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Trauma From Wild Boar Encounters During Hunting: A Nationwide Characterization of Injury Patterns and Outcomes in Germany

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Abstract

Background/Objectives: Injuries caused by wild boar during hunting are repeatedly reported worldwide, yet the scientific literature is remarkably sparse and largely limited to isolated case reports, forensic analyses of fatal events or heterogeneous international compilations. Before this study, no structured nationwide data existed for Germany or comparable European hunting systems. This study aimed to systematically characterize wild boar–related hunting injuries and expand the empirical knowledge base. **Methods:** In this nationwide exploratory study, German hunters who had sustained at least one wild boar–related injury were recruited via hunting journals. Structured physician-led telephone interviews were conducted using a standardized questionnaire. Data were pseudonymized and analyzed descriptively, stratifying injuries into closed, outpatient open and inpatient open categories. **Results:** A total of 101 injured hunters were included, representing the largest systematically collected cohort of wild boar hunting injuries to date. Most were highly experienced male dog handlers injured during close-range tracking of wounded wild boar. Injuries predominantly involved the lower extremities. Open injuries—particularly those requiring inpatient treatment—were associated with extensive surgical management, higher complication rates, prolonged recovery and persistent functional impairment. Despite severe courses, all participants resumed hunting. **Conclusions:** This study substantially expands the previously limited evidence base on wild boar–related hunting injuries by providing structured nationwide data across the full spectrum of injury severity. The findings offer transferable insights relevant to hunting practices, prevention strategies and clinical management in international contexts where wild boar populations and hunting activity are increasing.

Keywords: wild boar; hunting injuries; penetrating trauma; lower-extremity injury; tracking operations

1. Introduction

Wild boar hunting is an integral component of wildlife management in Germany and has increased markedly over recent decades as a consequence of expanding wild boar populations, changing land use and growing ecological and agricultural impacts. In addition to conventional hunting methods such as stand hunting and driven hunts, German hunters frequently engage in tracking operations (Nachsuchen) of wounded animals. These close-range encounters, often conducted in dense vegetation and under time pressure, place hunters at particular risk of direct confrontation with defensive wild boar.

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Severe injuries and occasional fatalities caused by wild boar are repeatedly reported in German media and hunting forums. Despite this recurrent public attention, the medical literature provides almost no systematic data on the epidemiology, injury mechanisms or clinical outcomes of such incidents. Existing evidence consists largely of older clinical observations [1], forensic analyses of fatal events [2] and a broader overview of wild pig attacks [3], which described general injury patterns but did not focus specifically on European hunting contexts. More recent regional case series, such as a study from Spain [4], confirm a predominance of male victims and lower-extremity trauma, yet these reports encompass diverse non-hunting encounters and therefore offer limited insight into the risks associated with organized hunting and tracking operations. For Germany and much of Europe, structured, nationwide data on hunting-related boar injuries have been entirely lacking.

Wild boar attacks typically involve penetrating soft-tissue trauma caused by tusks and bites, frequently affecting the lower extremities and potentially resulting in complex injuries involving vessels, nerves, bones and deep soft tissues—patterns highlighted in both older clinical descriptions and more recent compilations [1,3,4]. Such injuries can necessitate extensive surgical care and prolonged rehabilitation. At the same time, hunters constitute a unique risk group characterized by high exposure, extensive experience and a strong cultural commitment to hunting. A comprehensive understanding of the contextual circumstances of attacks, injury severity, treatment trajectories, long-term outcomes and post-injury behavioral adaptations is therefore essential.

Given the recurring anecdotal reports and the limited but consistent findings of previous studies, we hypothesized that (1) most wild boar–related hunting injuries in Germany occur during tracking operations and (2) open penetrating injuries—particularly to the lower extremities—are associated with substantially greater surgical requirements, longer recovery and higher complication rates than closed injuries.

The present study was designed to address the existing knowledge gap by providing the first systematic, nationwide characterization of wild boar–related hunting injuries in Germany. Using structured physician-led interviews, we analyzed self-reported cases from affected hunters to document demographics, hunting exposure, circumstances of injury, anatomical and clinical injury patterns, medical management and complications, and both short- and long-term outcomes. By capturing minor through severe injuries across a broad geographic and temporal range, this exploratory study aims to establish an empirical foundation for future preventive measures, targeted training concepts and improved clinical awareness and management of wild boar–related trauma.

2. Materials and Methods

This investigation was designed as a monocentric, exploratory, observational study aiming to systematically document injuries associated with wild boar hunting in Germany. The objective was to gather detailed, structured information from affected hunters in order to characterize injury mechanisms, clinical features, treatment pathways and outcomes.

