The Office of Medical Investigator Database
Conceptual Design Document (CDD) & Logical Relational Schema (LRC)

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Contents

1 The Office of Medical Investigator Database

The Forensic Anthropology Department at The Office of Medical Investigator (OMI) in Albuquerque states that they "investigate any death occurring in New Mexico that is sudden, violent, untimely, unexpected or where a person is found dead and the cause of death is unknown" (UNM Office of Medical Investigator, 2022). The OMI, which is a special program within the Department of Pathology, determines the cause and manner of death in these cases, and provides formal death certification. The OMI's database will be the powerhouse of all operations within their business. Ease of storing and accessing information regarding the cases that are currently under investigation and past cases is important to the OMI's mission. Each case has many identifiers such as the attributes of the body being investigated and details about their death. This data will be accessed by the database management team assigned by the Office of Medical Investigator. They will be able to add, edit and view information. All OMI employees will also be able to view information by multiple queries such as by date, time, location, etc. The Maxwell Museum of Anthropology is an important part of the OMI's goals and will be allowed to query for information about Does. Does are individuals who have not been identified by an individual or by any databases. In this paper is to expand on the scope of the database and identify specific information requirements. In section 2, we describe the notation and definitions used throughout the document. Next, section 3 expands on the conceptual schema of the database and an EER diagram will also be provided. Lastly, section 4 speaks on the example queries and possible extensions of the database.

2 Notation and definitions

The notation used: all upper case for entity names, lower case for the relationship names, and the first letter capitalized for attribute names.

The description of the entities starts with a sentence which explains their meaning. Then the attributes to describe the instances included. The relationships are described by a sentence and a list of attributes if needed.

Each attribute has a four-letter word code which describes the type of attribute according to the four classification criteria for attributes.

The format for this code is *(xyzw)*:

x tells whether the attribute is simple (S) or composite (C)

y tells whether the attribute has a single value (S) or is multivalued (M)

z tells whether the attribute is primitive (stored) (P) or derived (D), in case it is derived, an explanation of how to deduce it from other attributes or a formula/ procedure must be specified

w tells whether the attribute is fixed (F) (i.e. it must have a value that is not null) or optional (O), i.e. the domain of the attribute allows the null value

For example, an attribute that has the SSPF code is a simple attribute with a single value which is primitive and fixed. An example of this kind of attribute could be the Social Security Number (SSN). On the other hand, an attribute with the (CSPO) code is a composite attribute with a single value, primitive and optional. The date of birth could be an attribute with this code. If there is a single attribute that has the key constraint, it can be underlined. The key constraint is an entity set key that is used to identify an entity uniquely. If the key constraint applies to more than one attribute or if there are several combinations of attributes with the key constraint property it is better to list them separately.

If there are attributes that are very common and are used more than once, they can be defined as general types to be used as the type of each attribute which uses the same format.

3 Conceptual Schema of the Database

The order of presentation of the conceptual schema is:

1. Entities: description and attributes
2. Relationships: description and attributes (if they have them)
3. EER diagram
4. Explicit Integrity Constraints

The entities and relationships will be presented in alphabetical order.

3.1 Entities

- ARMS
- BIOLOGICAL_PROFILE
- BODY
- CASE
- CRANIAL
- DNA
- LEGS
- METHODS
- MODERN
- NONMODERN
- TAPHONOMY
- TORSO

A detailed description of each entity follows.

ARMS: Skeletal remains relating to the arms and hands of the body..

Attributes:	Completeness (0-100)	(SSPO)
	Humerus	(SMPO)
	Radius	(SMPO)
	Ulna	(SMPO)
	Carpals	(SMPO)
	Metacarpals	(SMPO)
	Hand Phalanges	(SMPO)

BIOLOGICAL_PROFILE: All properties that biologically identify the body.

Attributes:	Bioaffinity	(SMPO)
	Stature	(SSPO)
	Gender	(SSPO)
	Birth Date (DD/MM/YYYY)	(SMPO)
	Death Date (DD/MM/YYYY)	(SMPO)
	Zip code	(SSPO)

BODY: Physical remains that are currently or previously under investigation.

Attributes:	Completeness (0-100)	(SSPO)
	Date found (DD/MM/YYYY)	(SSPF)
	Time found (HH:MM:SS)	(SSPF)
	Location found	(SSPF)

CASE: An instance of a particular investigation.

