% of the attacks reported by Chauhan et al. (2009); 15% reported in the present study), fatal injuries can be caused by wild pig attacks. Some victims who are wounded by wild pigs die immediately (Manipady et al. 2005). For adults with most injuries to the lower region of the body, this is typically due to lacerated femoral arteries. Since these attacks most commonly occur in rural or remote areas, fatalities are often either not reported or not attributed to attacks by wild pigs (Barss and Ennis 1988).

The age-related differences between the victims’ two general body regions (i.e., upper and lower) that sustained the most injuries during attacks is associated with the height of the victims versus height of the pig. Means for the two general human body regions for the four age ranges used in this study (i.e., minor, adolescent/teen, adult, and senior) were based on data

obtained from Fredriks et al. (2005) and McDowell et al. (2008). These data represent combined gender and ethnicity samples. The heights for wild pigs were based on the range of shoulder heights for adult wild pigs obtained from Mayer and Brisbin (2009). A pig's mouth during an attack would be vertically located at or slightly below its shoulder, which in adult animals would put it in the aforementioned range (i.e., 52-106 cm). Given that height range and the means for the body regions of the four human age ranges, the wild pig's vertical range of impact to the two body regions would be 86% in the upper region for minors, 69% in the lower region for the adolescents/teens, 77% in the lower region for adults, and 70% in the lower region for seniors (Figure 5). This explanation is consistent with the findings from the attack victims (Figure 4). In general, a wild pig's mouth is vertically located at approximately the same height as most of the upper body in most minors. This location changes to the lower body in adolescents, adults and seniors. When victims are knocked to the ground by the attacking ani-

mal(s), injuries can then be sustained to the entire body (i.e., both upper and lower regions). This happened more in adolescents (46%) and seniors (42%) than to either minors (25%) or adults (28%).

The effect of other animals being present with the human victims at the attack scenes is unclear. Most of these animals survived the incident uninjured, and in some cases aided the humans in their defense against the attacking pigs. However, dogs walking with their human owners has been suggested to represent a hazard or risk with respect to wild pigs (Goulding 2003, DEFRA 2004, Wilson 2005), with the pig's aggressive behavior being influenced by the dog's presence. Wild pigs may consider dogs to be predators, and, as such, will attack them as a defensive response. In a few of the cases, the wild pigs even attacked dogs that were being walked on a leash by their owners. In some of the cases reviewed, the human owners intervened to save their dogs, only to then be attacked themselves by the wild pigs.

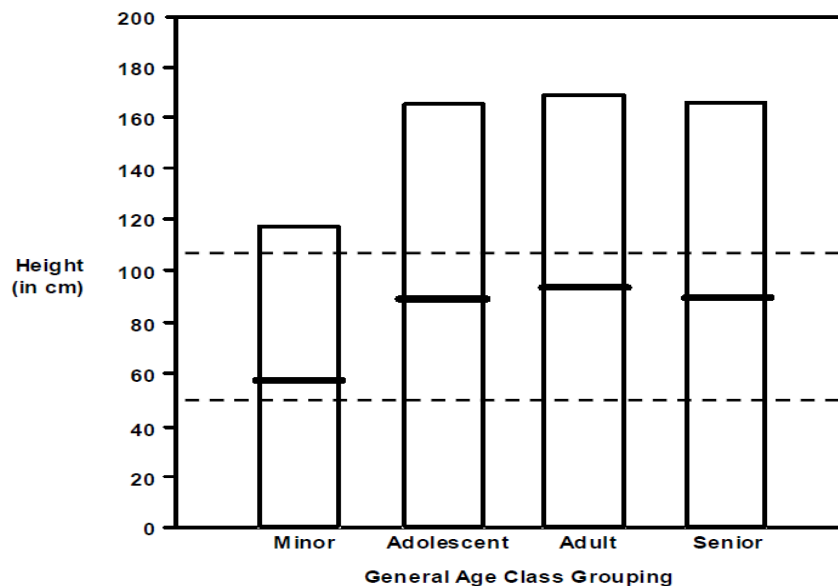


Figure 5. Graphic comparison of the mean heights for the four human general age class groupings (illustrated as two-dimensional columns) and the range of an adult wild pig at the shoulder (bounded as dashed lines). The bolded lines at about the midpoint of the columns indicate the approximate waist or division between the general upper and lower body regions. The mean human heights and body region proportions were developed from data provided in Fredriks et al. (2005) and McDowell et al. (2008).