The study was conducted in accordance with the Declaration of Helsinki and applicable German data protection regulations. It was approved by the Ethics Committee of Ludwig-Maximilians-University of Munich (Munich, Germany; reference 24-0377; date of approval 05 June 2024).

Participation was voluntary, withdrawal was possible at any time without disadvantage, and no interventions, risks or burdens beyond the interview time were involved.

Participants were adults aged 18 years or older who hunted in Germany, actively engaged in wild boar hunting within Germany, and had sustained at least one injury in direct association with such hunting activities. Individuals were eligible only if they were able to answer the study questionnaire completely and truthfully and had no conditions that interfered with participation. Recruitment was carried out on a voluntary basis following an announcement of the study in several of the most widely read German hunting journals ("Wild und Hund", "Pirsch", "Nachrichtenblatt des Deutschen Jagd Terrier – Club e.V.") and hunting social media channels. Interested individuals contacted the study team directly and received further study materials.

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After expressing interest, each potential participant was provided with an information sheet and the required consent documents. Written informed consent was obtained. Data acquisition took place via structured telephone interviews conducted by the first author of this study, who is an experienced physician with expertise in orthopedics, trauma medicine and hunting practice. During these interviews, the structured questionnaire was completed manually on paper. Each interview lasted approximately one hour.

The questionnaire comprised four major domains: demographic characteristics; hunting experience and exposure to wild boar; detailed information on the injury event, including anatomical localization, injury type, circumstances and characteristics of the involved wild boar; and medical management, recovery and subjective impressions. If a single event resulted in multiple injuries, each injury was documented separately. Injury characterization included whether the injury was open or closed, the affected body region, the specific anatomical structures involved and the presence of fractures, vascular injuries or nerve damage. Participants provided detailed information on temporal and environmental conditions at the time of injury – including hunting method and lighting – as well as the sex and measured weight of the wild boar involved. Medical treatment pathways were recorded, including pre-hospital care, outpatient or inpatient management, surgical interventions, rehabilitation, total duration of medical treatment and duration of work absenteeism. Self-reported healing outcomes and the presence or absence of persistent functional impairment were documented at the time of data collection.

To ensure data protection and confidentiality, a two-part pseudonymization system was used. Each paper questionnaire comprised an upper section with identifying information and a lower section containing only a sequential identification number. After the interview, a physical copy of the completed questionnaire was produced; the identifying section was removed from the copy and destroyed, and only the pseudonymized section was retained for analysis. The original questionnaire was stored securely in the clinic of the first author of this study in accordance with standard clinical documentation procedures.

All pseudonymized data were manually entered into Excel files (Microsoft, Redmond, WA, USA). Given the exploratory nature of the study, analyses were descriptive and conducted by predefined injury groups (closed injuries, open injuries treated on an outpatient basis and open injuries requiring inpatient treatment). Continuous variables (e.g., age, anthropometric data, hunting experience, measured wild boar weight) were summarized using means and ranges, while categorical variables (e.g., sex, hunting role, protective equipment use, injury characteristics, treatment pathways and outcomes) were reported as absolute numbers and percentages. Participants were counted once per variable unless otherwise specified; injuries involving multiple anatomical regions or characteristics were documented accordingly.

No formal inferential statistical tests, multivariable analyses or adjustments for multiple comparisons were performed, as the study was not designed to test causal associations or predictive models. Missing data were rare and were not imputed; analyses were conducted using available-case methodology. Statistical analyses were performed using GraphPad Prism (version 10.6.1; GraphPad Software, Boston, MA, USA). All results were presented in tabular form to provide transparent and comprehensive reporting of the collected data.

3. Results

3.1. Demographic Characteristics

A total of 101 individuals who sustained wild boar–related injuries during hunting activities were included in the study and categorized into three groups: closed injuries (n = 23), open injuries treated on an outpatient basis (n = 46) and open injuries requiring inpatient treatment (n = 32). Across all three groups, the population was overwhelmingly male, with proportions between 96% and 97%. The mean age at the time of injury was 49.1 years in the closed-injury group, 50.2 years in the outpatient open-injury group, and 47.0 years in the inpatient open-injury group, with ranges

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extending from the early 20s to the mid-70s. Body height at the time of the interview was similar across groups, averaging approximately 181 cm, while average body weight ranged from 83.5 to 91.0 kg. Corresponding BMI values varied by sex and group, with mean values of 26.0 (men) and 21.8 (women) in the closed-injury group, 25.7 (men) and 24.1 (women) in the outpatient group, and 28.0 (men) and 22.9 (women) in the inpatient group (Table 1).

