# Ontology Specification Document

## Taxonomy of Classes

owl:Thing
- BodyLocation
    - Bone
    - InternalOrgan
    - Joint
    - Muscle
    - Nerve
    - Skin

- CauseOfWound
    - Bites
    - BluntForce
    - PenetratingForce
    - SharpForce
    - SurgicalProcedure

- SeverityLevel

- Treatment
    - FirstAid
        - ColdOrWarmCompress
        - BleedingControl
        - Disinfection
        - Cleaning
        - Bandaging
    - MedicalTreatment
        - SurgicalClosure
        - Debridement
        - TetanusProphylaxis
        - Antibiotic

- Wound
    - ClosedWound
    - OpenWound
    - SurgicalWound

## Object Properties (domain → range)

- hasCause : Wound → CauseOfWound
- hasLocation : Wound → BodyLocation (represents affected tissue layers)
- hasSeverity : Wound → SeverityLevel (Functional)
- hasTreatment : Wound → Treatment

## Data Properties (domain → range)

- hasDepthInMM → Wound → xsd:decimal
- healingDaysExpected → Wound → xsd:integer
- occurredOn → Wound → xsd:dateTime
- painLevel → Wound → xsd:integer

## Non-trivial Axioms & Constraints

**1. Axiom:** ClosedWound, OpenWound, SurgicalWound are pairwise disjoint
**Type:** Disjoint classes
**Justification:** The most fundamental distinction in wound classification: a wound cannot simultaneously be closed and open. SurgicalWound is a controlled open wound but remains disjoint from ClosedWound.

**2. Axiom:** FirstAid disjointWith MedicalTreatment
**Type:** Disjoint classes
**Justification:** First aid can be performed by laypersons without medical training or prescription drugs, while medical treatments (antibiotics, sutures, debridement, tetanus prophylaxis) require qualified healthcare professionals and sterile/prescription resources. Marking them disjoint prevents any action from being classified as both.

**3. Axiom:** Bites, BluntForce, PenetratingForce, SharpForce, SurgicalProcedure are pairwise disjoint
**Type:** Disjoint classes
**Justification:** A single wound event has exactly one primary physical mechanism of injury.

**4. Axiom:** Wound ⊑ ≥1 hasCause
**Type:** Minimum cardinality restriction (object property)
**Justification:** Every wound must have at least one documented cause. Causeless wounds do not exist in clinical practice.

**5. Axiom:** Wound ⊑ ≥1 hasLocation
**Type:** Minimum cardinality restriction (object property)
**Justification:** Every wound affects at least one body part.

**6. Axiom:** Wound ⊑ =1 hasSeverity
**Type:** Exact cardinality restriction (functional property)
**Justification:** A wound has exactly one severity level at any given time (Minor, Moderate, or Severe) — never multiple severities simultaneously.

**7. Axiom:** OpenWound ⊑ ≥1 hasTreatment
**Type:** Minimum cardinality restriction
**Justification:** All open wounds breach the skin and require at least one active intervention (cleaning, pressure, closure, antibiotics, etc.). Closed wounds may heal without treatment.

**8. Axiom:** SurgicalWound ⊑ hasCause only SurgicalProcedure
**Type:** Universal (allValuesFrom) restriction
**Justification:** By definition, only wounds intentionally created during an operation are classified as surgical wounds. No accidental trauma can produce a SurgicalWound.

**9. Axiom:** SurgicalWound ⊑ ≥1 hasTreatment
**Type:** Minimum cardinality restriction
**Justification:** Surgical incisions are always formally closed and usually receive prophylactic antibiotics — treatment is mandatory.

**10. Axiom:** BodyLocation, CauseOfWound, SeverityLevel, Treatment, Wound are pairwise disjoint
**Type:** Disjoint classes
**Justification:** These five branches represent fundamentally different concepts in the domain and can never overlap.

## Populated Instances

### Wound instances

- Contusion_Ankle (ClosedWound) – blunt trauma to ankle, treated with cold compress, Minor severity
- DogBite_Forearm (OpenWound) – ldog bite involving Skin, Muscle and Nerve, treated with pressure, disinfection, sutures, antibiotics and tetanus booster, Moderate severity
- Appendicectomy_Incision (SurgicalWound) – laparoscopic appendicectomy wound, treated with sutures and antibiotics, Minor severity

### Supporting individuals (punning)

- Severity levels: Minor, Moderate, Severe
- Causes: Dog (instance of Bites), metal_bed_frame (BluntForce), Laparoscopic_Appendicectomy (SurgicalProcedure)
- Treatments: Sutures and Staples (SurgicalClosure), TdBooster (TetanusProphylaxis), Antibiotic, cold_compress (ColdOrWarmCompress), etc.
- Body locations: Skin, Muscle, Nerve, InternalOrgan (Appendix), Bone, Joint

# Queries

SPARQL query:

```
# 1. OpenWound that received SurgicalClosure (i.e. needed sutures/staples)
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound WHERE {
  ?wound a :OpenWound ;
        :hasTreatment ?closure .
  ?closure a :SurgicalClosure .
}
```

| wound |
| --- |
| DogBite_Forearm |
| Appendicectomy_Incision |

SPARQL query:

```
# 2. All wounds that received antibiotics
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound WHERE {
  ?wound :hasTreatment ?abx .
  ?abx a :Antibiotic .
}
```

| wound |
| --- |
| DogBite_Forearm |
| Appendicectomy_Incision |

SPARQL query:

```
# 3. All surgical wounds
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound WHERE {
  ?wound a :SurgicalWound .
}
```

| wound |
| --- |
| Appendicectomy_Incision |

SPARQL query:

```
# 4. All wounds that involve/affect the skin
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound WHERE {
  ?wound :hasLocation :Skin .
}
```

| wound |
| --- |
| DogBite_Forearm |
| Appendicectomy_Incision |

SPARQL query:

```
# 5. Wounds expected to heal in 14 days or less
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound ?days WHERE {
  ?wound :healingDaysExpected ?days .
  FILTER (?days <= 14)
}
```

| wound | days |
| --- | --- |
| Appendicectomy_Incision | "14"^^<http://www.w3.org/2001/XMLSchema#integer> |
| Contusion_Ankle | "10"^^<http://www.w3.org/2001/XMLSchema#integer> |

SPARQL query:

```
# 6. Wounds with severe pain (≥7/10)
PREFIX : <http://www.semanticweb.org/hp/ontologies/2025/10/untitled-ontology-7#>
SELECT ?wound ?pain WHERE {
  ?wound :painLevel ?pain .
  FILTER (?pain >= 7)
}
```

| wound | pain |
| --- | --- |
| DogBite_Forearm | "8"^^<http://www.w3.org/2001/XMLSchema#integer> |