Of the attacks reviewed in this study, six animals were found to have a history of repeated attacks on humans. These included from two up to four separate single attacks by each animal. All of these animals were reported to be large, and four were identified as males. Another was further described as being the “largest animal in a herd of 8-10 wild pigs.” These attacks were separated in time from a period of a few weeks up to one year. Most of the victims were seriously injured by these animals, four fatally. Four of these animals were eventually killed.

Wild pigs are opportunistic omnivores that can function as aggressive predators. Mature individuals have been documented to prey on large animals such as wild and domestic ungulates (Mayer and Brisbin 2009). Being scavengers, wild pigs have been specifically documented to feed on human corpses or remains in post-combat, rural accident (e.g., plane crash) and crime (e.g., homicide) situations (Barss and Ennis 1988, Williams et al. 1998, Rockenbach 2005). In addition, there is at least one instance on record of a wild pig in southern France that became a confirmed repeated man-eater. That animal focused its attacks on one village until finally being hunted down and killed (Elman and Peper 1975). In four of the attacks reviewed in the present study, the wild pig either partially or mostly consumed the remains of the human victim that had been fatally injured by that animal in the attack. Three of the four attacks were explicitly characterized by the investigating authorities as being predatory. In two additional attacks, the pig’s motivation was also described by either the victim or the victim’s companion as predatory; of those, one victim survived with serious injuries while the other was fatally injured. In a 2009 attack in India, a 3-year old girl, walking on a trail with her father, was grabbed by a wild pig, which then tried to flee with the minor child in its mouth. The father chased the animal, fighting with it until his daughter was released. Both the father and daughter were seriously injured during the attack; the child later died of her injuries (Pradesh 2009). Although attacks by these animals are primarily defensive in nature, the potential for an attack of a predatory nature cannot be completely discounted.

Unresolved Attack Circumstances

There are three types of circumstances associated with wild pig attacks on humans that need to be presented and discussed. The issues regarding these sets of attack circumstances center on the validity of these incidents as one of the four types of attacks. Each of these is discussed in the following paragraphs:

Escaped tame or captive-reared wild pigs - Familiarity with humans as the source of food provided in captive/penned situations may encourage wild pigs, which escape such confinement, to seek people out when these animals become hungry. A wild pig running up to a human seeking food or a handout could easily be mistaken for an attack. “Attacks” by recently escaped wild pigs (e.g., in England) would likely represent such circumstances. In those cases, the pigs left the scene after the humans either escaped or evaded those animals and did not provide them with any food or handouts.

Approaching wild pigs - In some cases, the victims were reportedly attacked merely because one or more wild pigs approached them or moved in their direction. Whether the people were inadvertently in the path being traveled by these animals or were in fact objects of curiosity or investigation by inexperienced, immature pigs, the apparent approach of a wild pig does not always mean that one is being attacked or threatened. Several of these victims either ran or climbed trees to escape these animals. In some instances, such attacks perceived by the victims are in reality just wild pigs moving toward the humans in question. Upon realizing the presence of such humans, some of these pigs retreated in the opposite direction (reportedly “broke off the attack”).

Accidental collisions - Some attacks are merely cases where wild pigs collided with the human “victims.” This included both people traveling on foot and riding bicycles or motorcycles. In many of these “attacks,” the wild pig left the scene immediately following the physical collision with the victim. In some of these cases, it is possible that the victims were inadvertently blocking the path that the running or escaping wild pig was attempting to use. Such incidents were likely just accidental collisions as opposed to aggressive attacks. As such, acci-

dental collisions would not qualify as a valid attack.