Table 1. Demographic characteristics of the study population.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Sex (male)	22 (95.6%)	44 (95.7%)	31 (96.9%)
Sex (female)	1 (4.4%)	2 (4.3%)	1 (3.1%)
Mean age at injury (years)	49.1	50.2	47.0
Age range (years)	26–74	22–74	24–75
Mean height (cm)	180.6	180.6	180.8
Height range (cm)	170–196	165–200	165–200
Mean weight (kg)	84.3	83.5	91.0
Weight range (kg)	63–102	64–120	63–125
BMI (men)	26.0	25.7	28.0
BMI (women)	21.8	24.1	22.9
Hunting experience (years), mean	25.3	30.6	24.4
Hunting experience range (years)	4–57	4–56	3–50

3.2. Hunting Experience and Exposure

Participants reported extensive hunting experience. Mean hunting seniority at the time of injury was 25.3 years in the closed-injury group, 30.6 years at the time of interview in the outpatient open-injury group and 24.4 years in the inpatient open-injury group (Table 1). Minimum hunting experience ranged from 3 to 4 years, while maximum experience reached 50 to 57 years (Table 1).

All participants stated that they had more than five wild boar contacts per hunting year. Exposure to tracking operations (Nachsuchen) was substantial across all groups. In the closed-injury group, 6 individuals reported fewer than 50 tracking events per year, 7 reported 50 to 100, and 10 reported more than 100, with 6 of the latter conducting more than 200 per year. In the outpatient open-injury group, 17 reported fewer than 50 tracking operations, 10 reported 50 to 100, and 19 reported more than 100, including 13 individuals conducting more than 200. In the inpatient group, 16 reported fewer than 50 tracking operations, 7 reported 50 to 100, and 9 reported more than 100, with 4 of these carrying out more than 200 per year (Table 2).

Table 2. Hunting exposure and hunting roles.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Dog handlers	22 (95.7%)	44 (95.7%)	29 (90.6%)
Registered tracking teams	15	13	16

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>5 wild boar contacts/year	23 (100%)	46 (100%)	32 (100%)
Tracking operations <50/year	6	17	16
Tracking operations 50–100/year	7	10	7
Tracking operations >100/year	10	19	9
>200 tracking operations/year	6	13	4
Hunting methods – Stand hunting	18 (78.3%)	34 (73.9%)	29 (90.6%)
Hunting methods – Stalking	13 (56.5%)	32 (69.6%)	31 (96.9%)
Hunting methods – Driven hunt	17 (73.9%)	38 (82.6%)	30 (93.8%)
Hunting methods – Tracking	19 (82.6%)	42 (91.3%)	31 (96.9%)

3.3. Hunting Regions, Roles, and Techniques

Participants were active in numerous German federal states, including Baden-Württemberg, Bavaria, Hesse, North Rhine–Westphalia, Rhineland-Palatinate, Saarland, Schleswig-Holstein, Thuringia and others depending on the group. A large majority were dog handlers at the time of injury, comprising 22 of 23 individuals with closed injuries, 44 of 46 with outpatient open injuries and 29 of 32 with inpatient open injuries. Between 13 and 16 handlers per group were registered tracking-dog teams (Table 2).

Most individuals used several hunting techniques. In the closed-injury group, stand hunting, stalking, driven hunts and tracking were all frequently reported, with tracking being the most prevalent. Similar distributions were seen in the outpatient open-injury group. In the inpatient open-injury group, nearly all participants reported involvement in stalking and tracking, and more than 90% reported driven hunts (Table 2).

3.4. Protective Equipment and Weapons

Use of protective equipment varied considerably. In the closed-injury group, 56.5% wore protective trousers, 26.1% wore both trousers and jacket, and 17.4% wore no protective clothing at all. In the outpatient open-injury group, 58.7% wore protective trousers, 21.7% wore both items, while 19.6% wore none. In the inpatient open-injury group, 65.6% reported wearing protective trousers, 3.1% wore both trousers and jacket, and 31.3% wore none. With regard to weapons, almost all participants carried a long gun—predominantly rifles. A minority in each group additionally carried a handgun, and all participants carried a hunting knife (Table 3).

