THE HUMAN RIGHTS IMPACTS OF BURIAL PRACTICES ON FORENSIC INVESTIGATIONS OF UNIDENTIFIED MIGRANT DEATHS IN SOUTH TEXAS

by

Molly A. Kaplan, B.A.

A thesis submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Arts
with a Major in Anthropology
May 2020

Committee Members:

Kate Spradley, Chair

Nicholas Herrmann

Ana Juárez

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair Use

Duplication Permission

DEDICATION

This research is dedicated to anyone who has ever journeyed near or far in search of a better future.

ACKNOWLEDGEMENTS

Thank you to my committee for your support throughout this process and for overall shaping me as a graduate student and anthropologist. I have learned much from you in the classroom, field, and the lab. An extra big thank you to Dr. Spradley for your continued mentorship on both a professional and personal level.

A deep thank you to all students and faculty who have ever contributed to Operation Identification. The invaluable answers that have been given to families thus far would not have been possible without you. Special thanks to Chloe McDaneld and Courtney Siegert for helping spearhead the project since its early days and for providing guidance as I have joined the team. Particular thanks to the Brooks County Sheriff's Office for all of the support and collaboration, and to Deputy Don White for just being the best.

Thank you to all members of the Forensic Border Coalition—the Argentine Forensic Anthropology Team (EAAF), South Texas Human Rights Center (STHRC), Colibrí Center for Human Rights, University of Houston Clearlake Anthropology Program, and the Forensic Anthropology Center at Texas State—for adopting me into this amazing research and advocacy work and for jointly collecting much of the data that has led to this thesis. Thank you to Mercedes Doretti for giving me my dream job and for continuing to expand the role of anthropologists around the world. Rachel Daniell, Molly Miranker, and Bea Abbott, thank you for being my colleagues and dear friends who always provide laughter, recipes, music, and matching sweatshirts for any occasion.

Thank you to the following for financially supporting this research: John Michael Kilby Fellowship in Anthropology, Forensic Anthropology Center at Texas State, and the Department of Anthropology.

Thank you to my cohort for being a fantastic cast of characters who have provided nothing but warmth, laughter, memes, murder mysteries, and much needed hugs and deep talks throughout this journey. I am going to miss you all and I can't wait to see where we all end up. Special shout out to Stephanie Medrano for being the best research partner and friend I could have asked for.

Finally, thank you from the bottom of my heart to my parents, Julie and Jonathan, my partner, Owen, and my family and loved ones around the country for helping me to thrive in Texas as I pursue my dream (including, but not limited to: Kate, Bayley, Delia, Hanna, and Dave). All of you have provided endless love and I could not have done it without you.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS v

LIST OF TABLES x

LIST OF FIGURES xiv

LIST OF ABBREVIATIONS xv

CHAPTER

I. INTRODUCTION 1

Background 1
Legal and Human Rights Precedents 2
South Texas 4
Research Questions 7

II. MATERIALS AND METHODS 10

Samples 10
Brooks County 11
Starr County 12
Willacy County 12
Methods 13
Grave Markers 14
Burial Traits 16
Additional Case Information 24
Condition of Remains 25
Case Records 27
Statistical Analyses 28

III. RESULTS 31

Grave Markers 31
Sacred Heart Cemetery, Brooks County 31
Río Grande City Cemetery (RGCC), Starr County 33
La Grulla Cemetery, Starr County 34

Starr County Totals 34
Tres Norias Cemetery, Willacy County 35
All Burials 37
Burial Traits 38
Sacred Heart Cemetery, Brooks County 38
Río Grande City Cemetery (RGCC), Starr County 40
La Grulla Cemetery, Starr County 42
Starr County Totals 43
Tres Norias Cemetery, Willacy County 45
All Burials 47
Additional Case Information 49
Sacred Heart Cemetery, Brooks County 49
Río Grande City Cemetery (RGCC), Starr County 50
La Grulla Cemetery, Starr County 51
Starr County Totals 52
Tres Norias Cemetery, Willacy County 53
All Burials 55
Condition of Remains 56
Sacred Heart Cemetery, Brooks County 56
Río Grande City Cemetery (RGCC), Starr County 58
La Grulla Cemetery, Starr County 59
Starr County Totals 60
Tres Norias Cemetery, Willacy County 61
All Burials 62
Case Records 63
Sacred Heart Cemetery, Brooks County 64
Starr County 64
Tres Norias Cemetery, Willacy County 65
All Burials 65
Statistical Analyses 66
Grave Markers 67
Grave Marker Style and Marker Information 68
Burial Traits 68
Burial Orientation and Burial Containers 70
Burial Orientation and Burial Wrapping 71
Burial Orientation and Burial Contents 71
Burial Containers and Burial Wrapping 71
Burial Containers and Burial Contents 72
Burial Wrapping and Burial Contents 72
Additional Case Information 72
Case Information Type and Content 74

Condition of Remains 74
State of Decomposition and Autopsy and DNA Sampling 76
Autopsy by DNA Sampling 76
Case Records 77
Grave Markers and Burial Traits 77
Grave Markers and Additional Case Information 78
Grave Markers and Condition of Remains 79
Grave Markers and NamUs Records 80
Burial Traits and Case Information 80
Burial Traits and Condition of Remains 81
Case Information and Condition of Remains 82
Case Information and NamUs Records 83
Condition of Remains and NamUs Records 84

IV. DISCUSSION 85

Grave Markers 86
Burial Traits 89
Additional Case Information 94
Condition of Remains 97
Case Records 101

V. CONCLUSIONS 103

APPENDIX SECTION 107

REFERENCES 140

LIST OF TABLES

Table **Page**

1. Total Sample of OpID Exhumed Burials by County, Cemetery, and Excavation Season 11

2. Grave Marker Variables 16

3. Burial Traits Variables 18

4. Additional Case Information Variables 25

5. Condition of Remains Variables 26

6. Case Records Variables 27

7. Frequency of Grave Marker Styles at Sacred Heart Cemetery 32

8. Frequency of Grave Marker Information at Sacred Heart Cemetery 32

9. Frequency of Grave Marker Styles at Río Grande City Cemetery 33

10. Frequency of Grave Marker Information at Río Grande City Cemetery 33

11. Frequency of Grave Marker Information at La Grulla Cemetery 34

12. Frequency of Grave Marker Styles in Starr County 35

13. Frequency of Grave Marker Information in Starr County 35

14. Frequency of Grave Marker Styles at Tres Norias Cemetery 36

15. Frequency of Grave Marker Information at Tres Norias Cemetery 36

16. Total Frequency of Grave Marker Styles 37

17. Total Frequency of Grave Marker Information 37

18. Frequency of Burial Orientations at Sacred Heart Cemetery 39

19. Frequency of Burial Containers and Wrappings at Sacred Heart Cemetery 39
20. Frequency of Burial Contents at Sacred Heart Cemetery 39
21. Frequency of Burial Orientations at Río Grande City Cemetery 41
22. Frequency of Burial Containers and Wrappings at Río Grande City Cemetery 41
23. Frequency of Burial Contents at Río Grande City Cemetery 41
24. Frequency of Burial Containers and Wrappings at La Grulla Cemetery 42
25. Frequency of Burial Contents at La Grulla Cemetery 43
26. Frequency of Burial Orientations in Starr County 44
27. Frequency of Burial Containers and Wrappings in Starr County 44
28. Frequency of Burial Contents in Starr County 44
29. Frequency of Burial Orientations at Tres Norias Cemetery 45
30. Frequency of Burial Containers and Wrappings at Tres Norias Cemetery 46
31. Frequency of Burial Contents at Tres Norias Cemetery 46
32. Total Burial Orientation Frequencies 47
33. Total Burial Container and Wrapping Frequencies 47
34. Total Frequency of Burial Contents 48
35. Frequency of Additional Case Information Types at Sacred Heart Cemetery 49
36. Frequency of Case Information Content at Sacred Heart Cemetery 49
37. Frequency of Additional Case Information Types at Río Grande City Cemetery 50
38. Frequency of Case Information Content at Río Grande City Cemetery 51
39. Frequency of Additional Case Information Types at La Grulla Cemetery 51

40. Frequency of Case Information Content at La Grulla Cemetery....52
41. Frequency of Additional Case Information Types in Starr County....52
42. Frequency of Case Information Content in Starr County....53
43. Frequency of Additional Case Information Types at Tres Norias Cemetery....54
44. Frequency of Case Information Content at Tres Norias Cemetery....54
45. Total Frequency of Additional Case Information Types....55
46. Total Frequency of Case Information Content....55
47. Condition of Remains Frequencies at Sacred Heart Cemetery....57
48. Autopsy and DNA Sampling Frequencies at Sacred Heart Cemetery....57
49. Condition of Remains Frequencies at Río Grande City Cemetery....58
50. Autopsy and DNA Sampling Frequencies at Río Grande City Cemetery....58
51. Condition of Remains Frequencies at La Grulla Cemetery....59
52. Autopsy and DNA Sampling Frequencies at La Grulla Cemetery....59
53. Condition of Remains Frequencies in Starr County....60
54. Autopsy and DNA Sampling Frequencies in Starr County....60
55. Condition of Remains Frequencies at Tres Norias Cemetery....61
56. Autopsy and DNA Sampling Frequencies at Tres Norias Cemetery....61
57. Total Condition of Remains Frequencies....62
58. Autopsy and DNA Sampling Total Frequencies....63
59. Frequency of NamUs DNA Profiling for Sacred Heart Cemetery....64
60. Frequency of NamUs DNA Profiling for Tres Norias Cemetery....65

61. Total Frequency of NamUs DNA Profiling 66

62. Chi-square Results for Grave Marker Variables Across Counties 67

63. Chi-square Results for Burial Traits Across Counties 69

64. Chi-square Results for Additional Case Information Across Counties 73

65. Chi-square Results for Condition of Remains Across Counties 75

66. Chi-square and Fisher's Exact Results for Grave Markers, Marker Information, and Additional Case Information 78

LIST OF FIGURES

Figure **Page**

1. Grave marker styles encountered in South Texas 15

2. Coffin burial oriented with the head to the west 19

3. Stacked burials in body bags oriented with the head to the west 20

4. Bundle burial in a biohazard bag 20

5. Styrofoam cooler classified as “other container” 21

6. Furry, cloth-lined box (possible faux wool) classified as “other container” 22

7. Sheet wrapped burial with the head to the north 23

8. Bundle burial in plastic bag with plastic wrapping and tape 23

LIST OF ABBREVIATIONS

Abbreviation	Description
ASR	Adjusted Standardized Residual
BCSO	Brooks County Sheriff's Office
EDR	Electronic Death Registration
FACTS	Forensic Anthropology Center at Texas State
OpID	Operation Identification
RGCC	Río Grande City Cemetery
TCCP	Texas Criminal Code of Procedure
TDR	Texas Death Record
WCOME	Webb County Office of the Medical Examiner

I. INTRODUCTION

The present study examines burial practices related to unidentified migrant remains in three South Texas counties in order to assess the effects that burial practices have on identification efforts in the region. In addition to assessing the impacts that burial practices have on the ability to forensically investigate and identify remains, the current study will also take a human rights approach to examine the dignity and respect with which migrant remains are being treated in regards to the rights of both the deceased and their families. The ultimate goal of the present research is to understand the underlying patterns and challenges to burial practices in South Texas in order to generate feasible solutions for improvement. The current study also seeks to add to the growing legal and human rights precedents surrounding the migrant death crisis at the U.S. southern border.

Background

The migrant death toll at the U.S.-Mexico border can be characterized as both a mass disaster and a humanitarian crisis. From 1998 to 2019 over 7,500 undocumented migrants died along the U.S. southern border with Mexico (U.S. Border Patrol, 2019). Beginning in 1994, the U.S. implementation of the "Prevention through Deterrence" strategy has continuously pushed migrants to re-route through remote and dangerous terrain, leading to stark increases in death and an ongoing lack of visibility to the scope of the disaster (Anderson, 2008; Kovic, 2013; De León, 2015; Kielty et al., 2018; Spradley et al., 2018). Since 2012, migrant death rates in Texas have surpassed those in Arizona, with the Río Grande Valley Sector continuing to have the highest numbers (Fleischman et al. 2017; U.S. Border Patrol, 2017; Spradley et al., 2018). However, accurate counts of death are largely unknown due to the difficulty of recovering remains from desert and

ranchland environments. In these remote landscapes natural taphonomic processes, such as fluctuating extreme temperatures and carrion and canid scavenging, can quickly decompose and scatter remains in such a way that greatly reduces their chances of being discovered or identified (Spradley et al., 2012; Beck et al., 2015; De León, 2015). Compounding this difficulty in Texas is the fact that the vast majority of shared borderland is privately owned and cannot be searched without permission (Kovic, 2013; Gocha et al., 2018; Spradley et al., 2018). These factors, coupled with Border Patrol's systematic underreporting of migrant deaths, contribute to an overall lack of understanding of the border crisis and an under-appreciation of the suffering experienced by missing migrants and their families (Kovic, 2013; De León, 2015; Hughes et al., 2017; Gocha et al., 2018).

Legal and Human Rights Precedents

Although there has been slow global recognition of migration crises around the world, the discourse has remained at a broad, international level and has not yet recognized the unique complexities of migrant death in Texas. Furthermore, there are very few international or federal U.S. protocols that formally address the rights of the deceased and their living relatives. While there are ongoing philosophical debates as to the extent to which the deceased have rights, explicit standards outlining the duties investigators have to the dead and their loved ones are globally lacking (Rosenblatt, 2010). In the U.S. death investigation of unidentified remains is governed at the state level, with each state having its own protocols, funding, and laws pertaining to the identification process and the storage of remains (Passalacqua and Pilloud, 2018). Common U.S. law recognizes next-of-kin rights to sepulcher, and defines the deceased as

quasi-property that should be returned to families in a timely manner and in a similar condition as to how they were found (Holland, 2015; Passalacqua and Pilloud, 2018). In order for these next-of-kin rights to be in effect, however, the identity of remains must be established (Holland, 2015). As long as remains are unidentified, jurisdiction lies with the medical examiner, coroner, or other local investigative authority (Passalacqua and Pilloud, 2018; Holland, 2015). While the non-legally binding international Vermillion Accord of 1989 calls for respectful treatment of the dead regardless of race, religion, and nationality, U.S. common law only prohibits the "mishandling" of human remains (Holland, 2015; Passalacqua and Pilloud, 2018). There appears to be no domestic or international legislation that defines what constitutes respectful or dignified treatment of remains, and laws regarding the handling of personal effects are also unclear.

In terms of international discourses on human rights and migration, the UN Universal Declaration of Human Rights from 1948 recognizes the right to "life, liberty, and the security of personhood," although this declaration is generally regarded as applying to the living and not the deceased (UN General Assembly, 2007: 3; Rosenblatt, 2010). The Universal Declaration also designates equal access and treatment for all persons under the law, but does not acknowledge the rights of the dead to be identified or the rights of families to seek justice and information about their loved ones (UN General Assembly, 2007). The 1996 Interpol Resolution on Disaster Victim Identification is the first international decree to formally recognize that "human beings have the right not to lose their identities after death," and to declare that disaster victim identification is of international importance (Interpol, 1996: 1).

In 2016, the New York Declaration on Refugees and Migrants called for a Global

Compact on Safe, Orderly, and Regular Migration—which was published in 2018 as the first official document to address the international crises of missing and deceased migrants (UN General Assembly, 2016; UN Office of the High Commission of Human Rights, 2018). Objective 8 of the Global Compact expresses a commitment to "identify those who have died or gone missing, and to facilitate communication with affected families," in addition to specifying the need to "centralize and systematize data regarding corpses and ensure traceability after burial" (UN Office of the High Commission of Human Rights, 2018: 16). Despite marking an important milestone in the visibility of migrant death, the 2018 Global Compact lacks any legal authority to ensure that investigations are being carried out and does not address the regional challenges faced along each migration corridor around the world.

South Texas

Whereas Arizona has the centralized agency of the Pima County Office of the Medical Examiner (PCOME)—as well as the Maricopa County Office of the Medical Examiner (MCOME)—to investigate the deaths of most unidentified migrants recovered in the state, in Texas, investigative authority varies by county, with most cases being handled by Justices of the Peace, local Sheriff's Offices, and funeral homes (Anderson, 2008; Fleischman et al. 2017; Gocha et al., 2018; Spradley et al., 2016; Spradley et al., 2018). Despite statewide legislation in Chapters 49 and 63 of the Texas Criminal Code of Procedure (TCCP) mandating that authorities conduct inquests and submit DNA for all unidentified remains, investigative efforts in Texas continue to be highly fragmented and lacking in oversight (Texas Constitution and Statutes, 2019ab; Kovic, 2013; Gocha et al., 2018; Spradley et al., 2018). According to the TCCP, Justices of the Peace are required to

make all efforts to "enable a timely and accurate identification" and "record and maintain for not less than 10 years all information pertaining to the body and the location of burial [of unidentified remains]" (Texas Constitution and Statutes: 1006, 1008). Yet, carrying out swift, thorough, and proper investigations—especially for international migrant cases—requires personnel, resources, and procedures that are greatly lacking in South Texas (Kovic, 2013; Spradley et al, 2016; Spradley et al., 2018). Because only 13 of the 254 counties in Texas have medical examiners, most local authorities in poor border counties with low population densities are essentially left on their own to deal with the influx of migrant death (Kovic, 2013; Gocha et al., 2018; Spradley et al., 2018).

The vast majority of unidentified migrants who perish in South Texas are therefore buried in local cemeteries, often without having been forensically examined or DNA sampled despite being against state law (Spradley et al., 2016). The way these individuals are buried, including the extent to which their graves and case information are documented, can greatly impact the preservation of evidence and the ability to re-locate burials for future identification. Exhumation efforts by Operation Identification (OpID) at Texas State University seek to recover the remains of unidentified migrants in order to conduct forensic skeletal analyses and DNA sampling for the purposes of identification and repatriation (Department of Anthropology, 2018). In partnership with the Forensic Border Coalition, Operation Identification is one of the only projects working to address migrant death in South Texas. When reporting on recent OpID exhumation field seasons, Spradley et al. (2018) and Gocha et al. (2018) describe the serious challenges of tracking unidentified burials in local cemeteries. Besides incomplete and missing burial records, grave markers, if present, are temporary and flimsy, often getting displaced from lawn

mowing (Spradley et al., 2018; Gocha et al., 2018). Although pedestrian and geophysical survey with ground penetrating radar (GPR) have helped isolate regions of interest, body bags buried at inconsistent depths are difficult to locate without exploratory excavation (Spradley et al., 2018). Once remains are located, associated case documents are still often missing or have degraded over time, leaving the remains themselves as the only source of evidence (Spradley et al., 2018).

In addition to presenting a variety of challenges to exhumation fieldwork, unpredictable burial practices in South Texas likely have significant impacts on the ability to identify migrant individuals. Taphonomic research has demonstrated that dispositional environments can significantly affect the condition of remains, especially in terms of the use of burial containers or wrappings (Galloway, 1989; Polkines et al. 2016; McDaneld, 2016; de Leeuwe & Groen, 2017). The use of coffins, for example, has been shown to damage buried remains from pressure points that develop as the wood degrades over time, while the use of body bags generally slows the rate of decomposition—and thus better preserves remains—by limiting insect scavenging and oxygen exposure (Polkines et al., 2016; de Leeuwe & Groen, 2017). Considering the challenges to recovering visibly identifiable remains along the U.S. southern border, ensuring optimal preservation is critical for obtaining viable samples for DNA analysis and for maintaining personal effects that can assist in positive identification and providing answers to families (Anderson, 2008; Fleischman et al., 2017; Spradley et al., 2018).

The present study examines burial practices related to unidentified migrant remains in three South Texas counties in order to assess the effects that burial practices have on forensic identification efforts as well as on the human rights of the deceased and

their families. By analyzing the exhumation data and case records for 103 burials from recent OpID exhumations in four South Texas cemeteries, the current study evaluates the treatment and condition of migrant remains and associated evidence in order to establish a baseline understanding of burial practices in the region. By exploring the ways that South Texas burial practices potentially hinder the identification of migrant individuals, the present study seeks to add to the precedents of recognizing the rights of the long-term dead and their living loved ones, in addition to making feasible recommendations to improve burial procedures across county cemeteries.

As a starting point for future research, the patterns assessed in this study will serve to inform county and statewide standardization of burial practices that ensure compliance with the law and maximize the chances of positive identification. Understanding the ways that burial procedures for unidentified migrants can be improved will be crucial for expediting future recovery, investigation, and identification efforts around the country.

Research Questions

1) What are the burial practices related to unidentified migrant remains in South Texas cemeteries?
2) Are there similarities and/or differences in how migrant remains are buried across South Texas counties?
3) How do these burial practices impact forensic investigations into the deaths of these undocumented individuals in terms of both the trace-ability of cases and the preservation of remains and evidence?

4) Additionally, are there overall patterns in the respect and dignity with which the remains of unidentified migrants are being treated in South Texas?

5) What are the most effective and feasible recommendations to help standardize burial procedures in order to ensure compliance with state law and improve the investigative efforts of anthropologists and local authorities?

6) Are there solutions to promote the respectful and dignified burial of unidentified migrants that will also expedite investigations into their deaths?