At-risk Behaviors

Several at-risk behaviors were evident based on review of the 412 attacks. Most are consistent with dealing with any large, potentially dangerous animal. These are as follows:

- Traveling alone and on foot through undeveloped areas, especially areas with dense thickets or understory vegetation
- Walking with a dog (leashed or un-leashed) through undeveloped areas
- Threatening or chasing a wild pig (e.g., out of a crop/farm field or developed area)
- Approaching an obviously wounded or injured wild pig
- Approaching or attempting to feed or pat/touch a wild pig, especially those seen in suburban or urban areas
- Blocking the path of a moving wild pig (e.g., one trying to escape a pursuer or leave the area)

Certain combinations of habitats in areas with wild pigs also represent an increased risk. This is especially true for agricultural lands that are adjacent to forested areas (Manipady et al. 2005, Gundezi et al. 2007, Rajendra and Chandru 2011).

Defensive Strategies

Lastly, again based on an overall review of the attacks in this study, there are several ways that one can avoid being involved in or reduce the severity of an attack by a wild pig. These are as follows:

- Be cautious and alert to the potential sudden presence of wild pigs when traveling through areas that these animals inhabit.
- If wild pigs are encountered, either detour around the animals, giving them a wide berth, or, if they are too close, slowly back away while being careful not to make any sudden or potentially threatening movements.
- Should a wild pig begin an aggressive approach from a far distance, try to out-

run the animal; however, wild pigs can run faster than humans, so trying to outrun them may be futile if the pig persists in the chase over a long distance.

- If a wild pig charges at you at a close distance, climb a tree or other elevated object to get out of the animal's reach, getting at least 6 feet off of the ground; these animals can't climb, but large wild pigs can work their way up a tree trunk, "walking" up the trunk with their front legs, to reach objects that are 4-5 feet above the ground level.
- If evasion or escape is not possible, turn and face the animal and prepare to aggressively fight back with anything at your disposal; under hunting circumstances, victims have fought back with weapons being used for harvesting game (e.g., guns, bows/arrows, spears); for the non-hunting circumstances, victims used a variety of items that they had with them to fend off the attacking pig(s) (e.g., camera tripod, hammer, bicycle, chair, machete, parang, shovel, cane, dog leash).
- While fighting back, try to stay on your feet and avoid being knocked to the ground; people who fall or are knocked down during a mauling attack sustain injuries to multiple parts of the body, and these injuries are more likely to be fatal.
- If you fall or are knocked down, get onto your back with your feet facing the animal, start kicking rapidly with your feet against the end of the snout or head, making sure that one of your foot doesn't get caught in the pig's mouth.
- Continue to fight back until the animal breaks off the attack; most wild pig attacks on humans last less than one minute in duration; if the animal tires of the attack and attempts to leave, do not try to pursue the animal or inadvertently block its potential escape route.
- Seek immediate medical care for any wounds sustained in the attack; in rural areas, victims should use good and immediate wound treatment, and seek

medical attention at the nearest hospital upon their return to a developed area.

In one incident, the victim was reported to have escaped a prolonged mauling by lying motionless and feigning death. The pig, which apparently either lost interest or perceived the threat to have ceased, left the scene of the attack. Although “playing dead” may have worked in that instance, there is no empirical basis to support that as a defensive strategy to employ in the event of a wild pig attack.

CONCLUSIONS

Wild pig attacks on humans do occur, but such incidents are rare. Attacks have been reported throughout the year and wherever these animals are found. In areas where the number of these animals continues to grow, the frequency of these incidents can be expected to increase. The consequences of such attacks on the human victims can be very serious; however, the injuries sustained by victims in wild pig attacks do not commonly result in fatalities. Although the general occurrence of these attacks is recognized, three unresolved sets of circumstances still exist with respect to what constitutes an attack. These specific circumstances should be taken into account when trying to determine the validity of such future incidents as attacks. With respect to reducing the potential for these incidents, the aforementioned information on both at-risk behaviors and defensive strategies should be made available to people either living/working in or traveling through areas inhabited these animals.