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Table 3. Protective equipment and weapons used at the time of injury.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
No protective clothing	4 (17.4%)	9 (19.6%)	10 (31.3%)
Protective trousers only	13 (56.5%)	27 (58.7%)	21 (65.6%)
Protective trousers + jacket	6 (26.1%)	10 (21.7%)	1 (3.1%)
Carried rifle	22	42	30
Carried shotgun	1	1	0
Carried handgun (in addition to long gun)	2	6	3
Carried knife	23	46	32

3.5. Temporal Distribution of Injuries

Injuries in the closed-injury group occurred between 1982 and 2024, with the majority reported after 2019. Outpatient open injuries occurred between 1985 and 2024, also peaking after 2019, while inpatient open injuries occurred between 1991 and 2024 with similar temporal clustering. Seasonal distribution revealed that most closed injuries occurred in November, most outpatient open injuries in December and August, and most inpatient open injuries in November and August. Nearly all incidents occurred during daylight; only three injuries across all groups took place in darkness (Table 4).

Table 4. Circumstances of injury events.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Tracking operations	18	42	24
Driven hunts	3	4	8
Other activities	2	0	0
Daylight	23 (100%)	45 (97.8%)	30 (93.8%)
Darkness	0	1	2
Male wild boar (Keiler)	14	35	30
Female wild boar (Bache)	8	10	2
Unknown	1	1	0
Mean boar weight (kg)	76.9 (Keiler) / 69.1 (Bache)	82.2 (Keiler) / 85.3 (Bache)	72.0 (Keiler) / 95.0 (Bache)

3.6. Situational Context and Characteristics of the Injuring Wild Boar

Tracking operations represented the predominant context at the time of injury. Eighteen of 23 closed injuries, 42 of 46 outpatient open injuries and 24 of 32 inpatient open injuries occurred during tracking. Additional injuries occurred during driven hunts, movement hunts, dog training, carcass retrieval or routine activities within the hunting district (Table 4).

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Most injuries across all groups were inflicted by male wild boar (Keiler). Mean measured body weights ranged from 72.0 to 85.3 kg across groups, with minimum values around 25–40 kg and maximum values reaching 135–155 kg. Injuries caused by sows (Bachen) were less common. One injury in the outpatient open-injury group was most probably inflicted by a subadult animal (Überläufer); however, the animal escaped and could therefore not be exactly characterized (Table 4).

3.7. Injury Distribution and Patterns

Lower-extremity injuries dominated across all groups. In the closed-injury group, 16 injuries involved the lower extremity only, three involved both upper and lower extremities, two involved the upper extremity only, and the remaining two involved the thorax or combined thoracic, abdominal and pelvic regions. In outpatient open injuries, 32 injuries were confined to the lower extremity, 4 involved both extremities, 7 involved the upper extremity only, 2 included pelvic involvement in combination with other regions, and one injury affected the face. In inpatient open injuries, 21 injuries affected the lower extremity alone, 7 affected both upper and lower extremities, 3 affected the upper extremity alone, and one involved the thorax in combination with lower-extremity injury.

Within the lower extremity, the lower leg and knee were the most frequently affected regions, followed by thigh and ankle injuries. Upper-extremity injuries included lesions of the hand, forearm, elbow, upper arm and shoulder. Thoracic, abdominal, pelvic and facial injuries occurred infrequently (Table 5).

Table 5. Anatomical distribution and type of injuries.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Lower extremity only	16	32	21
Lower + upper extremity	3	4	7
Upper extremity only	2	7	3
Thorax	1	0	1
Abdomen/pelvis	1	2	0
Face	0	1	0
Open injuries	0	46	32
Closed injuries	23	0	0
Fractures	2	1	3
Vascular injuries	0	0	6
Nerve injuries	0	0	2
Soft-tissue injuries	20	46	32

3.8. Injury Types

Closed injuries were predominantly soft-tissue injuries, with 20 cases limited to soft tissue, two fractures and one combined fracture and soft-tissue injury. In contrast, all outpatient and inpatient open injuries involved open soft-tissue wounds. In the outpatient open-injury group, one individual also sustained a fracture. In the inpatient group, additional injury components included fractures in three cases, vascular injuries in six cases and nerve injuries in two cases (Table 5).

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3.9. Time to First Help

Time to initial help was generally short. In the closed-injury group, 16 individuals received help within one hour, six within two to six hours and one within 24 to 48 hours. In the outpatient open-injury group, 16 received help within one hour, 28 within two to six hours and two within six to twelve hours. In the inpatient open-injury group, 18 received help within one hour, 13 within two to six hours and one within twelve to twenty-four hours (Table 6).