In order to address these research questions and evaluate burial practices related to unidentified migrant remains in South Texas, the present study analyzes the exhumation data of 103 burials from four cemeteries in three South Texas counties: Brooks, Starr, and Willacy. Data for all burials have been collected from recent Operation Identification (OpID) excavation seasons from 2017 through 2019. Burial data will also be cross-referenced with available case records from the online National Missing and Unidentified Persons System (NamUs) in order to further analyze the ability to track cases across South Texas and assess the potential for these cases to be identified. As a public-access clearinghouse for missing and unidentified persons reports, NamUs is one of the few nationwide systems allowing for the centralization of cases and sharing of antemortem and postmortem data across jurisdictions (National Missing and Unidentified Persons System, 2020). Additionally, because case submission to NamUs is required for

the inclusion and comparison of DNA in the national Combined DNA Index System, the availability of NamUs records associated with unidentified migrants will also shed light on the degree to which South Texas counties are complying with statewide mandates to conduct inquests and submit DNA. Taken together, these exhumation and case records data will ultimately lead to recommendations for how practices may be improved across the three counties and should serve to inform policy aimed at standardizing burial and investigative practices throughout South Texas.

II. MATERIALS AND METHODS

Samples

The present study analyzes 103 burials that have been exhumed by Operation Identification (OpID) from four cemeteries across three South Texas counties from 2017 through 2019. Table 1 summarizes the numbers of burials recovered form each cemetery throughout the seven excavation seasons conducted by OpID in Brooks, Starr, and Willacy Counties. All burials pertaining to probable unknown migrants are examined in the current study. These burials were those deemed forensically significant due to such factors as younger or middle adult age of remains (non-elderly), the presence of personal effects, particularly those indicative of migration, and a lack of evidence of medical intervention, such as hospital bracelets, gowns, or medical equipment. As will be discussed below, a few burials containing faunal remains or no remains at all are included in the sample, as these burials were either marked as containing unidentified migrant remains or contained personal effects and were initially assigned OpID case numbers. Unmarked burials that were assessed in the field but not deemed forensically significant according to demographics and contextual evidence, however, are not included in analyses, as they were ultimately not exhumed or assigned OpID case numbers.

Table 1. Total Sample of OpID Exhumed Burials by County, Cemetery, and Excavation Season

County	Cemetery	Field Season	Exhumed Burials	Total Burials
Brooks	Sacred Heart	January 2017	27	45
		January 2019	15	
		October 2019	3	
Starr	Rio Grande City	May 2017	13	19
	La Grulla	December 2019	6	
Willacy	Tres Norias	January 2018	38	39
		June 2018	1	
Total				103

Brooks County

In Brooks County, OpID has conducted three exhumation seasons at Sacred Heart Cemetery, also known as Sacred Heart Burial Park, a public cemetery measuring approximately 7,1205 m^2 that was used for all unidentified burials until 2013 when the county began contracting with the Webb County Office of the Medical Examiner (WCOME) (Frey, 2015; Spradley et al., 2018). Despite being located about 70 miles north of the border, Brooks County has some of the highest documented numbers of migrant deaths in Texas due to the presence of a major USBP checkpoint, and has been the focus of most exhumation work to date (McConahay, 2007; Frey, 2015; Spradley et al., 2016). OpID excavations at Sacred Heart Cemetery in January of 2017 and 2019 resulted in the recovery of 27 and 15 unidentified migrant burials. Three additional burials from follow-up exhumations in October of 2019 have resulted in a total of 45 exhumed burials from Sacred Heart Cemetery (Table 1). Data for each of these burials are included in the present study. It is important to note, however, that data for 121 burials from previous exhumations at Sacred Heart Cemetery conducted by Baylor

University and University of Indianapolis in 2013 and 2014 are not included in the current sample, as field notes are missing or incomplete. All remains recovered from Brooks County from 2013 through 2019 are currently housed at the Forensic Anthropology Center at Texas State University (FACTS) as part of OpID.

Starr County

Exhumations have been carried out by OpID at two cemeteries in Starr County: Río Grande City Cemetery (RGCC) in January of 2018 and La Grulla Cemetery in December of 2019. As the largest cemetery in the county, RGCC, measuring approximately 107,306 m^2, was utilized to bury most unidentified remains recovered in the county until around 2013 when space became limited (Communications with county officials, May 2017). At this time, other public cemeteries, including La Grulla Cemetery, measuring 13,738 m^2, were utilized for unidentified remains burials. In 2017, Starr County also began contracting with the WCOME, but it is unclear if unidentified individuals continue to be interred in the county. Currently, OpID has exhumed 19 burials of unidentified probable migrants from Starr County, with 13 coming from RGCC in May of 2017 and six from La Grulla in December of 2019 (Table 1).

Willacy County

The remaining 39 burials included in the present study come from Tres Norias Cemetery in Willacy County. Thirty-eight of these burials were exhumed by OpID in January of 2018, with one additional set of remains being recovered during a follow-up season in June. As a small private cemetery measuring approximately 6,400 m^2, Tres

Norias has been utilized for unidentified remains recovered from neighboring Cameron County since 2005, as very few unidentified remains have reportedly been found in Willacy (Communications with county officials, February 2016). Data from Tres Norias should therefore reveal patterns in Willacy County's burial practices, but may also speak to Cameron County's investigative procedures.

Methods

For each of the 103 exhumed burials, all associated documents and case files from 2017 through 2019 were examined in order to assess a total of 66 variables relating to five main categories: 1) grave markers, 2) burial traits, 3) case information included in the burials, 4) condition of remains, and 5) the presence of associated case records across different agencies. Tables 2 through 6 summarize each of these categories in terms of the variables assessed. The specific breakdown of the 66 variables and methods for data collection for each category are discussed independently below. While most information could be found on the digital copies of the OpID Burial and Intake Forms recorded in the field and lab (Appendices A and B), all exhumation and intake photos, notes, and sketch maps were checked to verify and supplement the data. Additional case records from other sources, such as recovery reports from the Brooks County Sheriff's Office (BCSO) or case files on the National Missing and Unidentified Persons System (NamUs), were also found in each OpID case file, and these too were examined (Table 6). NamUs records were then further verified online to confirm information was up-to-date.

All data for each of the 103 cases were recorded throughout four Excel spreadsheets, as organized by cemetery. For each spreadsheet, cases and associated burial numbers were listed as rows and the 66 total variables pertaining to the five categories

were listed as columns. Cases were then systematically analyzed in chronological order according to exhumation season. Sixty-three of the 66 total variables are nominal and were scored for presence/ absence utilizing a system of "1" for present and "0" for absent. For three variables—burial depth, grave marker year, and case information year—the numerical value was instead recorded in the relevant columns.

Once all 103 burials were scored, frequency data in the form of total sums and percentages were calculated in Excel for each nominal variable for each cemetery. Statistical analyses were then carried out using SPSS Statistics Grad Pack Standard Version 26.0 to assess significant patterns across counties and between variables both within and across the five main categories. Statistical analysis at the cemetery level was not possible at this time due to the small sample size of the Starr County cemeteries, as will be discussed below. The remainder of this chapter describes the specific methods pertaining to each of the five main categories listed in Tables 2 through 6 then describes the analyses carried out in SPSS.

Grave Markers

Grave markers were assessed at each cemetery in terms of their quantity, material, legibility, and content of case information, for a total of 16 variables. After noting the presence or absence of grave markers for each case and whether markers were staked or flush with the ground (flat), marker material was recorded as either metal or plastic and paper (Figure 1; Table 2). If the marker was made of metal, it was further scored as having metal lettering, etching, or a paper insert (Figure 1; Table 2).

In terms of case information included on grave markers, markers that were legible

were also scored for containing: dates, death record numbers (Texas Death Record and/or Electronic Death Record – TDR/ EDR), case numbers, recovery locations, or funeral homes (Table 2). If markers had legible dates, then the date year was recorded as well.

Figure 1. Grave marker styles encountered in South Texas.
From left to right: plastic stake with paper, metal stake with lettering, metal stake frame (missing paper insert), and flat metal frame with paper insert (not shown: metal stake with etching).

Table 2. Grave Marker Variables

Grave Marker Variables (n=16)
Marker Present/ Absent
Stake
Flat
Metal
Lettering
Etched
Paper insert
Plastic stake with paper
Blank/ illegible
Present case information
Date
Year
TDR/EDR
Case number
Location
Funeral home

Once scored, all nominal grave marker variables were summed with frequency percentages being calculated in regards to each cemetery, county, and the total number of burials (N=103). The date year ranges were recorded for each cemetery and county.

Burial Traits

Burial traits, as listed by 22 variables in Table 3, broadly refer to the ways unidentified migrant individuals are buried, and include aspects such as burial depth, burial containers, burial position or orientation, and the presence of other objects, such as personal effects or waste. Specifically, for the present study, burial depth was recorded as the center depth to the top of the container (cm below datum), or the shallowest corner if center depth was not available. Cases were then scored according to which types of burial containers were present, which included coffins (wood, lidded boxes or metal caskets), body bags, biohazard bags, trash or plastic bags, or other (such as Styrofoam coolers or

airline cargo boxes) (Table 3) (Figures 2 - 6). The presence of plastic and/or sheet wrapping and any type of tape were also scored (Figures 7 - 8). Burial orientation was scored as being stacked, bundled, or oriented with the head to the east, west, or north, as no remains were interred with the head to the south. Some individuals, however, were buried facedown, and this was scored as well (Table 3). Finally, burials were assessed for the inclusion of other contents apart from the human remains, including: the absence of human remains (i.e. faunal or no remains at all), personal effects, medical waste, or other non-medical trash, in addition to whether the remains were clothed (Table 3). Although individuals' personal effects sometimes included disposable items, such as toothbrushes or water bottles, the presence of trash was scored if it clearly did not belong to the individual and was found in the burial shaft above or below the remains. It is also important to note that most variables considered for burial traits were not mutually exclusive, with many graves having multiple containers, wrappings, or contents. Additionally, the burial orientations of "stacked" and "facedown" were not mutually exclusive as several individuals were either oriented in a cardinal direction and stacked or facedown, or bundled and stacked. Orientation was also scored for the burials containing faunal or nonhuman remains according to the placement or arrangement of the burial container.

Table 3. Burial Traits Variables

Burial Traits Variables (n=22)	
Depth (cm)	
Burial container	
	Coffin, wood
	Coffin, metal
	Body bag
	Biohazard bag
	Trash or plastic bag
	Other
Wrapping	
	Sheet
	Plastic
	Tape
Burial orientation	
	Head to the west
	Head to the east
	Head to the north
	Stacked
	Bundle
	Facedown
Burial contents	
	Faunal remains
	No remains
	Clothed
	Personal effects
	Medical waste
	Trash

Figure 2. Coffin burial oriented with the head to the west.

Figure 3. Stacked burials in body bags oriented with the head to the west.

Figure 4. Bundle burial in a biohazard bag.

Figure 5. Styrofoam cooler classified as “other container.”

Figure 6. Furry, cloth-lined box (possible faux wool) classified as “other container.”

Figure 7. Sheet wrapped burial with the head to the north.

Figure 8. Bundle burial in plastic bag with plastic wrapping and tape.

Once all variables were scored, they were summed and percentages calculated in terms of the total number of burials in each cemetery, county, and the overall total number of burials (N=103). Burial depths and ranges were calculated for each cemetery.

Additional Case Information

Whereas quantifying burial traits particularly reveals patterns in how unidentified migrant remains are treated in South Texas, quantifying the inclusion of case information in the burials, such as the presence of documents, morgue tags, or writing on containers, speaks to both the extent of past investigative efforts and the ability to positively identify remains. Much in the way that grave markers were scored, the presence, legibility, and types of additional case information and information content were recorded for a total of 11 variables for each of the 103 burials (Table 4). Information types included writing on burial containers, such as Sharpie on a body bag or sheet, the presence of morgue tags or bracelets, and other documentation, such as Reports of Death or Witnesses of Removal (Table 4). The presence of any additional case information was first recorded, followed by the types of information for each case. As will be discussed below, several cases had more than one form of additional information, and all were counted. Once the legibility of case information was recorded, the presence of the following types of information content was scored: dates, TDR/EDR numbers, case numbers, locations, and names of funeral homes (Table 4). If dates were included, the year number was recorded. Totals and percentages were then calculated for each cemetery and county, as well as for the total sample.

Table 4. Additional Case Information Variables

Additional Case Information Variables (n=11)	
Information present	
	Writing on container
	Tags
	Other documentation
Blank/ illegible	
	Date
	Year
	EDR/TDR
	Case Number
	Location
	Funeral Home

Condition of Remains

In the present study, examining the condition of human remains seeks to illuminate patterns in how individuals may have been treated due to their completeness or state of decomposition. Analyzing evidence of autopsy and DNA sampling especially reveals the extent to which counties were compliant with state law in their investigations of the remains. In total, 13 variables pertaining to the condition of remains were assessed. For each case that had a field or lab intake, the completeness of remains were scored as either complete or partial (Table 5). Completeness in the present study was considered 90% or more of remains present. The state of decomposition was scored as early or advanced decomposition, mummified, or skeletonized, as these are the four categories on the OpID Intake Form (Table 5). States of decomposition were treated as discrete categories with the most advanced state being scored when individuals were recorded as showing multiple. Autopsies were scored as: cranial, full, none, or unknown. Autopsies were generally recognized by postmortem cuts to the cranium and/or rib cage, and the presence of an organ bag in some cases. Although skeletonized remains may have undergone visual autopsies, autopsies were only scored if cut-marks or documentation

evidence were present. If remains were still clothed upon being exhumed and lacked documentation, they were also considered to have not undergone an autopsy. For cases that had faded tags or degraded documentation, but no skeletal evidence of autopsy, the "unknown" category was uses, as well as for those that have yet to undergo full intake for OpID. Finally, DNA sampling—as evidenced by cut bone—was scored as present, absent, or unknown. Unknown was utilized for cases that have yet to undergo intake or are partial and/or skeletonized and may have had whole bones sent for testing.

Table 5. Condition of Remains Variables

Condition of Remains Variables (n=13)	
Complete	
Partial	
State of decomposition	
	Early
	Advanced
	Mummified
	Skeletonized
Autopsied	
	Full
	Cranial
	None
	Unknown
DNA sampled	
	Yes
	None
	Unknown

After all variables were scored, totals and percentages were calculated across each cemetery, county, and the total number of burials. Only burials containing human remains were included in calculations and frequency analyses.

Case Records

In order to shed light on the ability to track cases across South Texas jurisdictions and understand the overall potential for migrant individuals to be identified, the availability of external case records corresponding to each exhumed burial was assessed. In particular, the presence or absence of case files on the online National Missing and Unidentified Persons System (NamUs) was scored for each case (see Introduction), as well as the presence of Recovery Reports from the Brooks County Sherriff's Office (BCSO) for the 45 burials from Sacred Heart Cemetery (Table 6). Because of the collaborative relationship that OpID has developed with the BCSO, all recovery reports pertaining to unidentified migrant remains since 2009 have been made available and are included in the current study. For all cases that had NamUs records, the status of whether DNA testing had been completed, samples had been submitted, or no DNA information was entered was also recorded (Table 6). It is important to note that all cases currently housed at FACTS as part of OpID undergo DNA sampling and have corresponding NamUs case files, but it is the availability of NamUs records prior to exhumation that is of interest for the present research.

Table 6. Case Records Variables

Case Records Variables (n=4-5)
NamUs
DNA completed
DNA submitted (tests not complete)
DNA not submitted/no DNA info
BCSO report (Brooks)

Frequency totals and percentages were calculated for NamUs files and DNA status for all four cemeteries and all three counties, as well as for the total number of

burials (N=103), while frequencies for BCSO reports were only calculated for Brooks County. No additional records from law enforcement or funeral homes were included in the present study, as they are either inaccessible, or without permission to publish.

Statistical Analyses

Statistical analyses consisted primarily of 2x2 and 2x3 Chi-square tests of independence and Fisher's Exact Tests when over 20 percent of expected values were less than five. For each of the five main categories, tests of independence were run first to test the significance of all variables across the three counties of Brooks, Starr, and Willacy. For all significant relationships with $p < 0.05$, effect size was measured using Cramer's V and adjusted standardized residuals (ASRs) to identify which of the counties significantly contributed to the variation. However, because several of the variables produced over 20 percent of expected values less than five in the 2x3 analyses, their results are not included in the present research. This is also true for 2x4 comparisons of variables across the cemeteries, which also all produced high percentages of low expected values. Frequency data in the form of the totals and percentages are instead utilized to identify patterns across cemeteries, while Chi-squares are utilized for cross-county relationships.

Once analyses were conducted across counties, 2x2 Chi-square tests of independence were run among variables within each of the five main categories across the entire sample of 103 burials. For grave markers, for example, this included looking at the relationships between marker materials and the types of information included on markers, whereas for burial traits, relationships were assessed between the different

burial orientations, containers, wrappings, and the various grave contents. For these 2x2 analyses, two-tailed Fisher's Exact p-values were utilized when over 20 percent of the cells produced expected values less than five. Results from intra-category analyses, therefore, include a mixture of Chi-square and Fisher's Exact values.

After examining the significance of relationships among variables within categories, cross-category relationships were also assessed using 2x2 Chi-square tests of independence and Fisher's Exact Tests. This included examining grave marker presence and marker information types in relation to burial containers, wrappings, and contents, as well as comparing markers and marker information with the additional case information buried in the graves. Grave markers were also compared to the completeness of remains and autopsy and DNA sampling status. Associations between grave markers and external case records were also tested. In terms of burial traits, relationships between burial containers and contents were assessed with the inclusion of additional case information, as well as with the condition of remains, including states of decomposition and autopsy and DNA sampling. Significant relationships were also examined between the inclusion of additional case information and autopsy and DNA sampling status, as well as between the inclusion of information and the presence of NamUs records. Autopsy and DNA sampling status of remains were finally tested against the presence of NamUs records.

Collectively, the results of the analyses of the exhumation, remains, and case records data pertaining to each of the five categories are discussed from a human rights perspective in terms of their impacts on the identification process and the ways they reflect disrespectful or undignified treatment of the dead. It is the ultimate goal that the

results from the present study will lead to recommendations for reforming burial and case tracking practices in each county and will inform future policy changes for standardizing investigative procedures and improving the treatment of unidentified remains across South Texas.

III. RESULTS

Due to the large number of variables examined in the current study, frequency results are presented thematically according to the five main categories pertaining to unidentified migrant burials: grave markers, burial traits, additional case information, the condition of remains, and external case records. Results of Chi-square analyses and Fisher's Exact Tests examining the relationships between variables are then provided for each category as well as for variables across categories.

Grave Markers

Results of grave marker frequencies, as well as the frequencies of case information included on grave markers are provided for each cemetery in each county, followed by results for the entire sample of 103 burials.

Sacred Heart Cemetery, Brooks County

In total, 14 grave markers were present out of the 45 unidentified burials exhumed from Sacred Heart Cemetery (31.1%). Table 7 summarizes the frequency of grave marker styles encountered at Sacred Heart from 2017 to 2019. Table 8 summarizes the frequency of the various types of case information included on the grave markers.

Table 7. Frequency of Grave Marker Styles at Sacred Heart Cemetery

Marker Material	N	% of Grave Markers (N=14)	% of Total Burials (N=45)
Stake	14	100	31.1
Flat	0	0	0
Metal	14	100	31.1
Metal letters	8	57.1	17.8
Metal etched	3	21.4	6.7
Metal frame with paper	3	21.4	6.7
Plastic stake with paper	0	0	0

Table 8. Frequency of Grave Marker Information at Sacred Heart Cemetery

Marker Information	N	% of Grave Markers (N=14)	% of Total Burials (N=45)
Blank/ illegible	3	21.4	6.7
Date	3	21.4	6.7
TDR/EDR	8	57.1	17.8
Case number	0	0	0
Location	4	28.6	8.9
Funeral home	4	28.6	8.9
Total Info	11	78.6	24.4
Year range: 2002 - 2005			

All 14 markers found were metal (aluminum) stakes, with eight containing metal lettering (57.1%), three with etched information (21.4%), and three frames with paper inserts (21.4%) (Table 7). Of the 14 grave markers found, three were blank or illegible and 11 contained legible case information (24.4% of the 45 total burials) (Table 8). Of the 11 markers with case information, the most frequent type of information included was Texas Death Record and/or Electronic Death Record (TDR/EDR) numbers (N=8, or 57.1% of 14 total markers). Locations where remains were recovered and names of funeral homes were each included on four markers, and dates were included on three,

with date years ranging from 2002 to 2005 (Table 8). No ME case numbers were found on grave markers at Sacred Heart Cemetery.

Río Grande City Cemetery (RGCC), Starr County

Grave markers were associated with two out of the 13 burials exhumed by OpID at RGCC in 2017 (15.4%). Marker style frequencies at RGCC are presented in Table 9, with the frequency of marker information in Table 10.

Table 9. Frequency of Grave Marker Styles at Río Grande City Cemetery

Marker Material	N	% of Grave Markers (N=2)	% of Total Burials (N=13)
Stake	2	100	15.4
Flat	0	0	0
Metal	2	100	15.4
Metal letters	0	0	0
Metal etched	0	0	0
Metal frame with paper	2	100	15.4
Plastic stake with paper	0	0	0

Table 10. Frequency of Grave Marker Information at Río Grande City Cemetery

Marker Information	N	% of Grave Markers (N=2)	% of Total Burials (N=13)
Blank/ illegible	1	50	7.7
Date	1	50	7.7
TDR/EDR	0	0	0
Case number	0	0	0
Location	0	0	0
Funeral home	0	0	0
Total Info	1	50	7.7
		Year range: 2012	

Both markers were staked metal frames with paper inserts (Table 9). One of the inserts was legible and contained a date from 2012. The other one was illegible.