Attributes:	OMI Case Number	(SSPO)
	Status (OPEN/CLOSED)	(SSPO)
	Start Date (DD/MM/YYYY)	(SSPF)
	End Date (DD/MM/YYYY)	(SSPF)

CRANIAL: Skeletal remains relating to the skull or cranium of the body.

Attributes:	Completeness (0-100)	(SSPO)
	Trauma	(CMPO)
	Parietal	(SMPO)
	Frontal	(SMPO)
	Occipital	(SMPO)
	Temporal	(SMPO)
	Sphenoid	(SMPO)
	Mandible	(SMPO)
	Lacrimal	(SMPO)
	Nasal	(SMPO)
	Ethmoid	(SMPO)
	Zygomatic	(SMPO)
	Maxilla	(SMPO)
	Dental	(SMPO)

DNA: Molecule containing the genetic information responsible for the development and function of the body currently under investigation.

Attributes:	Skeletal Element	(SMPO)
	Pulled (YES/NO)	(SSPO)
	Result	(SMPO)

LEGS: Skeletal remains relating to the legs and feet of the body.

Attributes:	Completeness (0-100)	(SSPO)
	Femur	(SMPO)
	Patella	(SMPO)
	Tibia	(SMPO)
	Fibula	(SMPO)
	Tarsals	(SMPO)

Metatarsals (SMPO)

Foot Phalanges (SMPO)

METHODS: Instances and descriptions of injuries occurring before, near, and after the time of death.

Attributes: Injury (SSPO)

Location (SSPO)

Occurrence (PRE-/PERI-/POST-MORTEM) (SSPO)

MODERN: Cases that identify with a more recent time period.

Attributes: Doe (YES/NO) (SSPO)

NONMODERN: Case that identify with a more historic or prehistoric context.

Attributes: **Maxwell ID Number** (SSPO)

Estimated Birth Date (DD/MM/YYYY) (SMPO)

Estimated Death Date (DD/MM/YYYY) (SMPO)

TAPHONOMY: Factors of decay and fossilization of specific bones throughout the body that show alterations due to natural factors.

Attributes: Bone found (SSPF)

Date found (DD/MM/YYYY) (SSPF)

Time found (HH:MM:SS) (SSPF)

Location found (SSPF)

Orientation (SSPF)

Artifacts (SMPO)

Taphonomic alterations (SMPO)

TORSO: Skeletal remains relating to the middle section or torso of the body.

Attributes: Completeness (0-100) (SSPO)

Clavicle (SMPO)

Cervical Vertebra	(SMPO)
Manubrium	(SMPO)
Sternum	(SMPO)
Ribs	(SMPO)
Scapula	(SMPO)
Thoracic Vertebra	(SMPO)
Lumbar Vertebra	(SMPO)
Pelvis	(SMPO)
Coccyx	(SMPO)
Sacrum	(SMPO)

3.2 Relationships

The relationships in this schema are listed in alphabetical order and described below. All relationships contain *no* attributes.

contains
: Provides a connection through stating that an entity has or holds another.
*Example: CASE **contains** a BODY*