Table 6. Time to first help and treatment pathways.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
<1 hour to first help	16	16	18
1–6 hours	6	28	13
6–12 hours	0	2	1
12–24 hours	0	0	1
24–48 hours	1	0	0
Self-treatment only	16	6	0
Outpatient only	7	46	0
Hospital admission	3	0	32
Operative treatment	1	35	32
Rehabilitation (any)	3	5	10

3.10. Treatment Pathways and Duration

Treatment patterns reflected the severity of injury in each group. In the closed-injury group, 16 individuals treated themselves exclusively, while 5 sought hospital care; 3 required inpatient treatment due to fractures or ligament rupture. In the outpatient open-injury group, all 46 individuals received outpatient treatment, although 35 required operative management. In the inpatient open-injury group, all 32 individuals required hospital admission and surgery (Table 6).

Treatment duration varied widely. Around half of the participants with closed or outpatient open injuries required treatment for 14 days or less, while more prolonged treatment durations of up to three months or beyond were more common in the inpatient group. Rehabilitation programs were initiated in 13.0% of those with closed injuries, 10.9% with outpatient open injuries and 31.3% with inpatient open injuries (Table 7).

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Table 7. Healing outcomes and work absenteeism.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Complete healing	22 (95.7%)	45 (97.8%)	21 (65.6%)
No functional impairment	22	45	24
Persistent impairment	1	1	8
No work absence	11 (47.8%)	14 (30.4%)	17
<14 days work absence	4	7	7
3 weeks–3 months	7	24	8
>3 months	1	1	0

3.11. Work Absenteeism

Work absence varied with injury severity. In the closed-injury group, nearly half of participants reported no work absence. In the outpatient open-injury group, more than half reported absences of three weeks to three months. In the inpatient open-injury group, 15 participants reported absences beyond the acute treatment phase, most commonly lasting between three weeks and three months (Table 7).

3.12. Healing Outcomes

Rates of complete healing differed substantially. In the closed-injury group, 95.7% reported complete healing, as did 97.8% of those in the outpatient open-injury group. In contrast, only 65.6% of those in the inpatient open-injury group reported complete healing at the time of data collection. Persistent functional impairment was noted only in the more severe open-injury categories (Table 7).

3.13. Severe Complicated Courses Requiring Surgical Revisions

A subset of severe inpatient open injuries required repeated surgical revisions. Eleven case narratives reflected extensive soft-tissue trauma, frequent infectious complications, repeated debridement and irrigation, negative pressure wound therapy and delayed wound closure. Some cases involved vascular injury, compartment syndrome, septic deterioration requiring prolonged hospitalization and deep venous thrombosis. One individual ultimately required a joint replacement in the lower limb following a seemingly superficial ankle wound; further details cannot be reported due to an ongoing legal dispute. Hospital stays ranged from several days to three weeks, and work incapacity extended from weeks to several months.

3.14. Preparedness, First-Aid Knowledge, and Training Needs

Self-reported first-aid knowledge varied. While most participants in all groups stated they possessed first-aid knowledge, self-assessed competence differed, with a notable proportion of participants in the inpatient open-injury group rating their knowledge as insufficient. The large majority of all participants—ranging from 87% to 96%—expressed the need for additional first-aid training. At the moment of injury, between one third and one half of participants felt prepared, while up to two thirds in the inpatient group felt unprepared (Table 8).

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Table 8. Preparedness, first-aid knowledge and behavioral changes.

Variable	Closed Injuries (n=23)	Open Injuries, Outpatient (n=46)	Open Injuries, Inpatient (n=32)
Felt prepared	10 (43.5%)	24 (52.2%)	11 (34.4%)
Felt unprepared	12 (52.2%)	22 (47.8%)	20 (62.5%)
First-aid knowledge rated “good”	12	23	13
First-aid knowledge rated “adequate”	9	20	11
First-aid knowledge rated “insufficient”	2	3	8
Additional training considered necessary	22	44	28
Changed protective equipment	6	24	24
Changed weapons	3	11	8
Changed tactics	6	16	16
Changed strategy	2	5	6
Stopped hunting	0	0	0

3.15. Post-Injury Behavioral Changes

Many participants reported adopting modified hunting practices following the injury. Changes in protective equipment were most common and increased with injury severity, reported by 26.1% of the closed-injury group, 52.2% of the outpatient open-injury group and 75.0% of the inpatient open-injury group. Changes in weapon configuration, hunting tactics and overall strategy were also frequently noted. Importantly, no participant in any group ceased hunting as a result of the injury (Table 8).