La Grulla Cemetery, Starr County

All six exhumed burials at La Grulla Cemetery were associated with staked metal frame markers, in addition to cement white crosses. Table 11 summarizes the frequency of grave marker information.

Table 11. Frequency of Grave Marker Information at La Grulla Cemetery

Marker Information	N	% of Grave Markers and Total Burials (N=6)
Blank/ illegible	5	83.3
Date	1	16.7
TDR/EDR	0	0
Case number	1	16.7
Location	0	0
Funeral home	1	16.7
Total Info	1	16.7
Year range: 2016		

Paper inserts were missing for five of the six markers (83.3%), while one included a case number, a funeral home, and a date from 2016 (Table 11). Data for this last marker are included as the paper insert was photographed during a 2017 survey; however, this marker was also technically blank in 2019.

Starr County Totals

Grave marker data for all 19 burials exhumed from Starr County from 2017 to 2019 are presented in Tables 12 and 13. Of the 19 Starr County burials, eight, or 42.1%, had grave markers.

Table 12. Frequency of Grave Marker Styles in Starr County

Marker Material	N	% of Grave Markers (N=8)	% of Total Burials (N=19)
Staked	8	100	42.1
Flat	0	0	0
Metal	8	100	42.1
Metal letters	0	0	0
Metal etched	0	0	0
Metal frame with paper	8	100	42.1
Plastic stake with paper	0	0	0

Table 13. Frequency of Grave Marker Information in Starr County

Marker Information	N	% of Grave Markers (N=8)	% of Total Burials (N=19)
Blank/ illegible	6	75	31.6
Date	2	25	10.5
TDR/EDR	0	0	0
Case number	1	12.5	5.3
Location	0	0	0
Funeral home	1	12.5	5.3
Total Info	2	25	10.5
Year range: 2012 - 2016			

All eight of grave markers found in Starr County were staked metal frames (Table 12). Six of the eight markers were blank, with the paper inserts having been lost or degraded (Table 13). Each of the two markers containing legible information included dates, with years ranging from 2012 to 2016. A case number and funeral home were found on the one legible grave marker at La Grulla Cemetery. No locations or TDR/EDR numbers were included on any grave markers encountered in Starr County (Table 13).

Tres Norias Cemetery, Willacy County

Of the 39 burials exhumed from Tres Norias Cemetery in 2018, eight had associated grave markers (20.5%). Tables 14 and 15 summarize grave marker style and

information frequencies for unidentified migrant burials at Tres Norias Cemetery.

Table 14. Frequency of Grave Marker Styles at Tres Norias Cemetery

Marker Information	N	% of Grave Markers (N=8)	% of Total Burials (N=39)
Staked	6	75.0	15.4
Flat	2	25.0	5.1
Metal	2	25.0	5.1
Metal letters	0	0	0
Metal etched	0	0	0
Metal frame with paper	2	25.0	5.1
Plastic stake with paper	6	75.0	15.4

Table 15. Frequency of Grave Marker Information at Tres Norias Cemetery

Marker Information	N	% of Grave Markers (N=8)	% of Total Burials (N=39)
Blank/ illegible	2	25.0	5.1
Date	5	62.5	12.8
TDR/EDR	0	0	0
Case number	4	50.0	10.3
Location	0	0	0
Funeral home	6	75.0	15.4
Total Info	6	75.0	15.4
Year range: 2008 - 2016			

Six of the grave markers recovered from Tres Norias Cemetery were plastic stakes with paper inserts and two were flat metal frames for paper inserts (Table 14). Six of the eight grave markers—five plastic stakes and one metal frame—corresponding to 15.4% of the burials contained legible case information (Table 15). Funeral homes were included on all legible markers (N=6), while dates and case numbers were present on five and four of the grave markers respectively. No locations or TDR/EDR numbers were included on grave markers in Tres Norias Cemetery (Table 15). The date year ranges spanned from 2008 to 2016.

All Burials

Grave marker data for all 103 burials exhumed from the four cemeteries to-date by OpID are presented in Tables 16 and 17. Of the 103 burials exhumed by OpID, 30 (29.1%) contained grave makers.

Table 16. Total Frequency of Grave Marker Styles

Marker Material	N	% of Grave Markers (N=30)	% of Total Graves (N=103)
Staked	28	93.3	27.2
Flat	2	6.7	1.9
Metal	24	80.0	23.3
Metal letters	8	26.7	7.8
Metal etched	3	10.0	2.9
Metal frame with paper	13	43.3	12.6
Plastic stake with paper	6	20.0	5.8

Table 17. Total Frequency of Grave Marker Information

Marker Information	N	% of Grave Markers (N=30)	% of Total Graves (N=103)
Blank/ illegible	11	36.7	10.7
Date	10	33.3	9.7
TDR/EDR	8	26.7	7.8
Case number	4	13.3	3.9
Location	4	13.3	3.9
Funeral home	10	33.3	9.7
Total Info	19	63.3	18.4
Year range: 2002 - 2016			

The majority of grave markers encountered were stakes (N=28; 98.3%), with 24 of them being metal and six being plastic with paper inserts (Table 16). The two flat markers and 11 of the metal stakes were metal frames for paper inserts, while the other metal stakes contained either metal lettering (N=8) or paper inserts (N=8) (Table 16; Figure 1). In total, 19 grave markers contained case-related information (18.5% of 103),

while the rest were blank or illegible (N=11, or 36.7% of total grave markers) (Table 17). The most common case information listed on grave markers across all four cemeteries were funeral homes and dates (N=10), followed by death record (TDR/EDR) numbers (N=8) (Table 17). Locations and other case numbers were each present on four total grave markers. The total year range for dates present on grave markers across all cemeteries is 2002 to 2016. Additionally, thus far, three of the four individuals who have been positively identified from exhumations from 2017 and 2019 were buried in graves with associated markers.

Burial Traits

The following section summarizes the burial trait frequencies at each cemetery across each of the three counties, in addition to collectively assessing the data for all 103 exhumed burials. The total frequencies of burial orientations, containers, wrappings, and burial contents are provided, as well as average depths and depth ranges.

Sacred Heart Cemetery, Brooks County

Tables 18, 19, and 20 summarize the total orientations, containers, wrappings, and non-human remains contents of the 45 exhumed graves from Sacred Hear Cemetery.

Table 18. Frequency of Burial Orientations at Sacred Heart Cemetery

Burial Orientation	N	% of Total Burials (N=45)
Head to the west	19	42.2
Head to the east	2	4.4
Head to the north	0	0
Stacked	4	8.9
Bundle	24	53.3
Facedown	2	4.4

Table 19. Frequency of Burial Containers and Wrappings at Sacred Heart Cemetery

Burial Containers and Wrapping	N	% of Total Burials (N=45)
Coffin - plywood	25	55.6
Coffin - metal	2	4.4
Body bag	29	64.4
Biohazard bag	13	28.9
Trash or plastic bag	14	31.1
Other container	4	8.9
Sheet	17	37.8
Plastic wrapping	15	33.3
Tape	11	24.4

Table 20. Frequency of Burial Contents at Sacred Heart Cemetery

Burial Contents	N	% of Total Burials (N=45)
Faunal remains	1	2.2
No remains	2	4.4
Clothed remains	1	2.2
Personal effects	35	77.8
Medical waste	11	24.4
Trash	11	24.4

The majority of burials exhumed from Sacred Heart Cemetery were bundles of skeletonized remains (N=24, or 53.3%), followed by extended burials oriented with the head to the west (N=19, or 42.2%) (Table 18). Four burials were stacked in two sets of

two remains (both bundles on top of a body bag) (8.9%), and two burials were oriented with the head in the east. Two individuals were interred facedown (4.4%) (Table 18).

Body bags were utilized in 29 of the 45 exhumed burials (64.4%) and 27 burials contained coffins, 25 of which were plywood lidded boxes and two of which were metal caskets (55.6% and 4.4% of 45) (Table 19). Trash bags or plastic shopping bags were utilized as containers for remains and personal effects in 14 burials (31.1%), while biohazard bags were present in 13 (28.9%) (Table 19). Remains from five burials were interred in unique containers, including tarp-like sand bags, an extra long particleboard coffin with cloth-lining, and a cotton-lined child's coffin with intricate metal hardware and Styrofoam supports.

In terms of the burial contents, personal effects were present in 35 of burials, or 77.8% (Table 20). Medical waste such as gloves and autopsy towels were present in 11 burials, as was other non-medical trash (24.4%). One burial at Sacred Heart contained faunal remains, while two burials contained no human remains, including an empty coffin and an interment of solely personal effects (Table 20). The average depth of the 45 burials exhumed from Sacred Heart Cemetery is 84.9cm below datum, with a range of 48 to 136cm below datum.

Río Grande City Cemetery (RGCC), Starr County

Burial traits for RGCC are summarized in Tables 21, 22, and 23.

Table 21. Frequency of Burial Orientations at Río Grande City Cemetery

Burial Orientation	N	% of Total Burials (N=13)
Head to the west	8	61.5
Head to the east	3	23.1
Head to the north	0	0
Stacked	0	0
Bundle	2	15.4
Facedown	0	0

Table 22. Frequency of Burial Containers and Wrappings at Río Grande City Cemetery

Burial Containers and Wrapping	N	% of Total Burials (N=13)
Coffin - plywood	3	23.1
Coffin - metal	0	0
Body bag	11	84.6
Biohazard bag	1	7.7
Trash or plastic bag	4	30.8
Other container	0	0
Sheet	10	76.9
Plastic wrapping	6	46.2
Tape	1	7.7

Table 23. Frequency of Burial Contents at Río Grande City Cemetery

Burial Contents	N	% of Total Burials (N=13)
Faunal remains	0	0
No remains	0	0
Clothed remains	1	7.7
Personal effects	3	23.1
Medical waste	7	53.8
Trash	1	7.7

Most unidentified burials exhumed from RGCC were in a supine position with the head oriented to the west for eight and to the east for three (61.5% and 23.1%) (Table 22). Two burials were bundles (15.4%) (Table 21). Remains were interred in body bags

in 11 graves (84.6%,) and were wrapped in sheets in ten (76.9%) (Table 23). Wooden coffins were utilized for three burials, while trash or plastic bags were present in four, and plastic sheets were utilized in six (46.2%) (Table 21). One biohazard bag was present in the RGCC burials, and one set of remains had tape (Table 21). Medical waste was the present in seven of the 13 burials (53.8%), while three contained personal effects (23.1%), one contained trash, and one set of remains was clothed (7.7%) (Table 23). All burials contained human remains, and the average depth for the 13 burials exhumed from RGCC is 151.2cm below datum, with a range of 60 to 193cm.

La Grulla Cemetery, Starr County

All six unidentified burials from La Grulla Cemetery were interred in a supine position and oriented with the head to the north. The frequency of burial containers, wrapping, and contents at La Grulla are presented in Tables 24 and 25.

Table 24. Frequency of Burial Containers and Wrappings at La Grulla Cemetery

Burial Containers and Wrapping	N	% of Total Burials (N=6)
Coffin - plywood	1	16.7
Coffin - metal	0	0
Body bag	6	100
Biohazard bag	0	0
Trash or plastic bag	2	33.3
Other container	3	50.0
Sheet	3	50.0
Plastic wrapping	1	16.7
Tape	0	0

Table 25. Frequency of Burial Contents at La Grulla Cemetery

Burial Contents	N	% of Total Burials (N=6)
Faunal remains	0	0
No remains	0	0
Clothed remains	1	16.7
Personal effects	5	83.3
Medical waste	1	16.7
Trash	1	16.7

Body bags were utilized in all six interments at La Grulla. One set of remains was contained in a plywood coffin, while three sets were interred in other containers, including two airline cargo boxes, and one felt and cotton-lined covered coffin with no lid (Table 24). Trash and plastic bags were used in two burials and one set of remains was wrapped in plastic (Table 24). Five of the burials contained personal effects with the remains (83.3%), while one contained medical waste, and one contained trash (each 16.7%) (Table 25). One set of remains was still clothed upon being exhumed. The six burials recovered from La Grulla Cemetery had an average depth of 147.8cm below datum, with a range of 130 to 164cm.

Starr County Totals

Tables 26, 27, and 28 summarize the burial traits data for the combined 19 burials exhumed from Starr County from 2017 to 2019.

Table 26. Frequency of Burial Orientations in Starr County

Burial Orientation	N	% of Total Burials (N=19)
Head to the west	8	42.1
Head to the east	3	15.8
Head to the north	6	31.6
Stacked	0	0
Bundle	2	10.5
Facedown	0	0

Table 27. Frequency of Burial Containers and Wrappings in Starr County

Burial Containers and Wrapping	N	% of Total Burials (N=19)
Coffin - plywood	4	21.1
Coffin - metal	0	0
Body bag	17	89.5
Biohazard bag	1	5.3
Trash or plastic bag	6	31.6
Other container	3	15.8
Sheet	13	68.4
Plastic wrapping	7	36.8
Tape	1	5.3

Table 28. Frequency of Burial Contents in Starr County

Burial Contents	N	% of Total Burials (N=19)
Faunal remains	0	0
No remains	0	0
Clothed remains	2	10.5
Personal effects	8	42.1
Medical waste	8	42.1
Trash	2	10.5

The majority of unidentified burials Starr County are extended with the head oriented either to the west in RGCC (42.1%) or north in La Grulla Cemetery (31.6%). The three burials with the head to the east and two bundle burials are from RGCC (Table 26). Body bags are the containers utilized in the majority of burials—17 out of 19, or

89.5% (Table 27). Thirteen sets of remains were wrapped in sheets (68.4%), and seven were wrapped in plastic (36.8%) (Table 27). Additional burial containers found in Starr County thus far include wooden coffins (N=4, or 21.1%), trash or plastic bags (N=6, or 31.6%), one biohazard bag, and the airline cargo boxes and lined coffin found in La Grulla (15.8%) (Table 27). Tape was found as wrapping in one burial in RGCC.

Eight graves total contained personal effects and medical waste in Starr County (42.1%) (Table 28). Trash was present in two burials and two sets of remains were still clothed (10.5%) (Table 28).

Tres Norias Cemetery, Willacy County

The characteristics of the 39 unidentified burials exhumed from Tres Norias Cemetery in 2018 are summarized in Tables 29, 30, and 31.

Table 29. Frequency of Burial Orientations at Tres Norias Cemetery

Burial Orientation	N	% of Total Burials (N=39)
Head to the west	29	74.4
Head to the east	5	12.8
Head to the north	0	0
Stacked	5	12.8
Bundle	5	12.8
Facedown	5	12.8

Table 30. Frequency of Burial Containers and Wrappings at Tres Norias Cemetery

Burial Containers and Wrapping	N	% of Total Burials (N=39)
Coffin - plywood	0	0
Coffin - metal	0	0
Body bag	35	89.7
Biohazard bag	4	10.3
Trash or plastic bag	4	10.3
Other container	1	2.6
Sheet	20	51.3
Plastic wrapping	7	17.9
Tape	7	17.9

Table 31. Frequency of Burial Contents at Tres Norias Cemetery

Burial Contents	N	% of Total Burials (N=39)
Faunal remains	0	0
No remains	0	0
Clothed remains	5	12.8
Personal effects	24	61.5
Medical waste	22	56.4
Trash	7	17.9

Twenty-nine of the 39 unidentified burials exhumed from Tres Norias were interred with the head to the west (74.4%) and five were interred with the head to the east (12.8%). Five of these supine individuals were buried face down (Table 29). Five burials were bundles of remains, and five burials were stacked as two sets of two remains, and another bundle on top of a non-forensically significant burial (Table 29).

Body bags were used as burial containers in 35 of the 39 burials (89.7%), while biohazard and trash or plastic bags were used in four burials (10.3%) (Table 30). One set of remains was found interred in a Styrofoam cooler. Twenty interments contained sheet wrapping (51.3%), and seven burials had plastic and tape wrappings (17.9%) (Table 30). Twenty-four graves contained personal effects (61.5%), 22 contained medical waste

(56.4%), and seven contained other trash (17.9%) (Table 31). Five sets of unidentified remains were clothed (12.8%).

Burials at Tres Norias were found at an average depth of 85.9cm below datum with a range of 51 to 124.5cm.

All Burials

Burial Traits totals and percentages for all 103 burials exhumed to-date by OpID are presented in Tables 32, 33, and 34.

Table 32. Total Burial Orientation Frequencies

Burial Orientation	N	% of Total Burials (N=103)
Head to the west	54	52.4
Head to the east	10	9.7
Head to the north	6	5.8
Stacked	9	8.7
Bundle	30	29.1
Facedown	7	6.8

Table 33. Total Burial Container and Wrapping Frequencies

Burial Containers and Wrapping	N	% of Total Burials (N=103)
Coffin - plywood	29	28.2
Coffin - metal	2	1.9
Body bag	81	78.6
Biohazard bag	18	17.5
Trash or plastic bag	24	23.3
Other container	9	8.7
Sheet	50	48.5
Plastic wrapping	29	28.2
Tape	19	18.4

Table 34. Total Frequency of Burial Contents

Burial Contents	N	% of Total Burials (N=103)
Faunal remains	1	1.0
No remains	2	1.9
Clothed remains	8	7.8
Personal effects	68	66.0
Medical waste	41	39.8
Trash	20	19.4

Of all 103 exhumed unidentified burials, 54 were interred with the head to the west (52.4%), ten were buried with the head to the east (9.7%), and six with the head to the north (5.8%) (Table 32). Thirty burials contained bundled remains (29.1%), nine were stacked (8.7%), and seven individuals were buried facedown (6.8%).

Body bags were used as containers for the majority of exhumed burials, as found in 81 out of 103 interments (78.6%) (Table 33). Wooden coffins were containers for 29 interments (28.2%), while trash or plastic bags were utilized in 24 (23.3%), and biohazard bags in 18 (17.5%) (Table 33). Nine other unique containers were present throughout the 103 burials (8.7%). The two metal coffins were found at Sacred Heart Cemetery in Brooks County. Fifty total burials contained remains wrapped in cloth sheets (48.5%), and plastic wrapping and tape were utilized in 29 and 19 graves respectively (28.2% and 18.4%) (Table 33).

Sixty-eight, or approximately two thirds, of the 103 burials exhumed by OpID contained personal effects (66%) (Table 34). Medical waste was present in 41 interments (39.8%) and trash was present in 20 (19.4%) (Table 34). Eight sets of remains were still clothed upon exhumation (7.8%), and three total interments contained no human remains—with two empty graves and one set of faunal remains being found in Brooks County (2.9%) (Table 34).

Additional Case Information

The present section is dedicated to examining the frequency with which additional case information has been included in the graves of unidentified migrant remains throughout the four cemeteries and three counties.

Sacred Heart Cemetery, Brooks County

The numbers and percentages for different types of case information and information content found at Sacred Heart Cemetery are presented in Tables 35 and 36. In total, 19 of the 45 graves exhumed from Sacred Heart Cemetery contained additional case information (42.2%).

Table 35. Frequency of Additional Case Information Types at Sacred Heart Cemetery

Additional Case Information Types	N	% of Total Case Info (N=19)	% of Total Burials (N=45)
Writing on burial container	10	52.6	22.2
Tag(s)	11	57.9	24.4
Other documentation	3	15.8	6.7

Table 36. Frequency of Case Information Content at Sacred Heart Cemetery

Content of Case Information	N	% of Total Case Info (N=19)	% of Total Burials (N=45)
Blank/ illegible	3	15.8	6.7
Date	14	73.7	31.1
TDR/EDR	3	15.8	6.7
Case number	0	0.0	0.0
Location	7	36.8	15.6
Funeral home	5	26.3	11.1
Year range: 2001 - 2012			

Among the 19 burials with additional case information, ten had writing on the burial container (22.2%), 11 had morgue tags or medical bracelets (24.4%), and three had other forms of documentation either taped to container or included inside of it (6.7%) (Table 35). The information for three cases was illegible, with two forms being degraded documents and one being a faded morgue tag. Dates were the primary content of information included in the burials, being present in 14 of the 19 graves that had additional evidence (73.3%), followed by locations (N=7, or 36.8%) and names of funeral homes (N=5, or 26.3%) (Table 36). TDR/ EDR numbers were also included in three burials (15.8% of 19), while no case numbers were present (Table 36). For the 14 cases with dates included at Sacred Heart the years range form 2001 to 2012.

Río Grande City Cemetery (RGCC), Starr County

Tables 37 and 38 summarize the types and content of information interred with unidentified remains from RGCC. Out of the 13 burials exhumed from RGCC, three contained additional case information (23.1%).

Table 37. Frequency of Additional Case Information Types at Río Grande City Cemetery

Additional Case Information Types	N	% of Total Case Info (N=3)	% of Total Burials (N=13)
Writing on burial container	2	66.7	15.4
Tag(s)	0	0	0
Other documentation	1	33.3	7.7

Table 38. Frequency of Case Information Content at Río Grande City Cemetery

Content of Case Information	N	% of Total Case Info (N=3)	% of Total Burials (N=13)
Blank/ illegible	2	66.7	15.4
Date	1	33.3	7.7
TDR/EDR	0	0	0
Case number	0	0	0
Location	0	0	0
Funeral home	1	33.3	7.7
Year range: 2006			

Out of the three burials containing additional case information, two had writing on the burial container (15.4%), and one had a pouch containing document scraps on the outside of the body bag (7.7%) (Table 37). Two of the three total pieces of information were illegible. A date from 2006 and funeral home name were written on the underside of a coffin lid (Table 38).

La Grulla Cemetery, Starr County

The frequencies of additional case information and information content for the six burials from La Grulla Cemetery are summarized in Tables 39 and 40. A total of four cases were found to include case information (66.7%).