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LITERATURE CITED

- ASIA PACIFIC NEWS. 2007. Wild boars attack pedestrians in Ehime Prefecture. <http://onlypunjab.com/fullstory2k7-insight-news-status-6-newsID-3419.html>. Accessed 23 Apr 2007.
- ATTARDE, H., S. BADJATE, and S. R. SHENOI. 2011. Wild boar inflicted human injury. *Journal of Maxillofacial & Oral Surgery* 10:77–79.
- BARNHAM, M. 1988. Pig bite injuries and infection: report of seven human cases. *Epidemiology and Infection* 101:641-645.
- BARSS, P., and S. ENNIS. 1988. Injuries caused by pigs in Papua New Guinea. *Medical Journal of Australia* 149:649-656.
- BBC NEWS. 1999. Berlin's boar brother. <http://news.bbc.co.uk/1/hi/world/europe/578665.stm>. Accessed on 10 Jan 2005.
- BBC NEWS. 2007. Wild boar attacks man in farm pen. <http://news.bbc.co.uk/1/hi/england/essex/6500995.stm>. Accessed on 10 Mar 2009.
- BEIER, P. 1991. Cougar attacks on humans in the United States and Canada. *Wildlife Society Bulletin* 19:403-412.
- BLANSFORD, W. T. 1891. The fauna of British India, including Ceylon and Burma – Mammalia I & II. Taylor and Francis, London, United Kingdom.
- CAHILL, S., F. LLIMONA, L. CABAÑEROS, and F. CALOMARDO. 2012. Wild boar conflicts in urban areas: the Collserola Mountains Natural Park and the lessons to be learned from similar experiences with other ungulates. Page 36 in 9th International Symposium on Wild Boar and Other Suids. 2-6 September 2012, Hannover, Germany.
- CARDALL, T. Y., and P. ROSEN. 2003. Grizzly bear attack. *The Journal of Emergency Medicine* 24:331-333.
- CÉLINE, P., M. HEYMANS, S. CAHILL, J. CASAER, and A. LICOPPE 2012. Wild boar (*Sus scrofa*) in peri-urban areas: preliminary results of a survey. Page 53 in 9th International Symposium on Wild Boar and Other Suids. 2-6 September 2012, Hannover, Germany.
- CHAUHAN, N. P. S., K. S. BARWAL, and D. KUMAR. 2009. Human-wild pig conflict in