3.16. Qualitative Statements

Qualitative responses from all 101 participants revealed consistent themes emphasizing the unpredictability and inherent danger of wild boar encounters, particularly during tracking operations. Many described their experiences as sudden, surprising or unavoidable. Participants repeatedly highlighted the importance of caution, daylight tracking, maintaining visual awareness in dense vegetation, reliance on experienced hunting companions and the essential role of dogs and protective equipment. Several accounts reflected errors attributed to distraction, routine or overconfidence, while others were framed as formative or life-changing experiences. Despite the severity of some injuries, all individuals expressed continued commitment to hunting.

4. Discussion

This nationwide exploratory study provides the most comprehensive characterization to date of wild boar–related hunting injuries in Germany and substantially expands the limited international evidence base on this topic. While earlier publications have primarily consisted of case reports, forensic analyses or heterogeneous global compilations [1–3], the present dataset offers a detailed, structured account of demographics, exposure patterns, injury characteristics, treatment pathways, outcomes and post-injury behavioral adaptations across a broad spectrum of injury severity. In doing so, it both confirms several patterns described in the literature and reveals important differences that

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refine current understanding of wild boar–inflicted trauma in a contemporary European hunting context.

One of the most striking findings is the profile of the injured population. Across all severity groups, injured hunters were almost exclusively male and predominantly middle-aged, with mean ages close to 50 years at the time of injury. This male predominance mirrors prior reports, including a Spanish case series [4] and an earlier global analysis [3], both of which identified adult men as the most frequently affected group. However, an important distinction in the present study is the exceptionally high level of hunting experience among injured individuals. Mean hunting seniority ranged from approximately 24 to over 30 years depending on group, with some participants reporting more than five decades of experience. Earlier literature has often included a mix of hunters, farmers or civilians with variable familiarity with wild boar, and in some accounts injuries were implicitly associated with inexperience or unexpected encounters [1–3]. In contrast, the present data demonstrate that extensive experience and routine exposure do not confer protection against injury. All participants reported frequent wild boar contacts, and a substantial proportion—particularly among outpatient open injuries—conducted more than 100, and in some cases more than 200, tracking operations per year. This finding refines the prevailing narrative by showing that risk is not confined to novice hunters or rare encounters but is concentrated among highly active specialists, especially tracking dog handlers.

The dominance of tracking operations as the situational context of injury further differentiates this cohort from much of the existing literature. While previous studies have described attacks during hunting in general terms, few have quantified the specific activities involved [3]. In the present study, tracking wounded wild boar accounted for the majority of injuries across all groups, including 91–97% of outpatient and inpatient open injuries. This proportion is higher than that reported in broader international compilations, where attacks were distributed across hunting, agricultural work and accidental encounters [3]. The present findings therefore sharpen the focus on Nachsuche as the primary risk scenario within the German hunting system, emphasizing that injury risk is concentrated at a specific moment in the hunting process rather than being evenly distributed across activities.

The characteristics of the injuring animals show both continuity and nuance relative to earlier reports. Consistent with the literature, most injuries were inflicted by male wild boar, and measured body weights were substantial, frequently exceeding 70 kg. Forensic analyses have long emphasized the danger posed by large adult males, particularly solitary individuals [2,3], and the present findings reinforce this association. At the same time, the data reveal that injuries were not exclusively caused by exceptionally large animals; some incidents involved boar of moderate size, and injuries inflicted by sows were documented in all groups. This observation challenges an overly simplistic equation of risk with extreme animal size alone and suggests that behavioral context—wounded, defensive and at close range—may be more critical than absolute body mass. Compared with older descriptions that focused heavily on “giant” boars [2,3], the present data indicate that particularly average-sized animals (including Überläufer) can inflict severe trauma when encountered under these conditions.

Anatomical injury distribution represents one of the strongest points of convergence with existing literature, but the present study adds important granularity. Lower-extremity injuries dominated across all groups, accounting for approximately two-thirds to three-quarters of cases, closely aligning with the proportions reported in ealier reports [3,4]. Forensic work [2] similarly highlighted lower-limb trauma, particularly deep thigh wounds, as a defining feature of fatal attacks. The present data confirm that this lower-extremity predominance extends across the full spectrum of severity, from closed blunt injuries to complex penetrating trauma. Importantly, the detailed breakdown within the lower extremity—showing the lower leg and knee as the most frequently affected sites—adds anatomical precision that has rarely been provided in previous publications. This distinction has direct implications for both protective equipment design and clinical assessment.