Table 39. Frequency of Additional Case Information Types at La Grulla Cemetery

Additional Case Information Types	N	% of Total Case Info (N=4)	% of Total Burials (N=6)
Writing on burial container	1	25.0	16.7
Tag(s)	1	25.0	16.7
Other documentation	2	50.0	33.3

Table 40. Frequency of Case Information Content at La Grulla Cemetery

Content of Case Information	N	% of Total Case Info (N=4)	% of Total Burials (N=6)
Blank/ illegible	0	0	0
Date	3	75.0	50.0
TDR/EDR	0	0	0
Case number	1	25.0	16.7
Location	1	25.0	16.7
Funeral home	1	25.0	16.7
Year range: 2011- 2016			

Two documents, one tag, and one container with writing were found at La Grulla (Table 39). Three of the four cases with additional information had legible dates with years ranging from 2011 to 2016 (50.0%), while one listed a case number, one a location, and one a funeral home (16.7%) (Table 40).

Starr County Totals

Tables 41 and 42 summarize the combined included case information data for the 19 burials exhumed from Starr County. In total, seven of the 19 burials from the county contained additional case information (36.8%).

Table 41. Frequency of Additional Case Information Types in Starr County

Additional Case Information Types	N	% of Total Case Info (N=7)	% of Total Burials (N=19)
Writing on burial container	3	42.9	15.8
Tag(s)	1	14.3	5.3
Other documentation	3	42.9	15.8

Table 42. Frequency of Case Information Content in Starr County

Content of Case Information	N	% of Total Case Info (N=7)	% of Total Burials (N=19)
Blank/ illegible	2	28.6	10.5
Date	4	57.1	21.1
TDR/EDR	0	0	0
Case number	1	14.3	5.3
Location	1	14.3	5.3
Funeral home	2	28.6	10.5
Year range: 2006 -2016			

Of the seven cases with additional information, three each contained writing on burial containers and documents (15.8%) and one contained a tag (5.3%) (Table 41). Dates, with years ranging from 2006 to 2016, were included in four cases (21.2%), while funeral homes were listed in two (10.5%) (Table 42). The one case number and one location were found on documents in the graves at La Grulla Cemetery. Additional case information was illegible for two of the cases in Starr County (10.5%) (Table 42).

Tres Norias Cemetery, Willacy County

The frequencies of additional case information and information content for the 39 burials exhumed from Tres Norias Cemetery are presented in Tables 43 and 44. Of the 39 unidentified remains burials exhumed from Tres Norias, 17 contained additional case information (43.6%).

Table 43. Frequency of Additional Case Information Types at Tres Norias Cemetery

Additional Case Information Types	N	% of Total Case Info (N=17)	% of Total Burials (N=39)
Writing on burial container	1	5.9	2.6
Tag(s)	15	88.2	38.5
Other documentation	5	29.4	12.8

Table 44. Frequency of Case Information Content at Tres Norias Cemetery

Content of Case Information	N	% of Total Case Info (N=17)	% of Total Burials (N=39)
Blank/ illegible	12	70.6	30.8
Date	4	23.5	10.3
TDR/EDR	0	0	0
Case number	7	41.2	17.9
Location	2	11.8	5.1
Funeral home	3	17.6	7.7
Year range: 2014 - 2016			

While 17 burials from Tres Norias contain additional information, four had multiple forms, with a total of 15 tags (38.5%), five other documents (12.8%), and one container with writing (2.6%) (Table 43). Case information was blank or illegible for 12 of the 17 cases (70.6%), while case numbers were present in seven (41.2% of 17) (Table 44). Four dates with years spanning 2014 to 2016 were included in the additional case information (23.5% of 17), and locations and funeral homes were present in two (11.8%) and three respectively (17.6%) (Table 44). No TDR/EDR numbers were found in the graves at Tres Norias.

All Burials

The presence of various types of case information is summarized for the entire sample of 103 exhumed graves in Tables 45 and 46. In total, 43 of the unidentified burials contained additional case information (41.7%).

Table 45. Total Frequency of Additional Case Information Types

Additional Case Information Types	N	% of Total Case Info (N=43)	% of Total Burials (N=103)
Writing on burial container	14	32.6	13.6
Tag(s)	27	62.8	26.2
Other documentation	11	25.6	10.7

Table 46. Total Frequency of Case Information Content

Content of Case Information	N	% of Total Case Info (N=43)	% of Total Burials (N=103)
Blank/ illegible	17	39.5	16.5
Date	22	51.2	21.4
TDR/EDR	3	7.0	2.9
Case number	8	18.6	7.8
Location	10	23.3	9.7
Funeral home	10	23.3	9.7
Year range: 2001 - 2016			

The majority of additional case information found was in the form of tags on the remains or attached to the burial container (N=27 or 62.8% of 43) (Table 45). Writing on the burial container was found in 14 cases (32.6%), while other documentation was present in 11 (25.6%) (Table 45). Dates are the most frequent type of information found inside the burials, being present in 22 of the 103 cases (21.4%), followed by location and funeral homes in ten (9.7%) and case numbers in eight (7.8%) (Table 46). Seventeen, or

39.5% of the 43 cases with included information, contained blank or illegible documents, tags, or writing (Table 46). The three TDR/ EDRs were found in the graves at Sacred Heart Cemetery. The total year range for the dates included on additional case information is 2001 to 2016.

Condition of Remains

Frequency results for the condition of unidentified remains in terms of the state of decomposition, autopsy status, and DNA sampling are presented for each cemetery and county. As described in Materials and Methods, autopsies were recognized from the presence of cuts, organ bags, and/or associated case documentation from an ME's office or NamUs. Skeletal remains with no physical evidence of autopsy or documentation were scored as not having undergone autopsy, as there is no way to verify if visual autopsies were conducted.

Sacred Heart Cemetery, Brooks County

The total frequencies of remains' completeness, decomposition states, autopsy status, and DNA sampling from Sacred Heart Cemetery are presented in Tables 47 and 48. Because no human remains were found in three of the 45 exhumed burials, and one set of remains is still awaiting a detailed intake, data for the condition of remains is evaluated for 41 cases. An additional case was recognized as an amputated leg that had been disposed of as medical waste; this case is not included in the autopsy and DNA sampling analyses, for a total of 40 cases included from Sacred Heart Cemetery.

Table 47. Condition of Remains Frequencies at Sacred Heart Cemetery

Condition of Remains	N	% of Total Human Remains Burials with Data (N=41)
Complete	15	36.6
Partial	26	63.4
Early decomposition	0	0
Advanced decomposition	5	12.2
Mummified	1	2.4
Skeletonized	35	85.4

Table 48. Autopsy and DNA Sampling Frequencies at Sacred Heart Cemetery

Autopsy and DNA Sampling	N	% of Total Human Remains Burials with Data (N=40)
Autopsy - full	10	25.0
Autopsy - cranial	1	2.5
Autopsy - none	28	70.0
Autopsy - unknown	1	2.5
DNA sampled	5	12.5
Not DNA sampled	31	77.5
Unknown DNA sampled	4	10.0

Of the 41 burials from Sacred Heart for which there are sufficient data, 26 sets of human remains are partial (63.4%), and 15 are complete (36.6%) (Table 47). Thirty-five sets of remains were skeletonized when recovered (85.4%), while five were in an advanced state of decomposition with adhering tissue (12.2%), and one case was mummified (2.4%) (Table 47).

Of the 40 forensically significant cases for which there are data, 28 of the individuals had no evidence of autopsy (70.0%), ten individuals had undergone full autopsies (25.0%), one had undergone a cranial autopsy (2.5%), and one is considered unknown due to possible cut ribs, but no evidence of cranial cuts (2.5%) (Table 48).

Thirty-one cases from Sacred Heart Cemetery show no signs of DNA sampling (77.5% of 40), while five have been sampled (12.5%) and four are still unknown (10.0%).

Río Grande City Cemetery (RGCC), Starr County

Tables 49 and 50 summarize the preservation, autopsy, and sampling status of the 13 sets of remains recovered from RGCC.

Table 49. Condition of Remains Frequencies at Río Grande City Cemetery

Condition of Remains	N	% of Total Burials (N=13)
Complete	11	84.6
Partial	2	15.4
Early decomposition	0	0
Advanced decomposition	2	15.4
Mummified	1	7.7
Skeletonized	10	76.9

Table 50. Autopsy and DNA Sampling Frequencies at Río Grande City Cemetery

Autopsy and DNA Sampling	N	% of Total Burials (N=13)
Autopsy - full	9	69.2
Autopsy - cranial	0	0
Autopsy - none	4	30.8
Autopsy - unknown	0	0
DNA sampled	0	0
Not DNA sampled	13	100
Unknown DNA sampled	0	0

Eleven of the 13 remains exhumed from RGCC are complete (84.6%), while two are partial (15.4%) (Table 49). Ten remains were skeletonized upon recovery (76.9%), two were in advanced decomposition (15.4%), and one was mummified (7.7%). The majority of remains, at nine out of 13, had undergone full autopsy (69.2%), while four

had not (30.8%) (Table 50). All 13 cases showed no evidence of DNA sampling.

La Grulla Cemetery, Starr County

The conditions of the six sets of remains exhumed from La Grulla Cemetery are presented in Tables 51 and 52.

Table 51. Condition of Remains Frequencies at La Grulla Cemetery

Condition of Remains	N	% of Total Burials (N=6)
Complete	6	100
Partial	0	0.0
Early decomposition	0	0.0
Advanced decomposition	4	66.7
Mummified	0	0.0
Skeletonized	2	33.3

Table 52. Autopsy and DNA Sampling Frequencies at La Grulla Cemetery

Autopsy and DNA Sampling	N	% of Total Burials (N=6)
Autopsy - full	4	66.7
Autopsy - cranial	0	0
Autopsy - none	2	33.3
Autopsy - unknown	0	0
DNA sampled	1	16.7
Not DNA sampled	4	66.7
Unknown DNA sampled	1	16.7

All six individuals are complete, with four in an advanced state of decomposition (66.7%), and two fully skeletonized (33.3%) (Table 51). The same four remains have also undergone full autopsies, while the two skeletonized individuals have not (Table 52). DNA sampling is evidenced on one case, but absent for four cases, and unknown for one.

Starr County Totals

Tables 53 and 54 provide the combined frequencies for the states of decomposition, autopsy status, and DNA sampling encountered in Starr County.

Table 53. Condition of Remains Frequencies in Starr County

Condition of Remains	N	% of Total Burials (N=19)
Complete	17	89.5
Partial	2	10.5
Early decomposition	0	0
Advanced decomposition	6	31.6
Mummified	1	5.3
Skeletonized	12	63.2

Table 54. Autopsy and DNA Sampling Frequencies in Starr County

Autopsy and DNA Sampling	N	% of Total Burials (N=19)
Autopsy - full	13	68.4
Autopsy - cranial	0	0
Autopsy - none	6	31.6
Autopsy - unknown	0	0.0
DNA sampled	1	5.3
Not DNA sampled	17	89.5
Unknown DNA sampled	1	5.3

Of the 19 total remains exhumed from Starr County, 17 were complete and two were partial (89.5% and 10.5%) (Table 53). Twelve individuals were skeletonized upon being recovered (63.2%), while six were in advanced decomposition (31.6%), and one was mummified (5.3%). Evidence of full autopsy is present on 13 of the 19 cases (68.4%) and is lacking for six (31.6%) (Table 54). Seventeen cases appear to have not undergone DNA sampling (89.5%), while one case has been sampled, and the sampling status is

unknown for one (both 5.3%) (Table 54).

Tres Norias Cemetery, Willacy County

The frequencies of decomposition stages and of autopsies and DNA sampling found at Tres Norias Cemetery are summarized in Tables 55 and 56.

Table 55. Condition of Remains Frequencies at Tres Norias Cemetery

Condition of Remains	N	% of Total Burials (N=39)
Complete	30	76.9
Partial	9	23.1
Early decomposition	4	10.3
Advanced decomposition	9	23.1
Mummified	7	17.9
Skeletonized	19	48.7

Table 56. Autopsy and DNA Sampling Frequencies at Tres Norias Cemetery

Autopsy and DNA Sampling	N	% of Total Burials (N=39)
Autopsy - full	14	35.9
Autopsy - cranial	8	20.5
Autopsy - none	14	35.9
Autopsy - unknown	3	7.7
DNA sampled	12	30.8
Not DNA sampled	18	46.2
Unknown DNA sampled	9	23.1

Thirty of the 39 sets of remains exhumed from Tres Norias are complete and nine are partial (76.9% and 23.1%) (Table 55). Nineteen individuals were found skeletonized (48.7%), while nine were in an advanced state of decomposition (23.1%), seven were mummified (17.9%), and four were still in early decomposition (10.3%) (Table 55).

Fourteen total remains have undergone full autopsy, while 14 have not undergone autopsy (both 35.9%); eight individuals had cranial-only autopsies (20.5%) (Table 56). The autopsy status for three cases is unknown (7.7%). Of the 39 remains, 18 show no evidence of DNA sampling (46.2%), while 12 have been sampled (30.8%), and nine are unknown (23.1%) (Table 56).

All Burials

The total states of preservation and frequencies of autopsy and DNA sampling of all exhumed remains from the four cemeteries are summarized in Tables 57 and 58. Due to the presence of nonhuman remains and the missing data for one case from Brooks County, percentages for the condition of remains were calculated out of a total of 99 cases. Percentages for autopsy and DNA status were calculated out of 98 cases due to the presence of the amputated leg burial in Brooks County.

Table 57. Total Condition of Remains Frequencies

Condition of Remains	N	% of Total Human Remains Burials with Data (N=99)
Complete	62	62.6
Partial	37	37.4
Early decomposition	4	4.0
Advanced decomposition	20	20.2
Mummified	9	9.1
Skeletonized	66	66.7

Table 58. Autopsy and DNA Sampling Total Frequencies

Autopsy and DNA Sampling	N	% of Total Human Remains Burials with Data (N=98)
Autopsy - full	37	37.8
Autopsy - cranial	9	9.2
Autopsy - none	48	49.0
Autopsy - unknown	4	4.1
DNA sampled	18	18.4
Not DNA sampled	66	67.3
Unknown DNA sampled	14	14.3

Sixty-two of the 99 human remains exhumed by OpID since 2017 are complete (62.6%), while 37 are partial (37.4%) (Table 57). Sixty-six total remains were skeletonized when exhumed (66.7%), 20 were in advanced decomposition (20.2%), nine were mummified (9.1%), and four were in early decomposition (4.0%) (Table 57). Of the 98 cases with complete data, 48 have not been autopsied (49.0), while 37 have undergone full autopsies (37.8%), nine have had cranial autopsies (9.2%), and four have unknown autopsy status (4.1%) (Table 58). Prior to burial, DNA sampling did not occur for 66 individuals (67.3%). Eighteen individuals were sampled for DNA (18.4%), while prior sampling for 14 cases is unknown (14.3%) (Table 58).

Case Records

The current section provides results for the availability of external case records that can be linked to the 103 burials exhumed by OpID from 2017 through 2019. The total numbers and percentages of case records—particularly NamUs records—are presented for each county, in addition to the totals and percentages of DNA statuses listed in the case files.

Sacred Heart Cemetery, Brooks County

Of the 45 burials exhumed to-date from Sacred Heart, 14 have been linked to an external case record (31.1%), with seven having corresponding NamUs reports (15.6%) and seven having recovery reports from the Brooks County Sheriff's Office (BCSO) (15.6%). None of the cases records correspond to one another. Table 59 summarizes the frequency results of the DNA processing status of the NamUs cases.

Table 59. Frequency of NamUs DNA Profiling for Sacred Heart Cemetery

DNA Profile Status	N	% of Total NamUs Cases (N=7)	% of Total Burials (N=45)
DNA profiling complete	1	14.3	2.2
DNA sample submitted*	0	0	0
No DNA info	6	85.7	13.3
Skeletal sampling and NamUs case	1	14.3	2.2

* test not complete

Of the seven exhumed cases with associated NamUs records, six have no DNA testing status listed on NamUs (85.7%), while one lists testing as complete (14.3%). One out of the five individuals that showed evidence of DNA sampling at Sacred Heart Cemetery has a corresponding NamUs case (2.2% out of 45 burials), while the other four do not (Tables 48 and 59). The one NamUs case corresponding to the sampled individual does not list the DNA profile status.

Starr County

No NamUs cases have been associated with any of the 19 burials that have been exhumed from Starr County from either RGCC or La Grulla cemeteries. No additional sheriff's reports or case files have been made available for comparison at this time.

Tres Norias Cemetery, Willacy County

In total, NamUs reports match seven cases out of the 39 burials exhumed from Tres Norias Cemetery (17.9%). Table 60 summarizes the DNA profiling status of the seven cases.

Table 60. Frequency of NamUs DNA Profiling for Tres Norias Cemetery

DNA Profile Status	N	% of Total NamUs Cases (N=7)	% of Total Burials (N=39)
DNA profiling complete	4	57.1	10.3
DNA sample submitted*	3	42.9	5.1
No DNA info	0	0	0
Skeletal sampling and NamUs case	7	100	17.9

*tests not complete

All seven NamUs reports for cases exhumed from Tres Norias Cemetery list information about DNA testing, with four having complete profiles (57.1%), and three having samples submitted that have yet to be sequenced (42.9%). All NamUs listings correspond to seven of the 12 exhumed remains that have evidence of prior DNA sampling (58.3%) (Tables 56 and 60). No other external case records corresponding to the cemetery are available at this time.

All Burials

Fourteen of the 103 exhumed burials were able to be associated with NamUs case records (13.6%). The total frequencies of DNA profiling status are presented in Table 61.

Table 61. Total Frequency of NamUs DNA Profiling

DNA Profile Status	N	% of Total NamUs Cases (N=14)	% of Total Burials (N=103)
DNA profiling complete	5	35.7	4.9
DNA sample submitted*	3	21.4	2.9
No DNA info	6	42.9	5.8
Skeletal sampling and NamUs Case	8	57.1	7.8

*tests not complete

Five of the 14 cases with NamUs have complete DNA profiles (4.9%), while three have DNA submitted (2.9%), and six have NamUs records, but no DNA information (5.8%) (Table 61). Eight total cases have both NamUs listings and show evidence of having been previously sampled for DNA prior to burial and exhumation (7.8%). BCSO recovery reports are currently the only other external case records available for comparison at this time, which correspond to seven total exhumed burials from Sacred Heart Cemetery in Brooks County (6.8% of 103 burials).

Statistical Analyses

The current section first provides results of the Chi-square tests of independence that were run to assess the significance of variables across the three counties, as well as the relationships between variables within each of the five main categories. For many of the 2x2 analyses, results of Fisher's Exact Tests are instead reported when more than 20 percent of expected values were less than five. Results are then provided for Chi-square tests of independence and Fisher's Exact Tests examining the relationships between variables across each of the categories. While the cross-county results are summarized in tables included in the chapter, all other tables for frequency analyses within and across variable categories are included as appendices, as they are very large. The only other table included in the text presents results of Chi-square and Fisher's Exact Tests

comparing grave markers and additional case information, as these had larger sample sizes and yielded several significant results worth highlighting. For all analyses, p-values less than 0.05 are considered statistically significant.

Grave Markers

Table 62 summarizes the results of Chi-square tests of independence comparing the three counties to grave marker presence, staked markers, metal markers, and the presence of marker information.

Table 62. Chi-square Results for Grave Marker Variables Across Counties

Grave Markers and Marker Info by County (df=2, N=103)	X^2	p	Cramer's V	Adjusted Standardized Residuals (Brooks, Starr, Willacy)
Total Markers	3.038	0.219	-	-
Stakes	5.231	0.073	-	-
Metal	12.502	**0.002**	0.348	± 1.7, ± **2.1**, ± **3.4**
Marker Info	2.111	0.348	-	-

There is no significant relationship between the presence of grave markers and the three counties, X^2 (2, N=103) = 3.038, p = 0.219 (Table 62). The distribution of staked markers in each county is also not significant, X^2 (2, N=103) = 5.231, p = 0.073, while the relationship between metal markers and counties is significant, X^2 (2, N=103) = 12.502, p = 0.002 with a medium effect size (Cramer's V = 0.348). Starr and Willacy are the two counties that significantly contribute to the variation in metal markers (ASRs = ± 2.1 and ± 3.4) (Table 62). The relationship between the presence of marker information and county is not significant, X^2 (2, N=103) = 2.111, p = 0.348. All other grave marker variables produce expected values less than five in more than 20 percent of the cells

when assessed across counties.

Grave Marker Style and Marker Information

Appendix C summarizes the results of Fisher's Exact Tests examining the relationships between grave marker materials and grave marker information across the sample of 103 exhumed OpID burials. Significant associations were found between metal markers and the following variables: presence of case information on markers ($p = 0.000$), blank/illegible information ($p = 0.000$), the inclusion of dates on markers ($p = 0.010$), the inclusion of EDR/TDR numbers ($p = 0.000$), the inclusion of locations ($p = 0.002$), and the inclusions of funeral homes ($p = 0.018$) (Appendix C). Metal markers with metal lettering have a significant relationship with marker case information ($p = 0.000$), the inclusion of EDR/TDR numbers ($p = 0.000$), and the inclusion of locations ($p = 0.029$) (Appendix C). Metal (aluminum) markers with etching have significant associations with the presence of marker case information ($p = 0.005$), and the inclusion of dates ($p = 0.001$), locations ($p = 0.003$), and funeral homes ($p = 0.001$). Metal markers with paper inserts have a significant relationship with blank/illegible information ($p = 0.000$) (Appendix C). Plastic and paper markers have a significant relationship with marker case information ($p = 0.001$) and the inclusion of dates ($p = 0.001$), case numbers ($p = 0.001$), and funeral homes ($p = 0.000$).