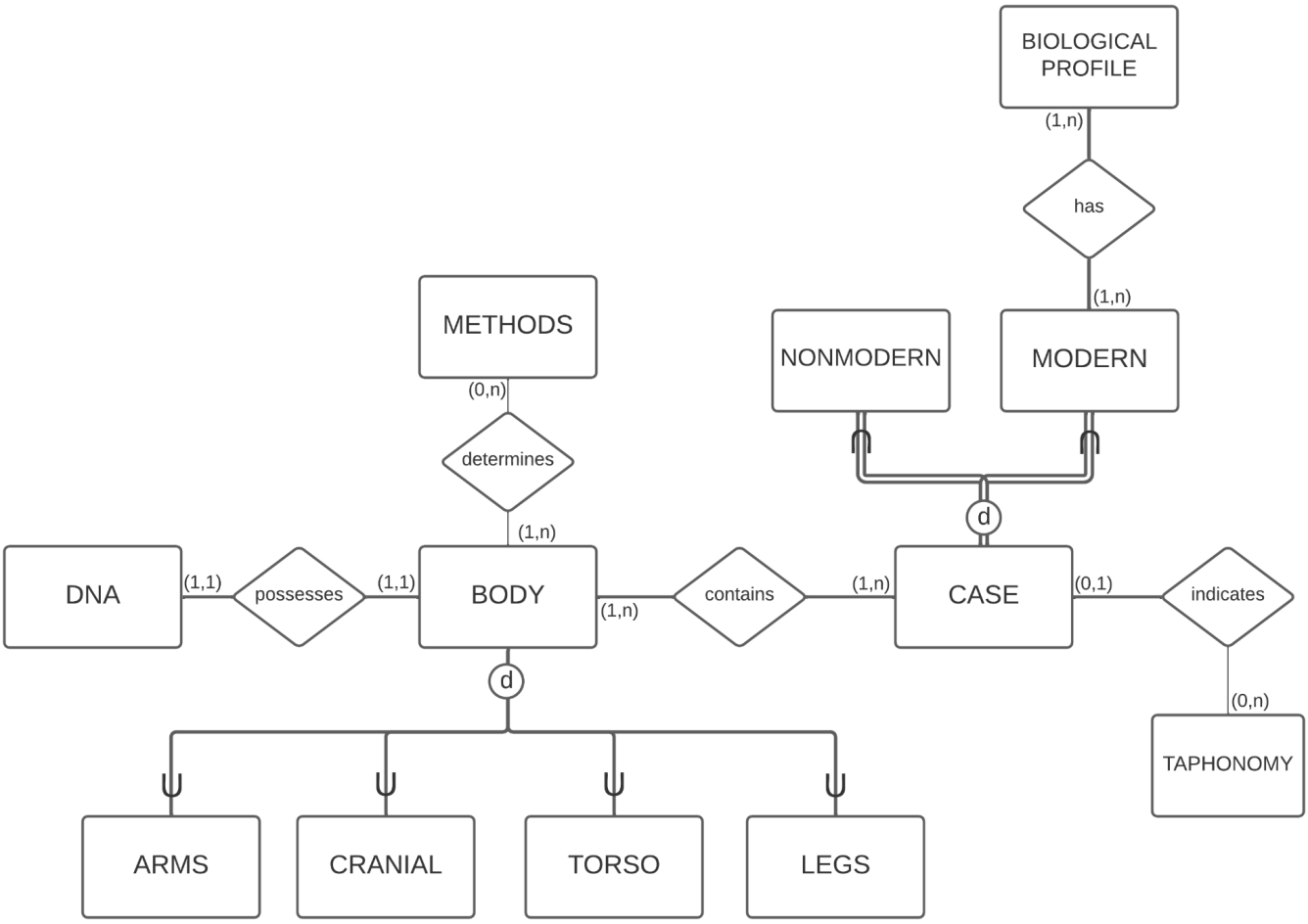
indicates
: Provides a connection through stating that an entity is the cause of another.
*Example: CASE **indicates** TAPHONOMY factors*

has
: Provides a connection through stating that an entity owns or holds another.
*Example: MODERN case **has** a BIOLOGICAL_PROFILE*

possesses
: Provides a connection through stating that an entity is possession of another.
*Example: BODY **possesses** DNA*

determines
: Provides a connection through stating that an entity is the cause of another.
*Example: BODY **determines** METHODS of mortem analysis*

3.3 EER Diagram



3.4 Explicit Integrity Constraints

Some examples of integrity constraints in our working example of a company database.

1. DNA attributes cannot be null.
2. All dates must be in the format DD/MM/YYYY.
3. All dates must be estimated if exact is not found (no null).
4. Missing skeletal inventory can be referred to as null.
5. Location must be referred to by City, State, Country and Address.
6. Location must be estimated if exact is not found (no null).
7. All time must be in the format HH:MM:SS.
8. All time must be estimated if exact is not known (no null).
9. Completeness needs to be an integer and between 0 and 100.
10. Maxwell ID number will be assigned when transferred to the museum.

4 Example Queries

A list of the most important queries.

1. Cases by status.
2. Cases by start/end date.
3. Cases by location.
4. Modern cases identified as Doe.
5. Body with trauma occurrences.
6. Body with cranial/arm/torso/leg completeness.
7. Body with specific cranial/arm/torso/leg features
8. Modern body by race/stature/other biological features.
9. Methods by pre-, peri-, and post mortem findings.
10. Cases with taphonomy by date/time found.
11. Cases with taphonomy by taphonomic alterations.
12. Cases with taphonomy by certain artifacts.