- selected states in India and mitigation strategies. *Acta Silvatica & Lignaria Hungarica* 5:189-197.
- CIHAN MEDIA SERVICES. 2010. Hungry wild boars attack people in western Turkish city. http://www.cihanmedya.com/media_service/product.do?method=detail&productId=2243&productDetailId=112066860&activePage=0&productEvent=MaxNew&categoryId=0. Accessed 4 Nov. 2010.
- COSTA TROPICAL. 2007. Two Motril teenagers seriously hurt after wild boar attack. http://www.typicallyspanish.com/news/public/article_13557.shtml. Accessed 14 Nov. 2007.
- DAS, R. 2004. Wild boar kills village boy. *The Tribune, India*. <http://www.tribuneindia.com/2004/20040128/haryana.htm>. Accessed 9 May 2007.
- DEFRA (DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS). 2004. The ecology and management of wild boar in southern England. Central Science Laboratory, Hutton, York, United Kingdom.
- ELMAN, R., and G. PEPPER. 1975. *Hunting America's game animals and birds*. Winchester Press, New York, USA.
- EGUCHI, Y., T. TANAKA, and T. YOSHIMOTO. 2001. Some aspects of farrowing in Japanese wild boars, *Sus scrofa leucomystax*, under captive conditions. *Animal Science Journal*, 72(7):J49-J54.
- ESCANDE, F., A. BAILLY, S. BONE, and J. LEMOZY. 1996. *Actinobacillus suis* infection after a pig bite. *Lancet* 348:888.
- FERAL HOG COP (COMMUNITY OF PRACTICE). 2012. Feral hogs in your backyard. <http://www.extension.org/pages/63619/feral-hogs-in-your-backyard>. Accessed 9 Jan 2013.
- FREDRIKS, A. M., S. VAN BUUREN, W. J. M. VAN HEEL, R. H. M. DIJKMAN-NEERINCX, S. P. VERLOOVE-VANHORICK, and J. M. WIT. 2005. Nationwide age references for sitting height, leg length, and sitting height/height ration, and their diagnostic value for disproportionate growth disorders. *Archives of Disease in Childhood* 90:807-812.
- FREER, L. 2004. North American wild mammalian injuries. *Emergency Medicine Clinics of North America* 22:445-473.
- GALHANO-ALVES, J. P. 2004. Man and wild boar: a study in Montesinho Natural Park, Portugal. *Galemys* 16:223-230.
- GOLDSTEIN, E. J. C., D. M. CINTRON, T. E. MERKIN, and M. J. PICKETT. 1990. Recovery of an unusual *Flavobacterium* group IIb-like isolate from a hand infection following a pig bite. *Journal of Clinical Microbiology* 28:1079-1081.
- GOULDING, M. J. 2003. *Wild boar in Britain*. Whittet Books, Ltd., Suffolk, United Kingdom.
- GOULDING, M. J., and T. J. ROPER. 2002. Press responses to the presence of free-living wild boar (*Sus scrofa*) in southern England. *Mammal Review* 32:272-282.
- GOULDING, M. J., G. SMITH, and S. J. BAKER. 1998. Current status and potential impact of wild boar (*Sus scrofa*) in the English countryside: A risk assessment. Central Science Laboratory, Ministry of Agriculture, Fisheries and Food, London, United Kingdom.
- GUBLER, J. G. H. 1992. Septic arthritis of the knee induced by *Pasteurella multocida* and *Bacteroides fragilis* following an attack by a wild boar. *Journal of Wilderness Medicine* 3:288-291.
- GUNDEZ, A., S. TUREDI, I. NUHOGLU, A. KALKAN, and S. TURKMEN. 2007. Wild boar attacks. *Wilderness and Environmental Medicine* 18:117-119.
- HATAKE, K., T. TANIGUCHI, M. NEGORO, H. OUCHI, T. MINAMI, and S. HISHIDA. 1995. A case of death of a woman attacked by a wild boar. *Research and Practice in Forensic Medicine* 38:275-277.
- HIGASHINADA WARD OFFICE (KOBE-CITY, JAPAN). 2003. Wild boars: about wild boars. <http://www.city.kobe.jp/cityoffice/81/e/wild/index.html>. Accessed 20 Apr 2007.
- HORANSKY, A. 2011. Marble Falls man attacked by feral pig. KVUE News. <http://www.kvue.com/news/local/Marble-Falls-man-attacked-by-feral-pig-125454263.html>. Accessed 18 Jul 2011.
- KAMAT, K. L. 1997. Cave paintings of India: prehistoric rock paintings of Bhimbetaka. <http://www.kamat.com/kalranga/rockpaint/6016.htm>. Accessed 10 Jul 2007.
- KIM, G. 2008. Wild boars threaten many S. Korean cities. *The Seoul Times*.