Burial Traits

Table 63 provides the results of Chi-square 2x3 tests of independence assessing the relationship between counties and burial traits. Results are for all variables that produced expected values over five for at least 20 percent of cells.

Table 63. Chi-square Results for Burial Traits Across Counties

Burial Traits by County (df=2, N=103)	X^2	p	Cramer's V	Adjusted Standardized Residuals (Brooks, Starr, Willacy)
Orientation - head to the west	10.110	**0.006**	0.313	**± 2.2**, ± 1.2, **± 3.2**
Orientation - bundle	20.540	**0.000**	0.447	**± 4.5**, **± 2.1**, **± 3.0**
Container - coffin	36.656	**0.000**	0.597	**± 5.8**, ± 1.0, **± 5.2**
Container - body bag	9.689	**0.008**	0.305	**± 3.1**, ± 1.3, **± 2.1**
Container - biohazard bag	7.439	**0.024**	0.269	**± 2.7**, ± 1.6, ± 1.5
Container - trash or plastic bag	5.987	0.050	-	-
Wrapping - sheet	5.211	0.074	-	-
Wrapping - plastic	43.31	0.191	-	-
Wrapping - tape	3.278	0.194	-	-
Contents - personal effects	7.818	**0.020**	0.275	**± 2.4**, **± 2.3**, ± 0.6
Contents - medical waste	8.961	**0.011**	0.295	**± 2.8**, ± 0.2, **± 2.7**
Contents - trash	1.740	0.419	-	-

There is a significant difference in the distribution of burials oriented with the head to the west across counties, X^2 (2, N=103) = 10.110, p = 0.006, with a moderate effect size (Cramer's V = 0.313) and Brooks and Willacy Counties significantly contributing to the variation (ASRs = ± 2.2 and ± 3.2) (Table 63). Bundle burials are also significantly distributed across counties, X^2 (2, N=103) = 20.540, p = 0.000, with a large effect size (Cramer's V = 0.447), and all three being significant contributors (ASRs = ± 4.5, ± 2.1, and ± 3.0).

In regards to burial containers, coffins are significantly distributed across counties, X^2 (2, N=103) = 36.656, p = 0.000, with a large effect size (Cramer's V = 0.597) and Brooks and Willacy Counties contributing to the variation (ASRs = ± 5.8 and ± 5.2) (Table 63). A significant association between body bags and county was also found, X^2 (2, N=103) = 9.589, p = 0.008, with a moderate effect size (Cramer's V = 0.305) and Brooks and Willacy being significant (ASRs = ± 3.1 and ± 2.1). Biohazard bags as burial

containers are significantly associated with county, X^2 (2, N=103) = 7.439, p = 0.024, with a moderate effect size (Cramer's V = 0.269), and Brooks County being the significant contributor (ASRs = ± 2.7). There is no significant relationship between county and trash or plastic bags as burial containers, X^2 (2, N=103) = 5.978, p = 0.050 (Table 63). There are also no significant differences in the distribution of burial wrappings across counties: sheets, X^2 (2, N=103) = 5.211, p = 0.074, plastic, X^2 (2, N=103) = 3.314, p = 0.191, and tape, X^2 (2, N=103) = 3.278, p = 0.194.

A significant association exists between county and the presence of personal effects in the burials, X^2 (2, N=103) = 7.818, p = 0.020, with a moderate effect size (Cramer's V = 0.275) and Brooks and Starr Counties being significant contributors (ASRs = ± 2.4 and ± 2.3) (Table 63). Medical waste and county also have a significant relationship, X^2 (2, N=103) = 8.961, p = 0.011, with a moderate effect size (Cramer's V = 0.295) and Brooks and Willacy Counties being significant contributors (ASRs = ± 2.8 and ± 2.7) (Table 63). The presence of trash in burials is not found to be significantly related to county, X^2 (2, N=103) = 1.740, p = 0.419.

Burial Orientation and Burial Containers

Appendix D provides the results for Chi-square 2x2 tests of independence and Fisher's Exact Tests of all burial orientations and burial containers across the entire sample of exhumed burials (N=103). Of the 30 cross tabulations of orientations and burial containers, six significant relationships were found. One is between head-to-the-west orientation and body bags, X^2 (1, N=103) = 11.290, p = 0.001, with a moderate effect size (Cramer's V = 0.331) (Appendix D). Head-to-the-west orientation and biohazard bags also have a significant relationship, X^2 (1, N=103) = 9.086, p = 0.003 with

a small effect size (Cramer's V = 0.297). For head-to-the-north orientation, a significant association is found with the use of other burial containers, Fisher's Exact p = 0.008 (Appendix D). Bundle burials have a significant relationship with the use of body bags, X^2 (1, N=103) = 29.593, p = 0.000, with a large effect size (Cramer's V = 0.536), as well as with biohazard bags, X^2 (1, N=103) = 9.972, p = 0.002, with a moderate effect size (Cramer's V = 0.311), and with trash or plastic bags, X^2 (1, N=103) = 5.982, p = 0.015, with a small effect size (Cramer's V = 0.239) (Appendix D).

Burial Orientation and Burial Wrapping

Appendix E summarizes the results from Chi-square and Fisher's Exact Tests of burial orientation and burial wrapping for All OpID exhumed burials. No significant relationships were found between any orientations and the use of wrappings, except for between bundle burials and the use of sheets, X^2 (1, N=103) = 6.759, p = 0.009, with a small effect size (Cramer's V = 0.256) (Appendix E).

Burial Orientation and Burial Contents

Appendix F provides the results of Chi-square and Fisher's Exact Tests of burial orientation and burial contents. Burials oriented with the head to the east have a significant relationship with the inclusion of personal effects in the burial, Fisher's Exact p = 0.031 (Appendix F). A significant association also exists between facedown orientation and remains being clothed, Fisher's Exact p = 0.001.

Burial Containers and Burial Wrapping

The results of Chi-square and Fisher's Exact Tests of burial containers and burial wrapping are included in Appendix G. A significant relationship was found between coffins and the use of plastic as burial wrapping, X^2 (1, N=103) = 0.167, p = 0.041, with a

small effect size (Cramer's V = 0.201) (Appendix G). Body bags and sheet wrapping also have a significant association, X^2 (1, N=103) = 5.067, p = 0.024, with a small effect size (Cramer's V = 0.222).

Burial Containers and Burial Contents

Appendix H summarizes the results of Chi-square and Fisher's Exact Tests of burial containers and burial contents. A significant relationship was found between coffins and the inclusion of personal effects, X^2 (1, N=103) = 4.745, p = 0.029, with a small effect size (Cramer's V = 0.215), as well as between coffins and the inclusion of medical waste, X^2 (1, N=103) = 5.492, p = 0.019, with a small effect size (Cramer's V = 0.231) (Appendix H). Body bags are also significantly associated with medical waste, X^2 (1, N=103) = 5.492, p = 0.019, with a small effect size (Cramer's V = 0.231), as are trash and plastic bags, X^2 (1, N=103) = 6.992, p = 0.008, with a small effect size (Cramer's V = 0.261) (Appendix H).

Burial Wrapping and Burial Contents

Appendix I summarizes the results of Chi-square tests of independence and Fisher's Exact Tests of burial wrapping and burial contents for the entire exhumed burial sample. No significant relationships were found between sheet, plastic, or tape wrapping and any of the burial contents (Appendix I).

Additional Case Information

Table 64 summarizes the results of 2x3 Chi-square tests of independence examining the relationships between counties and the various types of case information included in burials. All results are for case information variables that produced expected

values over five in at least 80 percent of cells.

Table 64. Chi-square Results for Additional Case Information Across Counties

Case Info Types and Info Content by County (df=2, N=103)	X^2	p	Cramer's V	Adjusted Standardized Residuals (Brooks, Starr, Willacy)
Total Case Info	0.247	0.884	-	-
Writing on container	6.970	**0.031**	0.260	**± 2.3**, ± 0.3, **± 2.5**
Tags	8.558	**0.014**	0.288	± 0.6, **± 2.4, ± 2.5**
Illegible info	9.412	**0.009**	0.302	**± 2.4**, ± 0.8, **± 3.0**
Date	7.066	**0.029**	0.262	**± 2.2**, ± 0.1, **± 2.5**

The overall presence of additional case information included in the burials is not significantly related to counties, X^2 (2, N=103) = 0.247, p = 0.884. A significant relationship is found between writing on the burial container and county, X^2 (2, N=103) = 6.970, p = 0.031, with a medium effect size (Cramer's V = 0.260), and Brooks and Willacy Counties significantly contributing to the variation (ASRs = ± 2.3 and ± 2.5) (Table 64). The inclusion of tags on the burial container or on the remains is significantly associated with county, X^2 (2, N=103) = 8.558, p = 0.014, with a medium effect size (Cramer's V = 0.288) and Starr and Willacy Counties being significant (ASRs = ± 2.4 and ± 2.5). There is also a significant relationship for case information being illegible across counties, X^2 (2, N=103) = 9.412, p = 0.009, with a large effect size (Cramer's V = 0.302) and Brooks and Willacy Counties being significant (ASRs = ± 2.4 and ± 3.0) (Table 65). The inclusion of dates on buried case information is significant across counties, X^2 (2, N=103) = 7.066, p = 0.029, with a medium effect size (Cramer's V = 0.262) and Brooks and Willacy Counties significantly contributing to the variation (ASRs = ± 2.2 and ± 2.5).

Case Information Type and Content

Appendix J provides the results of Fisher's Exact Tests assessing the relationships between additional case information types and the content of information included. For writing on containers, significant associations were found with the inclusion of dates ($p = 0.000$), EDT/TDRs ($p = 0.048$), locations ($p = 0.029$), and funeral homes ($p = 0.019$) (Appendix J). A significant relationship was found between tags and illegible information ($p = 0.000$), as well as between tags and dates ($p = 0.000$) and tags and case numbers ($p = 0.001$). Other documentation is significantly related to illegibility ($p = 0.001$), dates ($p = 0.004$), EDR/TDRs ($p = 0.024$), and locations ($p = 0.000$) (Appendix J).

Condition of Remains

The results of Chi-square tests of independence comparing the condition of remains across the three counties are provided in Table 65. Results are for variables that produced expected values over five in at least 80 percent of cells. As will be discussed below, understanding potential patterns in the condition of remains across counties may illuminate why certain burial practices are occurring, in addition to highlighting possible county differences in forensic analysis procedures.

Table 65. Chi-square Results for Condition of Remains Across Counties

Condition of Remains by County (df=2, N=99)	X^2	p	Cramer's V	Adjusted Residuals (Brooks, Starr, Willacy)
Complete	21.136	**0.000**	0.462	**± 4.5, ± 2.7**, **± 2.4**
Partial	21.136	**0.000**	0.462	**± 4.5, ± 2.7**, **± 2.4**
Advanced decomp	3.356	0.187	-	-
Skeletonized	12.210	**0.002**	0.351	**± 3.3**, ± 0.4, **± 3.1**
Autopsy, full	10.429	**0.005**	0.326	**± 2.2**, **± 3.1**, ± 0.3
No autopsy	12.046	**0.002**	0.351	**± 3.5**, ± 1.7, **± 2.1**
DNA sampled	7.095	**0.029**	0.269	± 1.2, ± 1.6, **± 2.6**
Not DNA sampled	14.071	**0.001**	0.379	± 1.8, **± 2.3**, **± 3.6**
DNA sampling unknown	4.325	0.115	-	-

Complete and partial remains were each significantly distributed throughout the counties X^2 (2, N=99) = 21.123, p = 0.000, with a large effect size (Cramer's V = 0.462), and all three counties being significant (ASRs = ± 4.5, ± 2.7 and ± 2.4) (Table 66). Advanced decomposition is not significantly related to county, X^2 (2, N=99) = 3.356, p = 0.187, but skeletonization is, X^2 (2, N=99) = 12.210, p = 0.002, with a large effect size (Cramer's V = 0.351) and Brooks and Willacy Counties being significant (ASRs = ± 3.3 and ± 3.1) (Table 65).

In regards to evidence of previous forensic examination, full autopsies are significantly distributed across counties, X^2 (2, N=99) = 10.429, p = 0.005, with a moderate effect size (Cramer's V = 0.326) and Brooks and Starr Counties being significant (ASRs = ± 2.2 and ± 3.1) (Table 65). Non-autopsied remains (in terms of lacking physical evidence of autopsy) are also significantly distributed across counties, X^2 (2, N=99) = 12.046, p = 0.002, with a large effect size (Cramer's V = 0.351) and Brooks and Willacy Counties being significant (ASRs = ± 3.5 and ± 2.1). DNA sampling is significant across counties, X^2 (2, N=99) = 7.095, p = 0.029, with a moderate effect size (Cramer's V = 0.269), and Willacy County significantly contributing to the variation

(ASR = ± 2.1) (Table 65). Non-DNA-sampled remains are also significant across counties, X^2 (2, N=99) = 14.071, p = 0.001, with a large effect size (Cramer's V = 0.379), and Starr and Willacy Counties being significant (ASRs = ± 2.3 and ± 3.6).

State of Decomposition and Autopsy and DNA Sampling

The results of Chi-square and Fisher's Exact Tests assessing relationships between states of decomposition and autopsy and DNA sampling are summarized in Appendix K. Early decomposition and evidence of a full autopsy have a significant relationship, p = 0.018, as does advanced decomposition and full autopsy, X^2 (1, N=98) = 5.291, p = 0.021, with a small effect size (Cramer's V = 0.232) (Appendix K). Advanced decomposition is also significantly associated with no autopsy, X^2 (1, N=98) = 8.445, p = 0.004, with a small effect size (Cramer's V = 0.294), and with unknown DNA sampling, Fisher's Exact p = 0.035. No significant relationships are found for mummified remains, but skeletonized remains are significantly related to full autopsy, X^2 (1, N=98) = 14.181, p = 0.000, with a medium effect size in a seemingly negative relationship, as discussed below (Cramer's V = 0.380) (Appendix K). Skeletonization is also significantly associated with no autopsy, X^2 (1, N=98) = 12.183, p = 0.000, with a medium effect size and a seemingly positive relationship (Cramer's V = 0.353).

Autopsy by DNA Sampling

Appendix L provides the results of Chi-square and Fisher's Exact Tests examining the relationship between autopsy status and DNA sampling for all exhumed human remains burials of forensic significance (N=98). No significant relationships were found for full or cranial autopsies and any of the DNA sampling conditions (sampled, not sampled, or unknown) (Appendix L). There is a significant relationship between no

autopsy and unknown DNA sampling, X^2 (1, N=98) = 4.961, p = 0.026, with a small effect size (Cramer's V = 0.225). There are also significant relationships between unknown autopsy and no DNA sampling and unknown autopsy and unknown DNA sampling, Fisher's Exact p = 0.010 and p = 0.000 respectively (Appendix L).

Case Records

The distribution of NamUs records associated with exhumed cases is not significant across counties, X^2 (2, N=103) = 3.767, p = 0.152. The only other available external records at this time are the BCSO Recovery Reports for Brooks County.

Grave Markers and Burial Traits

Appendix M includes results from Chi-square and Fisher's Exact Tests of relationships between grave markers and burial traits. Specifically, the distribution of grave markers was tested against all burial orientations, containers, wrappings, and contents. A significant relationship was found between the presence of grave markers and head-to-the-north orientation (Fisher's Exact p = 0.000), as well as between grave markers and coffins (both lidded, wooden boxes and metal caskets), X^2 (1, N=103) = 4.821, p = 0.028, with a small effect size (Cramer's V = 0.216) (Appendix M). Grave markers and tape wrapping also have a significant association, X^2 (1, N=103) = 9.341, p = 0.002, with a medium effect size (Cramer's V = 0.301), as do grave markers and the presence of personal effects, X^2 (1, N=103) = 4.162, p = 0.041, with a small effect size (Cramer's V = 0.201) (Appendix M).

Grave Markers and Additional Case Information

Chi-square tests of independence and Fisher's Exact Tests were run to examine relationships between grave markers and marker information with the presence of additional case information included in the burial (Table 67).

Table 66. Chi-square and Fisher's Exact Results for Grave Markers, Marker Information, and Additional Case Information

Grave Markers and Marker Info by Additional Case Info Types (df=1, N=103)	X^2	p	Cramer's V
markers present - total case info	3.874	**0.049**	0.194
markers present- writing on container	6.161	**0.013**	0.245
markers present - tags	0.170	0.808	-
markers present - other documentation	-	**0.006**	-
marker info present - total case info	4.391	**0.036**	0.206
marker info present - writing on container	-	0.129	-
marker info present - tags	1.098	0.295	-
marker info present - other documentation	-	**0.002**	-

There is a significant association between grave markers and the presence of buried case information, X^2 (1, N=103) = 3.874, p = 0.049, with a small effect size (Cramer's V = 0.194). Grave markers also have a significant relationship with writing on the burial container, X^2 (1, N=103) = 6.161, p = 0.013, with a small effect size (Cramer's V = 0.245), as well as with the inclusion of other documentation, Fisher's Exact p = 0.006 (Table 66). The presence of legible marker information across all burials is also significantly related to the overall presence of additional case information, X^2 (1, N=103) = 4.391, p = 0.036, with a small effect size (Cramer's V = 0.206). The presence of marker information is also significantly associated with the inclusion of other documentation in the grave, Fisher's Exact p = 0.002 (Table 66).

The presence of grave markers and the content of marker information were tested for any significant relationships with the content of additional case information included in the burials, as reported in Appendix N. The presence of grave markers is significantly related to the inclusion of dates in the burial, X^2 (1, N=103) = 10.03, p = 0.002, with a medium effect size (Cramer's V = 0.312). Grave markers are also significantly associated with EDR/TDRs included in burials, as well as with locations, Fisher's Exact p = 0.023 and p = 0.006 (Appendix N). In terms of the content of marker information, the inclusion of dates on markers is significantly related to the inclusion of case numbers in burials, Fisher's Exact p = 0.019 (Appendix N). EDR/TDRs on grave markers are also significantly related to the inclusion of dates, EDR/TDRs, and locations in burials, Fisher's Exact p = 0.001, p = 0.000, and p = 0.003 (Appendix N). Case numbers on grave markers are significantly associated with case numbers in buried case information, Fisher's Exact p = 0.036. Finally, the inclusion of funeral homes on grave markers is significantly related to case numbers in additional buried information (Appendix N).

Grave Markers and Condition of Remains

Results of Chi-square and Fisher's Exact Tests examining relationships between grave markers and the condition of remains are summarized in Appendix O. There are no significant relationships between the presence of grave markers and the completeness of remains, states of decomposition, or autopsy and DNA sampling. The overall presence of grave marker information is also not associated with autopsy or DNA sampling. Of the types of information included on grave markers, there is a significant relationship

between the inclusion of dates and remains that are not DNA sampled, Fisher's Exact p = 0.013 (Appendix O). Case numbers and DNA sampling and case numbers and evidence of no DNA sampling are also significantly associated, Fisher's Exact p = 0.042 and p = 0.038. The inclusion of funeral homes on grave markers is significantly related to non-DNA sampled remains, Fisher's Exact p = 0.036 (Appendix O).

Grave Markers and NamUs Records

Appendix P provides the results of Fisher's Exact Tests examining the relationships between grave markers, marker information, and NamUs case records and DNA sampling status. There is an overall significant relationship between grave markers and NamUs records, as well as between grave markers and complete DNA profiles on NamUs, both p = 0.024. The inclusion of dates on markers is also significantly associated with NamUs records and the completion of DNA profiles, both p = 0.000 (Appendix P). Case numbers on grave markers are significantly related to NamUs records and NamUs DNA completion, p = 0.017 and p = 0.018, as is the inclusion of funeral homes on markers for both NamUs records and complete DNA, p = 0.000 (Appendix P). There are no significant associations between markers or marker information and DNA being submitted (but not complete) on NamUs, nor between marker and marker information and a lack of DNA status on NamUs (Appendix P).

Burial Traits and Case Information

Relationships were assessed between burial traits (burial orientation, containers, and contents) and the presence and types of additional case information interred in the

burials. Results of Chi-square and Fisher's Exact Tests are provided in Appendix Q. No significant relationships were found between burial orientations and the presence of any types of additional case information, nor between burial contents and additional case information (Appendix Q). The only significant relationship for burial containers was between coffins and writing on the container, Fisher's Exact p = 0.021 (Appendix Q). No other associations were found between other containers and other types of interred case information (i.e. tags and other documentation).

Burial Traits and Condition of Remains

Chi-squares and Fisher's Exact Tests were run to evaluate relationships between burial containers, burial contents, and the condition of remains, including completeness, state of decomposition, autopsy status, and DNA sampling (Appendix R). Because the completeness of remains is a mutually exclusive category, with remains being either complete or partial, all statistical analyses for completeness produced the same values. Of the burial containers, all except for coffins and other containers had a significant relationship with complete and partial remains: body bags, X^2 (1, N=99) = 22.037, p = 0.000, with a medium effect size (Cramer's V = 0.472); biohazard bags, X^2 (1, N=99) = 8.065, p = 0.005, with a small effect size (Cramer's V = 0.285); and trash or plastic bags, X^2 (1, N=99) = 7.067, p = 0.008, with a small effect size (Cramer's V = 0.267), (Appendix R). In regards to states of decomposition, a significant relationship was found between coffins and skeletonized remains, X^2 (1, N=99) = 5.729, p = 0.017, with a small effect size (Cramer's V = 0.241), as well as between body bags and skeletonized remains, X^2 (1, N=99) = 5.504, p = 0.019, with a small effect size (Cramer's V = 0.236 (Appendix

R). No other significant associations exist between burial containers and states of decomposition.