4.1 Possible Extensions and Additional Comments

Some possible extensions include allowing more users access to a pool of open (not-classified) data. Many research opportunities can be achieved by that option. The Maxwell Museum of Anthropology can query for Does, but by adding an extension of a Doe-only database could help separate them from other data. Other extensions could be made for more depthness.

5 Logical Relational Schema

The conceptual schema described for the OMI Database is mapped into the Relational Schema presented in this section. All the attributes underlined in the same Relation belong to the primary key. By default all the attributes that do not belong to the primary key may be null, unless explicitly specified that they cannot be null.

ARMS(*OMI Case Number, Completeness, Humerus, Radius, Ulna, Carpals, Metacarpals, Hand Phalanges*)

OMI Case Number is a foreign key, references CASE

BIOLOGICAL_PROFILE(*OMI Case Number, Bioaffinity, Stature, Gender, Birth Date, Death Date, Zip Code*)

OMI Case Number is a foreign key, references CASE

BODY(*OMI Case Number, Completeness, Date Found, Time Found, Location Found*)

OMI Case Number is a foreign key, references CASE

CASE(*OMI Case Number, Status, Start Date, End Date*)

OMI Case Number is a foreign key, references CASE

CRANIAL(*OMI Case Number, Completeness, Trauma, Parietal, Frontal, Occipital, Temporal, Sphenoid, Mandible, Lacrimal, Nasal, Ethmoid, Zygomatic, Maxilla, Dental*)

OMI Case Number is a foreign key, references CASE

DNA(*OMI Case Number, Skeletal Element, Pulled, Result*)

OMI Case Number is a foreign key, references CASE

LEGS(*OMI Case Number, Completeness, Femur, Patella, Tibia, Fibula, Tarsals, Metatarsals, Foot Phalanges*)

OMI Case Number is a foreign key, references CASE

METHODS(*OMI Case Number, Injury, Location, Occurrence*)

OMI Case Number is a foreign key, references CASE

MODERN(*OMI Case Number, Doe*)

OMI Case Number is a foreign key, references CASE

NONMODERN(*OMI Case Number, Maxwell ID Number, Birth Date, Death Date*)

OMI Case Number is a foreign key, references CASE

TAPHONOMY(*OMI Case Number, Bone Found, Date Found, Time Found, Location Found, Orientation, Artifacts, Taphonomic Alterations*)

OMI Case Number is a foreign key, references CASE

TORSO(*OMI Case Number, Completeness, Clavicle, Cervical Vertebra, Manubrium, Sternum, Ribs, Scapula, Thoracic Vertebra, Lumbar Vertebra, Pelvis, Coccyx, Sacrum*)

OMI Case Number is a foreign key, references CASE

Each attributes domain is specified below:

ARMS(*Integer, Integer, String(s), String(s), String(s), String(s), String(s), String(s)*)

BIOLOGICAL_PROFILE(*Integer, String, String, String, Date, Date, Integer*)

BODY(*Integer, Integer, Date, Time, String*)

CASE(*Integer, Integer, Date, Date*)

CRANIAL(*Integer, Integer, String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s)*)

DNA(*Integer, Skeletal Element, String, String*)

LEGS(*Integer, Integer, String(s), String(s), String(s), String(s), String(s), String(s), String(s)*)

METHODS(*Integer, String, String, String*)

MODERN(*Integer, String*)

NONMODERN(*Integer, Integer, Date, Date*)

TAPHONOMY(*Integer, String, Date, Time, String(s), String(s), String(s), String(s)*)

TORSO(*Integer, Integer, String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s), String(s)*)

5.1 Additional Integrity Constraints for the relational schema

The integrity constraints that must hold for the OMI database and that are not guaranteed by the relation schemas described above are listed in this subsection.

Some attributes may be null if they cannot be determined.

1) Each case is associated with exactly one body (eg. every ARMS, LEGS, CRANIAL, TORSO relations should be tied to one OMI Case Number).
2) OMI Case Numbers are unique and cannot be repeated and cannot be null.
3) Completeness cannot be null.
4) Doe must be either True or False, not null.
5) Location in the METHODS relation refers to the location on the body where the injury occurred.
6) Maxwell ID numbers are unique and cannot be repeated.
7) All NONMODERN tuples must include a Maxwell ID number, and cannot be null.
8) Each case can only be affiliated with the MODERN or NONMODERN relation, not both.
9) Every end date/death date must occur chronologically after the start date/birth date.