At the same time, the German cohort demonstrates a broader anatomical range of injuries than is often emphasized in the literature. Although less common, injuries to the upper extremities, pelvis,

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thorax, abdomen and face were documented, particularly in the more severe groups. Prior reviews have tended to focus on leg injuries to the exclusion of other regions [3,4], potentially underestimating the diversity of injury patterns. The presence of thoracic and abdominal injuries in the present cohort, albeit rare, suggests that reliance on lower-limb protection alone may leave hunters vulnerable in certain attack configurations, especially when the animal's movement or the hunter's posture deviates from the typical scenario.

The stratification of injuries into closed, outpatient open and inpatient open categories represents a methodological advance relative to much of the existing literature [1–3] and reveals clinically meaningful differences that are often obscured in aggregated case series. Closed injuries were predominantly soft-tissue contusions or blunt trauma, frequently self-managed in the field and associated with rapid recovery. Such minor injuries are rarely described in the literature, which tends to focus on dramatic penetrating wounds or fatal cases [2,3]. By contrast, all open injuries in the present cohort involved soft-tissue penetration, and a substantial proportion required operative management. Notably, even among outpatient open injuries, more than three-quarters underwent surgical intervention, a rate higher than might be inferred from earlier reports that implicitly equate outpatient care with minor trauma [1,4]. This finding suggests that the burden of surgical treatment associated with wild boar injuries may be underappreciated when analyses focus solely on hospitalized cases.

The inpatient open-injury group in particular illustrates how the present data extend beyond prior descriptions. Vascular injuries were documented in six cases and nerve injuries in two, proportions that are difficult to compare directly with the literature because such complications are often mentioned only anecdotally [1,2,4]. Forensic studies emphasize vascular injury as a cause of death [2], but systematic reporting of non-fatal vascular trauma is rare. The present findings demonstrate that arterial injuries occur in a substantial minority of severe cases and are survivable with timely care, yet they contribute significantly to morbidity, prolonged treatment and incomplete recovery. Similarly, the identification of nerve injuries, including peroneal nerve lesions with functional consequences, expands the known spectrum of boar-related trauma and underscores the need for careful neurologic assessment, even when initial wounds appear limited.

Time to first help in this cohort was notably short, with the majority of participants receiving professional evaluation within one hour and nearly all within six hours. This contrasts with many cases described in the older literature, particularly in rural or agricultural contexts, where delays were common and outcomes often worse. One study [3] identified exsanguination as a leading cause of death in wild pig attacks, frequently associated with delayed treatment. The absence of fatalities in the present study, despite the presence of severe vascular injuries, likely reflects this rapid access to care. However, the data also show that early help does not eliminate the risk of prolonged morbidity, as a significant fraction of hospitalized patients experienced extended recovery, repeated surgical revisions or lasting impairment.

Healing outcomes in this cohort highlight another important divergence from simplistic narratives in the literature. While prior publications often imply a binary outcome—survival versus death [1–3]—the present study demonstrates a gradient of recovery. Nearly all closed and outpatient open injuries healed completely, whereas only about two-thirds of inpatient cases achieved full recovery. Persistent functional impairment was confined to the more severe open-injury groups and included limitations that affected work capacity and daily activities. This nuanced outcome assessment extends beyond earlier reports, which rarely addressed long-term functional consequences [1–3], and emphasizes that the impact of wild boar injuries should not be measured solely by mortality statistics.

The documentation of severe complicated courses in eleven inpatient cases further illustrates this point. These narratives included repeated debridements, infectious complications, sepsis, compartment syndrome, thromboembolic events and, in one case, progression from an apparently superficial ankle wound to an incident necessitating joint replacement in the lower limb; further details cannot be reported due to an ongoing legal dispute. Such cases echo earlier warnings about

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the deceptive nature of tusk wounds described in [1], yet the present study contextualizes these observations within a modern healthcare setting, showing that even with contemporary surgical and antibiotic management, complications remain a significant risk. Compared with older reports that focused on acute injury mechanisms, the present findings underscore the prolonged and resource-intensive nature of recovery in severe cases.

A further area where this study meaningfully extends the literature is in its examination of preparedness, first-aid knowledge and behavioral adaptation. Although most participants reported having some level of first-aid training, a substantial proportion—particularly in the inpatient group—rated their competence as insufficient and up to two-thirds felt unprepared at the moment of injury. The near-universal desire for additional first-aid training contrasts with the implicit assumption in some hunting cultures that experience alone ensures readiness. Earlier studies rarely addressed preparedness explicitly [1–4]; by quantifying these perceptions, the present work identifies a modifiable factor that could influence outcomes, particularly given the central role of hemorrhage control in preventing fatality.