Analyses between burial containers, autopsy, and DNA sampling yielded a significant relationship between coffins (wood boxes and metal caskets combined) and non-DNA sampled remains, X^2 (1, N=99) = 5.393, p = 0.020, with a small effect size (Cramer's V = 0.235). Relationships were also found between body bags and full autopsy, X^2 (1, N=99) = 6.661, p = 0.010, with a small effect size (Cramer's V = 0.261), and between body bags and no autopsy, X^2 (1, N=99) = 7.318, p = 0.007, with a small effect size (Cramer's V = 0.273) (Appendix R). Finally, a significant association was found between biohazard bags and non-sampled remains, X^2 (1, N=99) = 4.653, p = 0.031, with a small effect size (Cramer's V = 0.218). There are no other significant relationships between burial containers and autopsy and DNA sampling.

When comparing burial contents, autopsy, and DNA sampling, no significant associations are found for clothed remains, personal effects, or medical waste (Appendix R). There is a significant relationship between the inclusion of trash in the burial and cranial autopsy, Fisher's Exact p = 0.010. Trash is not related to any other autopsy or DNA sampling variables (Appendix R).

Case Information and Condition of Remains

Appendix S contains the results of Chi-square and Fisher's Exact Tests examining relationships between additional case information interred in the burials and the condition of recovered human remains. A significant association was found between the overall inclusion of buried case information and mummified remains, Fisher's Exact p = 0.031,

as well as with the inclusion of tags and mummified remains, Fisher's Exact p = 0.012 (Appendix S). The presence of other documentation is also significantly associated with skeletonized remains, Fisher's Exact p = 0.015. No significant associations exist between writing on the burial container and any stages of decomposition. In terms of autopsy and DNA sampling, there is a significant relationship between tags and DNA sampling, Fisher's Exact p = 0.001, and between tags and no DNA sampling, X^2 (1, N=98) = 8.889, p = 0.003, with a medium effect size (Cramer's V = 0.301) (Appendix S). There are no significant relationships between other forms of case information or any autopsy status.

Relationships for the content of case information and autopsy and DNA sampling were also assessed with Fisher's Exact Tests. Specifically the inclusion of EDR/TDR numbers, case numbers, and funeral homes were tested with autopsy and sampling status. A significant association was found between case numbers and DNA sampling, p = 0.002, and between case numbers and no DNA sampling p = 0.000 (Appendix S).

Case Information and NamUs Records

Additional case information in the burials was compared with NamUs records and NamUs DNA profiling status (Appendix T). There is a significant relationship between the overall presence of additional case information and NamUs records, X^2 (1, N=103) = 9.034, p = 0.003, with a small effect size (Cramer's V = 0.296). No relationships are found between writing on containers or the inclusion of documentation and any NamUs variables. Significant associations do exist for tags in the burial and NamUs records, tags and DNA submitted (but not completed) on NamUs, and tags and no DNA info on Namus, Fisher's Exact p = 0.000, p = 0.019, and p = 0.005 (Appendix T).

Condition of Remains and NamUs Records

Appendix U contains the results of Chi-square and Fisher's Exact Tests examining relationships between the condition of remains, NamUs records, and NamUs DNA profiling status. No significant associations were found between the completeness of remains and NamUs records or DNA status, nor between early and advanced decomposition and NamUs variables (Appendix U). A significant relationship was found for mummified remains and DNA being submitted (but not yet complete) on NamUs, Fisher's Exact $p = 0.021$. No relationships exist for skeletonized remains and NamUs (Appendix U). Additionally, there are no significant relationships between autopsy status (full, cranial, none, or unknown) and NamUs records or DNA. Remains that have evidence of DNA sampling are statistically associated with NamUs records, Fisher's Exact $p = 0.000$, as well as with complete NamUs DNA, $p = 0.004$, and NamUs DNA having been submitted, $p = 0.005$ (Appendix U). Remains that have clearly not been sampled for DNA are also statistically related to NamUs records, Fisher's Exact $p = 0.012$, NamUs DNA completion, $p = 0.038$, and NamUs DNA submission, $p = 0.033$. There are no statistical relationships for unknown DNA sampling and NamUs records or DNA (Appendix U).

IV. DISCUSSION

Before discussing the results of analyses pertaining to the five main variable categories, it is important to reiterate the main research questions posed by the present study:

1) What are the burial practices related to unidentified migrant remains in South Texas cemeteries?
2) Are there similarities or differences in how migrant remains are buried across South Texas counties?
3) How do these burial practices impact forensic investigations into the deaths of these undocumented individuals in terms of both the trace-ability of cases and the preservation of remains and evidence?
4) Are there overall patterns in the respect and dignity with which the remains of unidentified migrants are being treated in South Texas?
5) What are the most effective and feasible recommendations to help standardize burial procedures in order to ensure compliance with state law and improve the investigative efforts of anthropologists and local authorities?
6) Are there solutions to promote the respectful and dignified burial of unidentified migrants that will also expedite investigations into their deaths?

Questions 1 – 4 will be addressed directly below, while solutions and recommendations for questions 5 and 6 will be discussed in the Conclusion.

Grave Markers

Of the 103 burials exhumed by OpID across three South Texas counties, only 30 (29.1%) had associated grave makers. The majority of grave markers encountered were stakes (N=28, 93.3%) and made of metal (N=24, 80.0%), while only two markers were flat metal frames (Table 16). Results of the present study show that the use of grave markers throughout each county has been unique. Although metal stakes are the primary grave markers found in both Brooks and Starr Counties, metal stakes at Sacred Heart Cemetery in Brooks County varied between metal lettering, etching, and frames, while stakes at both RGCC and La Grulla Cemetery in Starr County were all metal frames with paper inserts (Tables 7 and 9). Plastic staked markers with paper inserts have been found solely at Tres Norias Cemetery in Willacy County, while La Grulla has been the only cemetery to mark all the unidentified burials (Table 9 and 14). Chi-square results further support significant differences in the use of metal markers across counties (Table 63).

Yet, apart from highlighting an overall lack of standardization in the use of grave markers for unidentified burials throughout South Texas, the materiality of grave makers contributes to their durability and function in helping to relocate burials and convey important case information. As Spradley et al. (2018) describe, flimsy staked markers are easily displaced by natural and human forces, such as extreme weather or lawn mowing from cemetery maintenance. Displaced markers can lead to the expenditure of time and resources excavating the wrong areas or the inability to re-associate remains with their markers. Paper inserts in metal frames have particularly been found to disappear or degrade, with ten of the 11 total blank markers being metal frames, as also supported by Fisher's Exact Tests showing a significant relationship between marker illegibility and

metal and paper markers (Appendix C). Anecdotally, in recent exhumations at La Grulla Cemetery, one such marker that had been photographed two years earlier no longer had its paper insert that had previously included a date, case number, and funeral home that could be used to link remains to a missing person.

In addition to marking grave locations, burial markers play a critical role in the identification process by providing case information that facilitates the tracking of cases across agencies and the comparison of antemortem and postmortem data. So far, only 19 grave markers of the 103 OpID exhumed burials have contained case-related information (18.5%), while the other 11 markers were blank or illegible—which is over a third of the total markers recovered (36.7% of 30) (Table 17). Dates and funeral homes have been found on at least one grave marker in each cemetery, while locations and EDR/TDR death record numbers have been found only at Sacred Heart Cemetery (Table 8). La Grulla and Tres Norias Cemeteries are the two cemeteries that have included case numbers on grave markers (Tables 11 and 15).

In terms of case tracking, statistical analyses from the current study support that the presence of both grave markers and marker information have significant relationships with the inclusion of additional case information in the burials, including writing on the container and other forms of documentation (Table 66). Specifically, the inclusion of certain types of information on markers, such as EDR/TDRs and case numbers, is significantly related to the same types of information being present in the graves (Appendix N). Additionally, significant relationships between grave markers, marker information, and NamUs case files further support the ability for grave markers to link cases to external records (Appendix P). Not only is the presence of grave markers

associated with NamUs records and the completion of NamUs DNA profiles, but the inclusion of dates, case numbers, and funeral homes on grave markers are as well (Appendix P). The significant relationship between grave marker case numbers and the physical evidence of DNA sampling on exhumed remains also speaks to the potential to track cases back to the offices of medical examiner's or forensic practitioners utilizing marker information (Appendix O).

Along with reinforcing the critical function of grave markers in helping to track cases across agencies, these relationships between grave markers, information included in the burials, and external case records also highlight a pattern of differential treatment in which certain sets of remains receive more thorough investigative attention than others. While the low numbers of grave markers found by OpID reveals an overall lack of consideration for monitoring unidentified migrant burials, the fact that the 30 markers that were found are associated with case information interred with the remains, NamUs case records, and NamUs DNA completion indicate that remains who receive analysis or tracking from the start are more likely to receive that level of care in the way they are interred. In total 17 cases that had grave markers also had additional case information in the burials, while eight cases with grave markers also have NamUs case records. The more careful treatment of marked burials is also evidenced in the relationships between grave markers and certain traits, such as the overall use of coffins and head-to-the-north orientation found at La Grulla Cemetery (Appendix M).

Beyond symbolizing care or attention to the burial, it is the role that grave markers play in facilitating positive identification that makes them a necessary component for unidentified migrant burials throughout South Texas. To date, three of the

four individuals who have been positively identified from OpID exhumations were buried in graves with associated markers. The 73 unmarked burials found so far; however, are in direct violation of the Texas Criminal Code of Procedure, which states that information about burial locations must be maintained for a minimum of 10 years (Texas Constitution and Statutes, 2019). Interring individuals in unmarked graves conceals the remains from detection and hinders their ability to identified, thus impeding the rights of families to know what happened to their loved ones.

Burial Traits

While grave markers directly impact the ability for unknown remains to be identified, burial traits, in terms of the manner in which unidentified individuals are interred, reflect their overall treatment and care. Assessing characteristics of the burial, including burial orientation, containers, wrappings, and contents, is therefore a way to concretely examine the handling of the dead and identify potential patterns specific to the South Texas border context. Although understanding the intentions of the individuals responsible for burying unidentified migrants is beyond the scope of the present study, closely examining burial traits does speak to the concepts of respect and dignity that are vaguely mentioned, but overall lacking in legislation and human rights accords.

In regards to burial orientation, the majority of the 103 graves exhumed by OpID across the three counties were interred with the head to the west (N=54, 52.4%), followed by bundle burials (N=30, 29.1%), and the head to the east (N=10, 9.7%) (Table 32). Head-to-the-west and bundle burials were found to be statistically significant across the three counties, with all three contributing to variation in bundles, and Brooks and Willacy contributing to head-to-the-west (Table 63). La Grulla Cemetery was the only cemetery

that interred individuals with the head to the north, and did so for all six unidentified burials, which uniformly matches the orientation for all known, non-migrant burials there as well (Table 25). Stacked burials (N=9, 8.7%) and individuals interred facedown (N=7, 6.8%) were found at Sacred Heart Cemetery and Tres Norias Cemetery, but not at either cemetery in Starr County (Tables 18, 26, and 29).

Overall, the present study considers singular, supine burials with the head in one of the cardinal directions to be more respectful than stacked and facedown interments. In cases when many individuals are interred with the head to the west, as was seen at Sacred Heart, RGCC, and Tres Norias Cemeteries, head-to-the-east orientation may be interpreted as less respectful due to the lack of uniformity, or may reflect hastiness or random occurrence, which statistical analysis cannot rule out (Table 18, 21, and 29). Stacked burials may also be a product of a rapid or haphazard response to the high numbers of migrant death and a lack of space in the cemetery. Considering that graves are dug by hand at Sacred Heart Cemetery, where burial depths range from 48 to 136cm below surface, interring multiple remains on top of each other is possibly as much an attempt to be efficient, as it is a lack of perceiving unidentified migrant individuals as deserving of different treatment. In the same vein, bundle burials may be an attempt to conserve space, whereas facedown burials serve no logistical purpose and are entirely preventable. Future work assessing burial orientation in relation to the identified/known population at each cemetery would better illuminate patterns in whether uniformity is a proxy for respectful treatment. Five of the individuals with the head to the west were also interred facedown, so conclusions about the respectfulness of certain burial orientations cannot yet be made without other evidence.

Out of all burial containers, body bags are found in a majority of the burials across all four cemeteries (N=81, 78.6%), and are statistically significant across counties, particularly for Brooks and Willacy (Table 34; Table 63). Plywood coffins, the second most prevalent burial containers (N=29, 28.2%), are also significant for Brooks and Willacy Counties, which makes sense considering the high presence of coffins at Sacred Heart and their total absence at Tres Norias (Tables 19, 30, and 63). Trash and plastic bags were utilized as burial containers in 24 of the burials across all cemeteries (23.3%), and biohazard bags are statistically significant for Brooks County, where Sacred Heart Cemetery had 13 of the 18 total recovered biohazard bags (Table 19 and 63). Other miscellaneous types of burial containers were also found in all three counties, but were statistically related to the northern oriented burials at La Grulla Cemetery, and were not present in RGCC (Appendix D; Table 22).

Although ascribing burial containers with status in terms of respect or dignity is somewhat subjective, utilizing biohazard and trash bags as opposed to coffins or body bags has connotations of waste disposal. While the use of different bag types, in addition to airline cargo boxes and Styrofoam coolers, further emphasizes the haphazard and possibly hurried nature of the burial process, interring human remains in any sort of waste disposal container should not be considered dignified and goes against international human rights accords calling for the respectful treatment of dead regardless of race, religion, or nationality (Holland, 2015). In regards to Texas law; however, the burial practices pertaining to unidentified migrants at Sacred Heart Cemetery have been deemed legally acceptable according to investigations conducted by the Texas Rangers in 2014, as the state only requires that remains be interred in any type of container (Frey,

2015). Clearly legal language for basic standards of dignified burials is greatly lacking in Texas, and developing enforceable statutes addressing the handling of unidentified remains is urgently needed.

When looking at relationships between burial containers and orientations, the arguably more respectful head-to-the-west interments are significantly associated with both body bags and biohazard bags, but this relationship with biohazard bags is negative considering that biohazard bags are primarily found at Sacred Heart Cemetery as part of bundle burials (Tables 18 and 19; Appendix D). Biohazard and trash/plastic bags also both have significant relationships with bundle burials, as do body bags (Appendix D).

Burial wrappings and burial contents further speak to the treatment of remains and the mass disaster context of the South Texas border. All three counties have been found to utilize sheets, plastic, and various types of tape to wrap remains, seemingly using whichever resources were available (Tables 19, 27, 30, and 33). While there is a statistically significant relationship between coffins and plastic wrapping and between body bags and sheets, all wrappings have been found with all types of burial containers and orientations, with the exception of sheets not often being present in bundle burials, as is statistically supported (Appendices E and G). Additionally, the presence of faunal remains and two empty burials with no remains at Sacred Heart Cemetery emphasize the particularly disorganized burial practices of Brooks County in response to the high numbers of migrant death (Table 20). The prevalence of personal effects in two thirds of the burials across all cemeteries also supports the lack of investigative capacity and storage throughout South Texas (Table 34). Not only do personal effects confirm the migratory status of the unidentified individuals, but they serve as untapped sources of

evidence for positive identification (Table 34). While interring personal effects with unidentified remains is important for decreasing the scattering of evidence across agencies, doing so signals that thorough analysis of the remains was likely not carried out. Interestingly, Brooks and Starr Counties significantly contribute to the distribution of personal effects across counties likely due to the high presence of personal effects at Sacred Heart Cemetery, and their overall low prevalence at RGCC (Tables 20, 24, and 64).

In the same vein, clothing on remains also indicates that individuals were not autopsied or forensically examined prior to burial. At least one individual was found still clothed at each of the four cemeteries, with five from Tres Norias, and eight total being recovered (7.8%) (Table 20, 23, 25, 31 and 34). A statistically significant relationship between clothed remains and facedown orientation further indicates that some degree of disregard or disrespect for unidentified migrant remains is present in South Texas (Appendix F). Additionally, trash and medical waste have been found in 39.8% and 19.4% of the burials respectively, reinforcing the waste-disposal approach to migrant burials in the region (Table 34). Overall, medical waste, such as gloves or towels in the burial, seems to be primarily related to the interment of remains, as opposed to evidence of medical attention or forensic analysis—though autopsy towels have been found. In terms of Chi-square analysis, medical waste is significant in Brooks and Willacy Counties, but is prevalent in 24.4% of burials at Sacred Heart and 56.4% burials at Tres Norias, indicating that medical waste is particularly prominent in Willacy County (Tables 20, 31, and 63). The negative statistical relationship between coffins and medical waste due to the overall lack of medical waste in coffin burials also supports that coffins are

handled in a generally more respectful manner, or at least without the use of gloves (Appendix H).

One final note about burial traits is that the condition of remains when they are found may influence how they are interred, particularly in terms of burial containers. Frequency data and statistical analyses confirm that body bags have been used more often for complete remains, but biohazard and trash bags have been used more for partial remains (Appendix R). Coffins and body bags are also significantly related to skeletonized remains, but this relationship is positive for coffins, and negative for body bags, which are used more often for remains in other stages of decomposition (Appendix R). Relationships between coffins, biohazard bags, and a lack of evidence of DNA sampling may also be due to the skeletonization of remains, while the relationships between body bags and both the completion of full autopsy and no autopsy indicate that remains interred in body bags were autopsied more so than they were not (Appendix R).

Additional Case Information

Examining the presence of additional case information in the graves of unidentified migrant remains is another way to assess past investigative efforts and measure the traceability of cases across agencies. In terms of a human rights perspective, the presence—or lack—of case information in the graves speaks to the potential for remains to be identified and repatriated. In terms of the Texas Criminal Code of Procedure, additional case information is evidence for whether inquests and possible DNA sampling have been conducted, as is legally mandated (Texas Constitution and Statutes, 2019ab).

In total, additional case information was found interred in 43 of the 103 exhumed

burials across all four cemeteries (41.7%) (Table 45). Although the overall presence of additional case information is not statistically significant across counties, writing on burial containers is significant for Brooks and Willacy, being found in ten of the 45 exhumed burials from Sacred Heart Cemetery (22.2%), but in only one burial at Tres Norias Cemetery (2.6%) (Tables 35, 43, and 64). The presence of tags in the burials is also significant for Willacy and Starr Counties, being present in 15 burials at Tres Norias (38.5%), but in only one at La Grulla Cemetery (5.3%) (Tables 41, 43, and 64). Other documentation, such as reports of death, or witnesses of removal, has been found in 11 total burials across all four cemeteries (Table 45).

Despite being more prevalent than grave markers, buried case information is only useful for aiding in investigative efforts if it is legible and includes content that can be linked to other agencies or case files. Of the 43 pieces of information recovered, 17 are blank or illegible in the form of smudged writing or degraded paper (39.5%) (Table 46). Tags and other documentation are also significantly related to illegibility, which indicates that more durable forms of information instead need to be utilized (Appendix J).

For information that is legible, dates are present on roughly half of the recovered documents, tags, and writing (51.2%) and are statistically significant for Brooks and Willacy Counties (Tables 46 and 64). Locations and funeral homes are each listed in ten burials (23.3%) (Table 46). Seven of the eight case numbers found on buried information come from Tres Norias Cemetery, while all three of the EDR/TDR numbers are from Sacred Heart Cemetery (Tables 36 and 43). This distribution of information content is in line with the pattern observed for grave markers in which Brooks County utilizes death record numbers to label or track remains, while Willacy County utilizes case numbers

associated with a medical examiner or forensic practitioner. Because writing on containers was significant at Sacred Heart and tags were significant at Tres Norias, the relationship found between writing and EDR/TDRs and between tags and case numbers is logical (Appendix J).

Also consistent with the pattern noted for grave markers, certain cases with additional buried information show evidence of receiving more investigative attention than others. For one, eight individuals have two types of additional case information, such as a tag and writing, to where the 43 pieces of information recovered in reality apply to a total of 35 cases. As mentioned above, 17 of these cases with additional case information were also buried in marked graves. In regards to the traceability of external case records, a significant association exists between the presence of buried case information and NamUs records (Appendix T). Tags are specifically associated with the presence of NamUs records, as well as with DNA having been submitted (but not completed) on NamUs (Appendix T). In total, 11 of the 14 cases with NamUs records have additional interred information.

Finally, additional case information was compared with the condition of remains in order to see if significant patterns exist in which remains that were more complete or less decomposed possibly received more documentation than others. However, the only statistical relationships found are between mummified remains and the presence of additional case information, in the form of tags, and between other documentation and skeletonized remains, as only three of the 66 skeletonized cases have documentation (Appendix S).

Condition of Remains

As discussed with burial traits, the condition of human remains at the time of interment may have some bearing on the way they are treated in which more complete or more recently deceased individuals are interred in more respectful manners. From a medico-legal standpoint, the condition of remains also reveals much about past efforts to make positive identifications, particularly in terms of evidence of autopsy or DNA sampling. Although one major limitation in studying exhumed remains is that it is impossible to know their exact state when they were found and interred, it is nonetheless important to recognize the condition of remains as a possible factor in the analysis of burial practices.