- <http://theseoultimes.com/ST/?url=/ST/db/re ad.php?id=6806&PHPSESSID=6d1d44db c61afc47355da2bd696a602f>. Accessed 7 Jul 2008.
- KOSE, O., F. GULER, A. B. BAZ, S. AKALIN, and A. TURAN. 2011. Management of a wild boar wound: a case report. *Wilderness and Environmental Medicine* 22:242-245.
- LEVER, C. 1985. *Naturalized mammals of the world*. Longman, London, United Kingdom.
- MANGASARIAN, L. 2010. Berlin's wild boar population cut in half by hunters, coldness. <http://www.businessweek.com/news/2010-03-12/berlin-s-wild-boar-population-cut-in-half-by-hunters-coldness.html>. Accessed 22 Apr 2010.
- MANIPADY, S., R. G. MENEZES, and B. K. BASTIA. 2006. Death by attack from a wild boar. *Journal of Clinical Forensic Medicine* 13:89-91.
- MASSEI, G. 2010. Too many pigs? Population trends and control methods for wild boar and feral pigs. Page 29 in 2010 International Wild Pig Conference – Science and Management. 11-13 April 2010, Pensacola, Florida, USA.
- MAYER, J. J., and I. L. BRISBIN, JR. 1988. Sex identification of *Sus scrofa* based on canine morphology. *Journal of Mammalogy* 69:408-412.
- MAYER, J. J., and I. L. BRISBIN, JR., editors. 2009. Wild pigs: biology, damage, control techniques and management. SRNL-RP-2009-00869. Savannah River National Laboratory, Aiken, South Carolina, USA.
- MCDOWELL, M. A., C. D. FRYAR, C. L. OGDEN, and K. M. FLEGAL. 2008. Anthropometric reference data for children and adults: United States, 2003-2006. National Health Statistics Report No. 10, U.S. Department of Health and Human Services, Washington, D.C., USA.
- MEMELONI, P. H., and A. M. CHAND. 2002. Killed by a boar. *International Journal of Medical Toxicology and Legal Medicine* 5:10.
- MORRIS, S. 2007. Woman, 80, saves pet from wild boar on Dartmoor. *The Guardian/Guardian Unlimited*. http://www.guardian.co.uk/uk_news/story/0,1982175,00.html. Accessed 20 Apr 2007.
- MOREHOUSE, L. G., L. D. KINTNER, and S. L. NELSON. 1968. Rabies in swine. *Journal of the American Veterinary Medical Association* 153:57-64.
- PHILLIPS, W. W. A. 1935. *Manual of the mammals of Ceylon*. Dulau & Co., Ltd, London, United Kingdom.
- PRADESH, A. 2009. Boar attacks child. <http://www.thehindu.com/2009/09/20/stories/2009092058970600.htm>. Accessed 27 Sep 2009.
- RAJENDRA, K. R., and K. CHANDRU. 2011. Death – who caused it? Wild boar or Doctor – case report. *Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology*, 12(2). http://www.anilaggrawal.com/ij/vol_012_no_002/papers/paper001.html. Accessed 8 Dec 2011.
- RAPPAPORT, R. A. 1968. *Pigs for the ancestors: ritual in the ecology of a New Guinea people*. Yale University Press, New Haven, Connecticut, USA.
- RICCIUTI, E. R. 1976. *Killer animals*. Walker Publishing Company, Inc., New York, USA.
- ROCKENBACH, S. I. 2005. "War upon our border": War and society in two Ohio valley communities, 1861-1865. Ph.D. Dissertation, University of Cincinnati, Ohio, USA.
- SAN ANTONIO NEWS. 2006. Wild hog attacks man. <http://www.ksat.com/news/9424590/detail.html>. Accessed 21 Feb 2009.
- SEVERN TEMPLE. 2004. Graveyard: those who have left the covenant. *Severn Temple Covenant*. <http://www.sophist.talktalk.net/dead.htm>. Accessed 27 Jun 2007.
- SHETTY, M., R. G. MENEZES, T. KANCHAN, B. S. K. SHETTY, and A. CHAUHAN. 2008. Fatal craniocerebral injury from wild boar attack. *Wilderness and Environmental Medicine* 19:222-223.
- THE HINDU (ONLINE EDITION OF INDIA'S NATIONAL NEWSPAPER). 2009. Wild boar kills farmer. <http://www.thehindu.com/009/08/09/stories/2009080951920400.htm>. Accessed 13 Aug 2009.
- THE INDEPENDENT (LONDON). 2004. Hungry wild boar attacks man in apartment. http://findarticles.com/p/articles/mi_qn4158

- [/is 200040101/ai n9685504](#). Accessed 24 Apr 2007.
- TISDELL, C. A. 1982. Wild pigs: environmental pest or economic resource? Pergamon Press, New York, USA.
- TOWNE, C. W., and E. N. WENTWORTH. 1950. Pigs from cave to cornbelt. University of Oklahoma Press, Norman, USA.
- TRIBUNE NEW SERVICE. 2008. Leopard, wild boar injure two. <http://www.tribuneindia.com/2008/20080207/himachal.htm#10>. Accessed 9 Feb 2008.
- WALKER, M. 2008. In Berlin's boar war, some side with the hogs. The Wall Street Journal 252:A1
- WILLIAMS, D. J., A. J. ANSFORD, D. S. PRIDAY, and A. S. FORREST. 1998. Forensic pathology: colour guide. Elsevier Health Services, Elsevier Press, New York, USA.
- WILSON, C. J. 2005. Feral wild boar in England: status, impact and management. DEFRA, RDS National Wildlife Management Team, Exeter, United Kingdom.