Behavioral changes following injury provide additional insight that has been largely absent from prior research [1–4]. None of the participants ceased hunting, underscoring the cultural and personal importance of this activity. However, many reported concrete changes, particularly regarding protective equipment, tactics and overall strategy, with the likelihood of change increasing markedly with injury severity. This gradient suggests that severe injury acts as a catalyst for reassessment of risk and preventive measures. The adoption of thermal imaging by some participants following their accidents further illustrates how personal experience may drive uptake of safety-enhancing technologies. These observations complement earlier literature by moving beyond injury description to consider how hunters respond and adapt, offering a more dynamic understanding of risk management in practice.

In comparison with existing studies, the present findings therefore occupy an intermediate position. They confirm core patterns described elsewhere—male predominance, lower-limb injuries, high risk during encounters with wounded boar [3,4]—while simultaneously refining these patterns by situating them within a highly experienced, highly exposed hunting population and by documenting outcomes and adaptations in detail. The German context, with its organized hunting structures and relatively rapid access to medical care, may partly explain differences from reports originating in agricultural or peri-urban settings, where delayed care and non-hunting victims feature more prominently. This highlights the importance of contextualizing wild boar injuries within specific social, cultural and healthcare systems rather than assuming uniform risk profiles across regions.

From a prevention perspective, the present data strengthen and specify recommendations suggested in earlier literature [1,3,4]. The overwhelming predominance of lower-extremity injuries supports continued emphasis on protective trousers and boots, but the presence of injuries outside this region suggests that upper-body protection may deserve greater attention than is currently common practice. The observation that a higher proportion of severely injured hunters were not wearing any protective clothing underscores a potential association between lack of protection and injury severity, although causal inference is limited. The strong demand for additional first-aid training suggests that targeted, scenario-based education focusing on hemorrhage control could address a recognized gap. Compared with earlier literature that often concluded with general calls for caution [3,4], the present study provides empirical support for specific, actionable interventions.

For clinicians, the findings reinforce established principles while adding nuance. The predictable predominance of lower-limb penetrating trauma aligns with prior descriptions, but the documented frequency of vascular, nerve and infectious complications emphasizes the need for thorough assessment even when external wounds appear limited. The German cohort demonstrates that prompt care can prevent death but does not obviate the need for aggressive management and follow-up. By providing systematic outcome data, the study complements earlier case-based literature and offers a more realistic picture of prognosis and recovery.

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The strengths of this study include its nationwide scope, structured data collection, inclusion of mild through severe cases and integration of quantitative and qualitative information. It represents the largest and most detailed series of wild boar hunting injuries reported to date and fills an important gap in the European context. At the same time, limitations inherent to voluntary participation, self-reported medical data and the absence of fatal cases must be acknowledged. These factors limit incidence estimation and may bias the sample toward more memorable events. Nevertheless, when interpreted alongside existing literature [1–4], the present findings provide a robust and complementary perspective rather than an isolated account.

In summary, this study confirms key patterns of wild boar–related hunting injuries described in earlier work [2–4] while substantially extending knowledge by focusing on a highly experienced hunting population, systematically stratifying injury severity and documenting outcomes, complications, preparedness and behavioral change. The data suggest that risk is concentrated not among inexperienced hunters but among those with the greatest exposure, particularly during tracking of wounded animals. While rapid medical care appears to mitigate fatal outcomes, severe injuries remain associated with prolonged recovery and lasting impairment. By situating these findings within the existing literature, the study contributes to a more nuanced and practically relevant understanding of wild boar–inflicted trauma and provides an empirical foundation for targeted prevention, training and clinical management strategies.

5. Conclusions

This exploratory investigation delivers the first structured, nationwide dataset of injuries sustained by hunters during encounters with wild boar in Germany. The analysis of 101 cases demonstrates that injuries occur primarily during close-range tracking of wounded male wild boar and typically involve the lower extremities, with open wounds often requiring extensive surgical treatment and showing higher complication rates. The dataset uniquely documents not only injury mechanisms and clinical courses but also long-term outcomes and behavioral adaptations—information that has previously been unavailable in this detail. These findings provide a much-needed empirical basis for developing targeted prevention strategies, advancing protective equipment and improving clinical awareness and management of boar-inflicted trauma.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The anonymized datasets generated and analyzed during this study are available from the corresponding author upon reasonable request and in compliance with institutional and data protection regulations.

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