Especially considering that the completeness of remains is significant across all three counties, there seem to be county-specific patterns in the overall state of unidentified remains when they are first discovered (Table 65). Partial remains have been interred in Brooks County much more than in Starr or Willacy, comprising 63.4% of the exhumed individuals at Sacred Heart Cemetery (Table 47). Conversely, complete remains represent 89.5% of the unidentified individuals from both cemeteries in Starr County and 76.9% of the individuals recovered from Tres Norias in Willacy (Tables 53, and 55). This difference in completeness of remains may be largely due to the fact that the majority of exhumed individuals from Brooks County have also been skeletonized (85.4%), while skeletonized remains compose fewer than half of unidentified remains from Willacy County (48.7%)—a pattern that is statistically supported (Tables 47, 55, and 65). Although exploring the taphonomic factors that contribute to potential differences in the condition of remains when they are found is beyond the scope of the present study, the

completeness of remains may have some bearing on the use of certain burial containers at the cemeteries. Considering the significant relationships between partial remains and body bags, biohazard bags, and trash or plastic bags discussed above, this high prevalence of partial and skeletonized remains at Sacred Heart Cemetery may, in part, explain the frequencies of the containers found there.

Yet, the same relationships between burial containers and the condition of remains may also speak to the taphonomic impacts that the burial process itself has on the preservation of remains. While relationships between coffins, body bags, and skeletonized remains may indicate that remains were less decomposed when buried in body bags, but not in coffins, this may instead—or additionally—support that body bags do a better job of preserving remains than plywood coffins (Pokines et al., 2016; Junkins & Carter, 2017). It is also important to note the possible effects that differences in the timing of cases may have on preservation. Cases from Sacred Heart Cemetery and RGCC, for example, are generally older, from before 2013, whereas unidentified burials from Tres Norias range from 2008 to 2016, and from 2011 to 2016 at La Grulla, according to dates on both grave markers and case information (Tables 7, 9, 11, 15, 36, 38, 40, and 44). Of course, taphonomic variables impacting remains prior to initial recovery must also be studied, and future research incorporating evidence of weathering and scavenging from the OpID exhumed remains will aid in understanding the regional, or county-specific, South Texas contexts in which they are recovered, particularly as compared to Arizona (Galloway et al., 1989; Beck et al., 2015).

Arguably the most important evidence to be gleaned from the remains of unidentified individuals is the extent to which they were previously investigated and

sampled. Because many remains are skeletonized or decomposed beyond recognition when they are found, DNA analysis is often the only hope they have for positive identification (Anderson, 2008; Gocha et al., 2018; Spradley et al., 2018). Legally, the TCCP has required since 2005 that all unidentified remains in Texas undergo inquests and DNA sampling; assessing the extent to which exhumed individuals have been forensically examined or sampled is therefore a direct measure of compliance with state law since that time (Texas Constitution and Statutes, 2019ab).

In total 46 of the 98 unidentified remains (46.9%) received an autopsy prior to burial (37 full and 9 cranial), while only 18 show clear evidence of DNA sampling (18.4%) and 66 distinctly lack evidence of sampling, corresponding to over two-thirds of the burials (Table 58). County differences in both autopsies and DNA sampling are supported by frequency data and Chi-square results, with Brooks County overall having significantly less forensic analysis (Table 65). While autopsied individuals were found at all four cemeteries, 13 of the 19 individuals recovered from Starr County received full autopsies (68.4%), compared to only ten of the 40 exhumed from Sacred Heart Cemetery (25%), which also had the largest percentage of non-autopsied individuals (70%) (Tables 48, 54, and 65). As confirmed by statistical analyses, the higher frequency of cranial autopsies at Tres Norias Cemetery in Willacy County—which contained eight of the nine cranially autopsied individuals—make Willacy and Brooks Counties significantly different in the numbers of individuals who did not receive autopsies (Table 56 and 65). What is crucial to note about county differences in forensic analyses; however, is that most, if not all, unidentified remains from Tres Norias Cemetery come from neighboring Cameron County, so evidence of autopsy and sampling procedures instead reflect

Cameron County practices.

Cameron County is therefore the county conducting significantly more DNA sampling than Brooks or Starr, even though still less than a third of the individuals buried in Tres Norias Cemetery have undergone DNA sampling (Table 56 and 65). Interestingly, while Starr County conducts significantly more full autopsies, it is also the county conducting the least genetic sampling, with 89.5% of remains showing no evidence of it (Tables 54 and 65). In total, only nine of the 98 forensically significant burials exhumed by OpID have undergone both autopsy and DNA sampling (9.2%). This finding, coupled with the fact that 67.3% of cases received no DNA sampling, represent a blatant, large-scale violation of state law and of the duties owed to the dead and their families to facilitate an opportunity for positive identification (Rosenblatt, 2010; Texas Constitution and Statutes, 2019ab).

While not an excuse for the widespread under-sampling of remains occurring in South Texas, state of decomposition seems to have some degree of impact on whether remains receive forensic analysis. Remains in early and advanced decomposition upon exhumation, for example, are significantly related to full autopsies, while skeletonized remains are related to both no autopsy and full autopsy in that significantly fewer skeletonized remains have received full autopsies (Appendix K). Although, as discussed, it is not possible to determine the condition of remains at the time of initial discovery, it is more likely that remains in early or advanced decomposition were fresh or in earlier stages at the time they were found, which may make it more likely that they receive an autopsy and/or that it is easier to recognize autopsy evidence upon exhumation. Remains that are fully skeletonized, instead, may have likely already been skeletonized when

found, which means they either received no analyses or a visual examination and even DNA sampling of whole bones that cannot be recognized without proper documentation. As of now, no significant relationships have been found between skeletonization and any physical evidence of DNA sampling, or lack thereof (Table 58).

Finally, in terms of possible relationships between the condition of remains and the availability of NamUs case files, DNA sampling is the factor most associated with both the presence of NamUs records and NamUs DNA status (Appendix U). Considering that generating a NamUs case file is a requirement for submitting DNA profiles to the Combined DNA Index System (CODIS), this association between the genetic sampling of remains and NamUs is not surprising. However, only eight of the 18 total exhumed individuals with evidence of DNA sampling have been successfully linked back to NamUs records (44.4%), which raises the question of why records may be missing or untraceable for the ten other cases. As discussed more below, although genetic sampling is of the utmost importance for identification, sampling can only be effective if profiles can be properly tracked and compared with antemortem data (Spradley et al., 2016).

Case Records

As has been emphasized, assessing the availability of external case records informs the extent to which buried remains can be tied to the agencies that previously handled them. The fact that only 14 NamUs cases and seven BCSO Recovery Reports have been obtained for the 103 exhumed burials exemplifies the overall lack of documentation related to unidentified migrant remains in South Texas (Table 61). Further, the finding that eight of the 14 cases (42.9%) list no information about DNA profiling reiterates that proper forensic analysis of remains is inconsistent and lacking in

oversight. Although no statistically significant differences have been found for NamUs records across counties, no NamUs records have been located for burials exhumed from either cemetery in Starr County. While additional records, such as death certificates or funeral home invoices may be possible to obtain with more research, the inherent scarcity of available case records and the need to search across multiple agencies speaks to the highly fragmented nature of the medico-legal system in South Texas. Even locating NamUs case files requires that some sort of case information be associated with the burial, such as dates, locations, or ME case numbers interred in the grave or on a burial marker. Enhancing burial documentation is thus a critical step in streamlining casework.

V. CONCLUSIONS

In response to the main research questions, the burial and investigative practices related to unidentified migrant remains throughout South Texas are inconsistent, to say the least. Burial containers have ranged from trash bags to re-purposed expensive coffins, while documentation and forensic analysis have been thorough for a handful of cases, but missing for most. Differences have been found across counties, particularly in Brooks and Willacy Counties, where burials have been seemingly more haphazard and less respectful in nature, as recognized with stacked burials, facedown interments, and the presence of medical waste or other trash in the burials. Treating unidentified remains as waste-disposal has been especially prominent at Sacred Heart Cemetery in Brooks County in terms of the high presence of biohazard bags and bundle burials of partial remains, sometimes in areas with other remnants of medical waste.

Yet, practices across all three counties in the present study have served to hinder identification and repatriation efforts in such a way that impedes human rights outlined in even the most vague of international accords and U.S. common laws on handling the dead. Specifically, major violations of the Texas Criminal Code of Procedure Articles 49 and 63 have been found across all counties in terms of the overwhelming lack of forensic analysis, case tracking, and documentation observed for the 103 burials. Although improving the investigative response to unidentified migrant death in South Texas will require large-scale policy change and resource allocation, some immediate changes to burial practices can greatly assist in future identification efforts:

- **Promote the use of permanent grave markers.**

Promoting the use of permanent grave markers that contain relevant case information and that can be easily located should become standard practice for unidentified migrant burials. Especially in counties that lack access to medical examiners or forensic practitioners, utilizing permanent grave markers is a feasible solution that will greatly aid in the ability to recover and identify remains by facilitating records tracking and the comparison of antemortem information. Metal grave markers that are flush with the ground are much less vulnerable to disturbance than the staked markers and unprotected paper inserts encountered in the present study. Developing a prototype for flat metal markers with metal lettering or durable plastic frames is a future research objective that could lead to the widespread use of grave markers across South Texas. Exploring the extent to which funeral homes or cemeteries would be willing to adopt prototype grave markers, especially if they were distributed to them, is another future research objective growing out of the present study.

- **Standardize the use of body bags as burial containers.**

In terms of physical interment, body bags should, at minimum, become the standardized container utilized to bury unidentified migrant remains. Not only are body bags relatively lightweight and easy to store, but they are seemingly the best containers for the preservation of remains and evidence, while being more dignified than biohazard or trash bags. Future research into the costs and durability of body bag materials should serve to refine which types are the most feasible to procure in South Texas. Additionally, qualitative interviews with funeral home employees and cemetery workers will be key for understanding where challenges lie in accessing body bags and in gauging the willingness

to change current practices.

- **Include durable and legible case information inside the burial.**

The present study has shown that interring additional case information in the grave allows for the tracking of cases and the comparison of remains with missing persons' data. While this practice of including case information with the burial container or on the remains should continue, ensuring that information is legible and durable is of the utmost importance. As writing has been found to smudge or fade, and paper often degrades, laminating documents, as well as using etched or embossed tags could increase longevity. Although, again, more research is needed to refine an understanding of materials, plastic tags, such as those used in agriculture, could be produced on a large scale and easily distributed. Redundancy of interred case information is also valuable as a safeguard if markers degrade or get displaced.

- **Improve case documentation and record keeping practices.**

In regards to improving autopsy and DNA sampling practices, increasing county resources and access to forensic practitioners is seemingly the only solution. Despite the clear evidence of non-compliance with state law in the region, outreach, oversight and funding are needed to ensure that proper investigative procedures are being carried out. In the mean time; however, all efforts should be made to improve case documentation and record keeping to better locate remains for future analysis. The treatment of all remains should also be consistent, regardless of the condition in which they are found, with all efforts being made to preserve evidence. In counties that have had access to autopsy services, such as Starr County, understanding why genetic sampling has not been conducted will also be critical for improvements. In the same vein, qualitative research

will be the primary way to understand the large gaps in NamUs records, in addition to conducting outreach to facilitate the sharing of data and collaboration between agencies.

Although numerous challenges to investigating unidentified migrant deaths have been identified in the present study, beginning to address these challenges by way of better standardizing burial practices at the county level should increase positive identification and repatriation. While exhumations continue to be necessary as long as migrant individuals are dying in numbers beyond the capacity of local investigative systems, efforts to better mark and document burials will make recovery much swifter. Not only is it critical to re-locate burials for identification efforts by OpID or local authorities—particularly if resources become available to investigate cold cases—but it is essential to know the disposition of remains if state-mandated DNA profiling leads to a positive match. Losing a body and being unable to repatriate an individual to their family because remains are buried in an unmarked grave is simply unacceptable and should be made explicitly illegal. In regards to improving the respectful treatment of remains, certain practices such as placing individuals facedown are also unnecessary and need to be stopped. However, taking the steps to standardize burial containers, mark graves, and include as much durable case information as possible will largely enhance the dignified treatment of remains by providing them with a real chance to be positively identified.

APPENDIX SECTION

A: OPID BURIAL FORM 109

B: OPID INTAKE FORM 110

C: RESULTS OF FISHER'S EXACT TESTS FOR GRAVE MARKER STYLES AND MARKER INFORMATION 111

D: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL CONTAINERS 112

E: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL WRAPPING 113

F: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL CONTENTS 114

G: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL CONTAINERS AND BURIAL WRAPPING 115

H: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL CONTAINERS AND BURIAL CONTENTS 116

I: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL WRAPPING AND BURIAL CONTENTS 117

J: RESULTS OF FISHER'S EXACT TESTS FOR ADDITIONAL CASE INFORMATION TYPES AND INFORMATION CONTENT 118

K: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR STATE OF DECOMPOSITION AND AUTOPSY AND DNA SAMPLING 119

L: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR AUTOPSY AND DNA SAMPLING 120

M: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS AND BURIAL TRAITS 121

N: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND ADDITIONAL CASE INFO CONTENT ... 122

O: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND CONDITION OF REMAINS 124

P: RESULTS OF FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND NAMUS RECORDS 127

Q: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL TRAITS AND ADDITIONAL CASE INFORMATION 128

R: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL TRAITS AND CONDITION OF REMAINS 131

S: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR ADDITIONAL CASE INFO AND CONDITION OF REMAINS 134

T: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR ADDITIONAL CASE INFO TYPES AND NAMUS RECORDS 137

U: RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR CONDITION OF REMAINS AND NAMUS RECORDS 138

APPENDIX A: OPID BURIAL FORM

OPERATION IDENTIFICATION BURIAL FORM

COUNTY/CEMETERY NAME: _____

AREA NUMBER: _____ **DATE:** _____ **NOTE TAKER:** _____

TEAM MEMBERS PRESENT: _____

_____

_

CAMERA: _____ **PHOTO RANGE(S):** _____

DATE DISCOVERED: _____ **DATE REMOVED:** _____

ASSOCIATED MARKER (circle one): YES NO **MARKER MATERIAL (circle):** Metal Plastic Paper

MARKER INFORMATION:

(FRONT) (BACK)

ASSOCIATED CASE NUMBERS	
Burial #	
OpID Case #	
IBSC #	
Investigating Agency Case #	
TDR/EDR #	

BURIAL CONTAINER TYPE: _____

_____

INFORMATION ON/ IN BURIAL CONTAINER:

_____

_____

MAPPING COORDINATES			
SUBDATUM:			
	X	Y	Z
SW corner			
SE corner			
NE corner			
NW corner			
Center- exposed	------	------	
Center-removed	------	------	

BURIAL ORIENTATION (Bundle? Stacked?):

_____

_____

SEDIMENT & FILL DESCRIPTION: _____

_____

ADJACENT BURIAL(S): _____

_____

MEDICAL WASTE/TRASH IN BURIAL: Yes No **If yes explain:**

_____

NOTES: _____

_____

_____

_____

_____

APPENDIX B: OPID INTAKE FORM

Operation ID Intake Form: Field ORPL

DATE: _____ **PEOPLE PRESENT:** _____

OpID CASE #: _____ **CAMERA:** _____ **BEG. PHOTO #:** _____ **END PHOTO #:** _____

ASSOCIATED CASE NUMBERS	
Burial # (cem.)	
IBSC #	
Investigating Agency Case #	
TDR/EDR #	

ASSOCIATED DOCUMENTS (explain in notes): YES NO

ASSOCIATED GRAVE MARKER: YES NO

ASSOCIATED MORGUE TAG (explain in notes): YES NO

BODY BAG DESCRIPTION:

_____

INFORMATION/WRITING ON BODY BAG:

_____

_____

_____

CONDITION OF REMAINS (circle): Early Decomp. Advanced Decomp. Mummified Skeletonized

(circle): Complete Remains Partial Remains

Scavenging Present (circle): YES NO UNKNOWN

Autopsy Present (circle): Complete Autopsy Cranial Only None

DNA Sample Taken (circle): YES NO UNKNOWN

If Yes Location: _____

PERSONAL EFFECTS (circle): YES NO **No. of Bags (personal effects):**

(circle) On body With Body Both

BRIEF DESCRIPTION: _____

_____

_____

_____

MEDICAL WASTE (circle): YES NO

BRIEF DESCRIPTION: _____

_____

PROCESSING NEEDED (circle): Maceration (heat) Sanitize Brushing None

NOTES: _____

_____

_____

_____

_____

DISPOSITION PRIOR TO PROCESSING (circle): FARF ORPL

APPENDIX C:
RESULTS OF FISHER'S EXACT TESTS FOR GRAVE MARKER STYLES AND MARKER INFORMATION

Grave Marker Materials by Marker Information Types (df=1, N=103)	p		p
metal - info present	**0.000**	metal & paper - info present	0.703
metal - blank/illegible	**0.000**	metal & paper - blank/illegible	**0.000**
metal - date	**0.010**	metal & paper - date	0.112
metal - EDR/TDR	**0.000**	metal & paper - EDR/TDR	0.591
metal - case number	0.331	metal & paper - case number	0.119
metal - location	**0.002**	metal & paper - location	1.000
metal - funeral home	**0.018**	metal & paper - funeral home	0.627
metal letters - info present	**0.000**	plastic & paper - info present	**0.001**
metal letters - blank/illegible	0.595	plastic & paper - blank/illegible	0.501
metal letters - date	1.000	plastic & paper - date	**0.001**
metal letters - EDR/TDR	**0.000**	plastic & paper - EDR/TDR	1.000
metal letters - case number	1.000	plastic & paper - case number	**0.001**
metal letters - location	**0.029**	plastic & paper - location	1.000
metal letters - funeral home	1.000	plastic & paper - funeral home	**0.000**
metal etched - info present	**0.005**		
metal etched - blank/illegible	1.000		
metal etched - date	**0.001**		
metal etched - EDR/TDR	1.000		
metal etched - case number	1.000		
metal etched - location	**0.003**		
metal etched - funeral home	**0.001**		

APPENDIX D:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL CONTAINERS

Burial Orientation by Burial Container (df=1, N=103)	X^2	p	Cramer's V
head to the west - coffin	1.841	0.175	-
head to the west- body bag	11.29	**0.001**	0.331
head to the west - biohazard bag	9.086	**0.003**	0.297
head to the west - trash or plastic bag	2.035	0.154	-
head to the west - other container	-	0.076	-
head to the east - coffin	-	0.275	-
head to the east - body bag	-	0.114	-
head to the east - biohazard bag	-	0.374	-
head to the east - trash or plastic bag	-	0.112	-
head to the east - other container	-	0.594	-
head to the north - coffin	-	0.665	-
head to the north - body bag	-	0.337	-
head to the north - biohazard bag	-	0.587	-
head to the north - trash or plastic bag	-	0.622	-
head to the north - other container	-	**0.008**	-
stacked - coffin	-	1.000	-
stacked - body bag	-	0.398	-
stacked - biohazard bag	-	0.190	-
stacked - trash or plastic bag	-	0.432	-
stacked - other container	-	1.000	-
bundle - coffin	0.024	0.877	-
bundle - body bag	29.593	**0.000**	0.536
bundle - biohazard bag	9.972	**0.002**	0.311
bundle - trash or plastic bag	5.982	**0.015**	0.239
bundle - other container	-	0.447	-
facedown - coffin	-	1.000	-
facedown - body bag	-	0.341	-
facedown - biohazard bag	-	0.349	-
facedown - trash or plastic bag	-	0.196	-
facedown - other container	-	1.000	-

APPENDIX E:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL WRAPPING

Burial Orientation by Wrapping (df=1, N=103)	X^2	p	Cramer's V
head to the west - sheet	3.633	0.057	-
head to the west - plastic	0.294	0.588	-
head to the west - tape	0.028	0.866	-
head to the east - sheet	-	0.518	-
head to the east - plastic	-	1.000	-
head to the east - tape	-	0.201	-
head to the north - sheet	-	1.000	-
head to the north - plastic	-	1.000	-
head to the north - tape	-	0.590	-
stacked - sheet	-	0.162	-
stacked - plastic	-	0.709	-
stacked - tape	-	1.000	-
bundle - sheet	6.759	**0.009**	0.256
bundle - plastic	0.121	0.728	-
bundle - tape	3.303	0.069	-
facedown - sheet	-	0.438	-
facedown - plastic	-	0.670	-
facedown - tape	-	0.344	-

APPENDIX F:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL ORIENTATION AND BURIAL CONTENTS

Burial Orientation by Burial Contents (df=1, N=103)	X^2	p	Cramer's V
head to the west - clothed	-	0.285	-
head to the west - personal effects	0.426	0.514	-
head to the west - medical waste	1.198	0.274	-
head to the west - trash	2.066	0.151	-
head to the east - clothed	-	0.572	-
head to the east - personal effects	-	**0.031**	-
head to the east - medical waste	-	0.084	-
head to the east- trash	-	0.404	-
head to the north- clothed	-	0.392	-
head to the north - personal effects	-	0.662	-
head to the north - medical waste	-	0.398	-
head to the north - trash	-	1.000	-
stacked - clothed	-	1.000	-
stacked - personal effects	-	0.489	-
stacked - medical waste	-	1.000	-
stacked - trash	-	1.000	-
bundle - clothed	-	0.102	-
bundle - personal effects	0.142	0.823	-
bundle - medical waste	3.627	0.057	-
bundle - trash	1.157	0.282	-
facedown - clothed	-	**0.001**	-
facedown - personal effects	-	1.000	-
facedown - medical waste	-	0.112	-
facedown - trash	-	0.341	-

APPENDIX G:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL CONTAINERS AND BURIAL WRAPPING

Burial Container by Burial Wrapping (df=1, N=103)	X^2	p	Cramer's V
coffin - sheet	0.167	0.683	-
coffin - plastic	4.163	**0.041**	0.201
coffin - tape	1.597	0.206	-
body bag -sheet	5.067	**0.024**	0.222
body bag - plastic	0.186	0.667	-
body bag - tape	-	0.547	-
biohazard bag - sheet	2.02	0.155	-
biohazard bag - plastic	0.380	0.538	-
biohazard bag - tape	-	0.515	-
trash or plastic bag - sheet	0.592	0.441	-
trash or plastic bag - plastic	1.351	0.245	-
trash or plastic bag - tape	-	0.551	-
other container - sheet	-	0.489	-
other container - plastic	-	0.265	-
other container - tape	-	0.670	-

APPENDIX H:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL CONTAINERS AND BURIAL CONTENTS

Burial Container by Burial Contents (df=1, N=103)	X^2	p	Cramer's V
coffin - clothed	-	1.000	-
coffin - personal effects	4.745	**0.029**	0.215
coffin - medical waste	5.492	**0.019**	0.231
coffin - trash	0.284	0.594	-
body bag - clothed	-	0.197	-
body bag - personal effects	0.121	0.728	-
body bag - medical waste	5.459	**0.019**	0.230
body bag - trash	-	0.362	-
biohazard bag - clothed	-	1.000	-
biohazard bag - personal effects	0.494	0.482	-
biohazard bag - medical waste	0.946	0.331	-
biohazard bag - trash	-	1.000	-
trash or plastic bag - clothed	-	0.193	-
trash or plastic bag - personal effects	1.363	0.243	-
trash or plastic bag - medical waste	6.992	**0.008**	0.261
trash or plastic bag - trash	-	0.556	-
other container - clothed	-	0.532	-
other container - personal effects	-	0.489	-
other container - medical waste	-	0.083	-
other container- trash	-	0.069	-

APPENDIX I:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL WRAPPING AND BURIAL CONTENTS

Wrapping by Burial Contents (df=1, N=103)	X^2	p	Cramer's V
sheet - clothed	-	0.271	-
sheet - personal effects	1.089	0.297	-
sheet - medical waste	2.723	0.099	-
sheet - trash	1.304	0.253	-
plastic - clothed	-	0.436	-
plastic - personal effects	0.004	0.950	-
plastic - medical waste	0.042	0.838	-
plastic - trash	0.816	0.366	-
tape - clothed	-	0.346	-
tape - personal effects	0.117	0.733	-
tape - medical waste	0.085	0.770	-
tape - trash	-	1.000	-

APPENDIX J:
RESULTS OF FISHER'S EXACT TESTS FOR ADDITIONAL CASE INFORMATION TYPES AND INFORMATION CONTENT

Case Info Types by Case Info Content (df=1, N=103)	p
writing on container - illegible	1.000
writing on container - date	**0.000**
writing on container - EDR/TDR	**0.048**
writing on container - case number	0.589
writing on container - location	**0.029**
writing on container - funeral home	**0.019**
tags - illegible	**0.000**
tags - date	**0.000**
tags - EDR/TDR	0.179
tags - case number	**0.001**
tags - location	0.130
tags - funeral home	0.059
other documentation - illegible	**0.001**
other documentation - date	**0.004**
other documentation - EDR/TDR	**0.024**
other documentation - case number	0.137
other documentation - location	**0.000**
other documentation - funeral home	0.211

APPENDIX K:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR STATE OF DECOMPOSITION AND AUTOPSY AND DNA SAMPLING

Decomposition by Autopsy and DNA sampling (df=1, N=98)	X^2	p	Cramer's V
early decomp - autopsy, full	-	**0.018**	-
early decomp - autopsy, cranial	-	1.000	-
early decomp - no autopsy	-	0.118	-
early decomp - autopsy, unknown	-	1.000	-
early decomp - DNA sampled	-	0.153	-
early decomp - not DNA sampled	-	0.595	-
early decomp - DNA sampling unknown	-	1.000	-
advanced decomp - autopsy, full	5.291	**0.021**	0.232
advanced decomp - autopsy, cranial	-	0.383	-
advanced decomp - no autopsy	8.445	**0.004**	0.294
advanced decomp - autopsy, unknown	-	1.000	-
advanced decomp - DNA sampled	-	0.110	-
advanced decomp - not DNA sampled	0.063	0.802	-
advanced decomp - DNA sampling unknown	-	**0.035**	-
mummified - autopsy, full	-	0.292	-
mummified - autopsy, cranial	-	1.000	-
mummified - no autopsy	-	1.000	-
mummified - autopsy, unknown	-	1.000	-
mummified - DNA sampled	-	0.056	-
mummified - not DNA sampled	-	0.147	-
mummified - DNA sampling unknown	-	1.000	-
skeletonized - autopsy, full	14.181	**0.000**	0.380
skeletonized - autopsy, cranial	-	1.000	-
skeletonized - no autopsy	12.183	**0.000**	0.353
skeletonized - autopsy, unknown	-	1.000	-
skeletonized - DNA sampled	0.269	0.604	-
skeletonized - not DNA sampled	2.160	0.142	-
skeletonized - DNA sampling unknown	-	0.222	-

APPENDIX L:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR AUTOPSY AND DNA SAMPLING

Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
Autopsy, full - DNA sampled	0.001	0.971	-
Autopsy, full - Not DNA sampled	0.012	0.913	-
Autopsy, full - DNA sampling unknown	0.029	0.865	-
Autopsy, cranial - DNA sampled	-	0.668	-
Autopsy, cranial - Not DNA sampled	-	0.468	-
Autopsy, cranial - DNA sampling unknown	-	0.612	-
No autopsy - DNA sampled	0.009	0.924	-
No autopsy - Not DNA sampled	2.506	0.113	-
No autopsy - DNA sampling unknown	4.961	**0.026**	0.225
Autopsy unknown - DNA sampled	-	1.000	-
Autopsy unknown - Not DNA sampled	-	**0.010**	-
Autopsy unknown - DNA sampling unknown	-	**0.000**	-

APPENDIX M:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS AND BURIAL TRAITS

Grave Markers by Burial Orientation, Container, Wrapping, and Contents (df=1, N=103)	X^2	p	Cramer's V
head to the west	1.012	0.314	-
head to the east	-	0.274	-
head to the north	-	**0.000**	-
stacked	-	0.278	-
bundle	0.000	0.989	-
facedown	-	1.000	-
coffin	4.821	**0.028**	0.216
body bag	0.555	0.456	-
biohazard bag	1.640	0.200	-
trash or plastic bag	0.000	0.996	-
other container	-	0.118	-
sheet	0.460	0.498	-
plastic	0.071	0.790	-
tape	9.341	**0.002**	0.301
clothed	-	0.689	-
personal effects	4.162	**0.041**	0.201
medical waste	0.74	0.390	-
trash	2.399	0.121	-

APPENDIX N:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND ADDITIONAL CASE INFO CONTENT

Grave Markers and Marker Info by Additional Case Info Content (df=1, N=103)	X^2	p	Cramer's V
markers present - illegible	-	142	-
markers present - date	10.03	**0.002**	0.312
markers present - EDR/TDR	-	**0.023**	-
markers present - case number	-	0.412	-
markers present - location	-	**0.006**	-
markers present - funeral home	-	0.442	-
marker illegible - illegible	-	0.206	-
marker illegible - date	-	0.229	-
marker illegible - EDT/TDR	-	1.000	-
marker illegible - case number	-	1.000	-
marker illegible -location	-	1.000	-
marker illegible - funeral home	-	0.054	-
marker date - illegible	-	1.000	-
marker date - date	-	1.000	-
marker date - EDR/TDR	-	1.000	-
marker date - case number	-	**0.019**	-
marker date - location	-	0.250	-
marker date - funeral home	-	1.000	-
marker EDR/TDR - illegible	-	1.000	-
marker EDR/TDR - date	-	**0.001**	-
marker EDR/TDR - EDR/TDR	-	**0.000**	-
marker EDR/TDR - case number	-	1.000	-
marker EDR/TDR - location	-	**0.003**	-
marker EDR/TDR - funeral home	-	1.000	-
marker case number - illegible	-	1.000	-
marker case number - date	-	1.000	-
marker case number - EDR/TDR	-	1.000	-
marker case number - case number	-	**0.036**	-
marker case number - location	-	1.000	-
marker case number - funeral home	-	1.000	-

APPENDIX N (CONTINUED)

Grave Markers and Marker Content by Additional Case Info Content (df=1, N=103)	X^2	p	Cramer's V
marker location - illegible	-	1.000	-
marker location - date	-	1.000	-
marker location - EDR/TDR	-	1.000	-
marker location - case number	-	1.000	-
marker location - location	-	1.000	-
marker location - funeral home	-	1.000	-
marker funeral home - illegible	-	0.679	-
marker funeral home - date	-	0.691	-
marker funeral home - EDR/TDR	-	0.290	-
marker funeral home - case number	-	**0.025**	-
marker funeral home - location	-	0.072	-
marker funeral home - funeral home	-	1.000	-

APPENDIX O:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND CONDITION OF REMAINS

Grave Markers by Completeness of Remains and State of Decomposition (df=1, N=99)	X^2	p	Cramer's V
Complete remains	0.146	0.702	-
Partial remains	0.146	0.702	-
Early Decomp	-	1.000	-
Advanced Decomp	0.394	0.530	-
Mummified	-	1.000	-
Skeletonized	0.024	0.876	-

Grave Markers by Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
Autopsy, full	0.230	0.631	-
Autopsy, cranial	-	0.274	-
No Autopsy	0.008	0.928	-
Autopsy unknown	-	0.579	-
DNA sampled	2.335	0.127	-
Not DNA sampled	1.426	0.232	-
DNA sampling unknown	0.008	0.928	-

Grave Marker Info by Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
Autopsy, full	0.012	0.913	-
Autopsy, cranial	-	0.204	-
No autopsy	0.382	0.537	-
Autopsy unknown	-	0.562	-
DNA sampled	-	0.312	-
Not DNA sampled	1.394	0.238	-
DNA sampling unknown	-	0.717	-

APPENDIX O (CONTINUED)

Marker Info Type by Autopsy and DNA Sampling (df=1, N=99)	X^2	p	Cramer's V
blank/illegible- autopsy, full	-	0.743	-
blank/illegible - autopsy, cranial	-	1.000	-
blank/illegible - no autopsy	0.789	0.374	-
blank/illegible - autopsy, unknown	-	0.384	-
blank/illegible - DNA sampled	-	0.419	-
blank/illegible - not DNA sampled	-	0.746	-
blank/illegible - DNA sampling unknown	-	1.000	-
date - autopsy, full	-	0.171	-
date - autopsy, cranial	-	0.592	-
date - no autopsy	-	0.318	-
date - autopsy, unknown	-	0.354	-
date - DNA sampled	-	0.083	-
date - not DNA sampled	-	**0.013**	-
date - DNA sampling unknown	-	0.152	-
EDR/TDR - autopsy, full	-	0.249	-
EDR/TDR - autopsy, cranial	-	1.000	-
EDR/TDR- no autopsy	-	0.057	-
EDR/TDR - autopsy, unknown	-	1.000	-
EDR/TDR - DNA sampled	-	1.000	-
EDR/TDR - not DNA sampled	-	0.421	-
EDR/TDR - DNA sampling unknown	-	0.589	-
case number - autopsy, full	-	1.000	-
case number - autopsy, cranial	-	1.000	-
case number - no autopsy	-	0.674	-
case number - autopsy, unknown	-	1.000	-
case number - DNA sampled	-	**0.042**	-
case number - not DNA sampled	-	**0.038**	-
case number - DNA sampling unknown	-	0.545	-

APPENDIX O (CONTINUED)

Marker Info Type by Autopsy and DNA Sampling (df=1, N=99)	X^2	p	Cramer's V
location - autopsy, full	-	0.149	-
location - autopsy, cranial	-	1.000	-
location - no autopsy	-	0.617	-
location - autopsy, unknown	-	1.000	-
location - DNA sampled	-	0.562	-
location - not DNA sampled	-	1.000	-
location - DNA sampling unknown	-	1.000	-
funeral home - autopsy, full	-	0.323	-
funeral home - autopsy, cranial	-	0.592	-
funeral home - no autopsy	0.789	0.374	-
funeral home - autopsy, unknown	-	0.384	-
funeral home - DNA sampled	-	0.114	-
funeral home - not DNA sampled	-	**0.036**	-
funeral home - DNA sampling unknown	-	0.190	-

APPENDIX P:
RESULTS OF FISHER'S EXACT TESTS FOR GRAVE MARKERS, MARKER INFO, AND NAMUS RECORDS

Grave Markers and Marker Info by NamUs Records and NamUs DNA (df=1, N=103)	p
markers - NamUs records	**0.024**
markers - NamUs DNA complete	**0.024**
markers - NamUs DNA submitted	1.000
markers - NamUs no DNA info	0.354
marker date - NamUs records	**0.000**
marker date - NamUs DNA complete	**0.000**
marker date - NamUs DNA submitted	0.266
marker date - NamUs no DNA info	0.103
marker EDT/TDR - NamUs records	0.594
marker EDT/TDR - NamUs DNA complete	1.000
marker EDT/TDR - NamUs DNA submitted	1.000
marker EDT/TDR - NamUs no DNA info	1.000
marker case number - NamUs records	**0.017**
marker case number - NamUs DNA complete	**0.018**
marker case number - NamUs DNA submitted	0.140
marker case number - NamUs no DNA info	1.000
marker location - NamUs records	0.088
marker location - NamUs DNA complete	0.183
marker location - NamUs DNA submitted	1.000
marker location - NamUs no DNA info	0.216
marker funeral home - NamUs records	**0.000**
marker funeral home - NamUs DNA complete	**0.000**
marker funeral home - NamUs DNA submitted	0.290
marker funeral home - NamUs no DNA info	0.123

APPENDIX Q:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL TRAITS AND ADDITIONAL CASE INFORMATION

Burial Orientation by Additional Case Info (df=1, N=103)	X^2	p	Cramer's V
west - total case info	0.062	0.803	-
west - writing on container	0.865	0.352	-
west - tags	1.542	0.217	-
west - other documentation	-	1.000	-
east - total case info	-	0.187	-
east - writing on container	-	1.000	-
east - tags	-	0.279	-
east - other documentation	-	1.000	-
north - total case info	-	0.232	-
north - writing on container	-	1.000	-
north - tags	-	1.000	-
north - other documentation	-	0.103	-
stacked - total case info	-	0.289	-
stacked - writing on container	-	0.606	-
stacked - tags	-	1.000	-
stacked - other documentation	-	1.000	-
bundle - total case info	-	1.000	-
bundle - writing on container	-	0.347	-
bundle - tags	-	1.000	-
bundle - other documentation	-	0.719	-
facedown - total case info	-	0.234	-
facedown - writing on container	-	0.589	-
facedown - tags	-	0.671	-
facedown - other documentation	-	1.000	-

APPENDIX Q (CONTINUED)

Burial Container by Additional Case Info (df=1, N=103)	X^2	p	Cramer's V
coffin - total case info	0.002	0.962	-
coffin - writing on container	-	**0.021**	-
coffin - tags	0.189	0.664	-
coffin - other documentation	-	0.721	-
body bag - total case info	2.41	0.121	-
body bag - writing on container	-	0.729	-
body bag - tags	1.145	0.285	-
body bag - other documentation	-	0.685	-
biohazard bag - total case info	0.635	0.426	-
biohazard bag - writing on container	-	1.000	-
biohazard bag - tags	0.271	0.602	-
biohazard bag - other documentation	-	1.000	-
trash or plastic bag - total case info	0.00	0.993	-
trash or plastic bag - writing on container	-	0.734	-
trash or plastic bag - tags	-	1.000	-
trash or plastic bag - other documentation	-	0.695	-
other container - total case info	-	0.159	-
other container - writing on container	-	1.000	-
other container - tags	-	0.701	-
other container - other documentation	-	0.211	-

APPENDIX Q (CONTINUED)

Burial Contents by Additional Case Info (df=1, N=103)	X^2	p	Cramer's V
clothed - total case info	-	1.000	-
clothed - writing on container	-	0.594	-
clothed - tags	-	1.000	-
clothed - other documentation	-	0.572	-
personal effects - total case info	0.723	0.395	-
personal effects - writing on container	-	1.000	-
personal effects - tags	1.675	0.196	-
personal effects - other documentation	-	0.488	-
medical waste - total case info	1.618	0.203	-
medical waste - writing on container	-	1.000	-
medical waste - tags	2.026	0.155	-
medical waste - other documentation	-	0.736	-
trash - total case info	0.031	0.860	-
trash - writing on container	-	1.000	-
trash - tags	0.060	0.807	-
trash - other documentation	-	0.203	-

APPENDIX R:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR BURIAL TRAITS AND CONDITION OF REMAINS

Burial Container by Complete and Partial Remains (df=1, N=99)	X^2	p	Cramer's V
coffin - complete remains	0.180	0.672	-
coffin - partial remains	0.180	0.672	-
body bag - complete remains	22.037	**0.000**	0.472
body bag - partial remains	22.037	**0.000**	0.472
biohazard bag - complete remains	8.065	**0.005**	0.285
biohazard bag - partial remains	8.065	**0.005**	0.285
trash or plastic bag - complete remains	7.067	**0.008**	0.267
trash or plastic bag - partial remains	7.067	**0.008**	0.267
other container - complete remains	0.593	0.441	-
other container - partial remains	0.593	0.441	-

Burial Container by State of Decomposition (df=1, N=99)	X^2	p	Cramer's V
coffin - early decomp	-	0.572	-
coffin - advanced decomp	1.903	0.168	-
coffin - mummified	-	0.437	-
coffin - skeletonized	5.729	**0.017**	0.241
body bag - early decomp	-	1.000	-
body bag - advanced decomp	-	0.347	-
body bag - mummified	-	0.200	-
body bag - skeletonized	5.504	**0.019**	0.236
biohazard bag - early decomp	-	1.000	-
biohazard bag - advanced decomp	-	0.111	-
biohazard bag - mummified	-	0.358	-
biohazard bag - skeletonized	1.222	0.269	-
trash or plastic bag - early decomp	-	1.000	-
trash or plastic bag - advanced decomp	-	0.553	-
trash or plastic bag - mummified	-	0.680	-
trash or plastic bag - skeletonized	0.028	0.866	-
other container - early decomp	-	1.000	-
other container - advanced decomp	-	0.200	-
other container - mummified	-	1.000	-
other container - skeletonized	-	1.000	-

APPENDIX R (CONTINUED)

Burial Container by Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
coffin - autopsy, full	0.310	0.578	-
coffin - autopsy, cranial	-	0.060	-
coffin - no autopsy	2.916	0.088	-
coffin - autopsy unknown	-	1.000	-
coffin - DNA sampled	-	0.382	-
coffin - not DNA sampled	5.393	**0.020**	0.235
coffin - DNA sampling unknown	-	0.104	-
body bag - autopsy, full	6.661	**0.010**	0.261
body bag -autopsy, cranial	-	1.000	-
body bag - no autopsy	7.318	**0.007**	0.273
body bag - autopsy unknown	-	0.562	-
body bag - DNA sampled	-	0.737	-
body bag - not DNA sampled	0.005	0.949	-
body bag - DNA sampling unknown	-	1.000	-
biohazard bag -autopsy, full	0.012	0.913	-
biohazard bag - autopsy, cranial	-	0.668	-
biohazard bag - no autopsy	0.009	0.924	-
biohazard bag - autopsy unknown	-	1.000	-
biohazard bag - DNA sampled	-	0.181	-
biohazard bag - not DNA sampled	4.653	**0.031**	0.218
biohazard bag - DNA sampling unknown	-	0.455	-
trash or plastic bag - autopsy, full	0.024	0.876	-
trash or plastic bag - autopsy, cranial	-	0.681	-
trash or plastic bag - no autopsy	0.123	0.726	-
trash or plastic bag - autopsy unknown	-	1.000	-
trash or plastic bag - DNA sampled	-	0.552	-
trash or plastic bag - not DNA sampled	0.067	0.795	-
trash or plastic bag - DNA sampling unknown	-	0.734	-
other container -autopsy, full	-	0.421	-
other container - autopsy, cranial	-	0.502	-
other container - no autopsy	-	0.436	-
other container - autopsy unknown	-	1.000	-
other container - DNA sampled	-	0.114	-
other container - not DNA sampled	-	0.211	-
other container - DNA sampling unknown	-	1.000	-

APPENDIX R (CONTINUED)

Burial Contents by Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
clothed - autopsy, full	-	0.252	-
clothed - autopsy, cranial	-	1.000	-
clothed - no autopsy	-	0.155	-
clothed - autopsy unknown	-	0.293	-
clothed - DNA sampled	-	1.000	-
clothed - not DNA sampled	-	0.714	-
clothed - DNA sampling unknown	-	0.320	-
personal effects - autopsy, full	1.255	0.263	-
personal effects - autopsy, cranial	-	1.000	-
personal effects - no autopsy	3.169	0.075	-
personal effects - autopsy unknown	-	0.110	-
personal effects - DNA sampled	0.001	0.973	-
personal effects - not DNA sampled	0.125	0.724	-
personal effects - DNA sampling unknown	-	0.767	-
medical waste - autopsy, full	0.647	0.421	-
medical waste - autopsy, cranial	-	0.153	-
medical waste - no autopsy	2.181	0.140	-
medical waste - autopsy unknown	-	0.643	-
medical waste - DNA sampled	0.120	0.729	-
medical waste - not DNA sampled	0.816	0.366	-
medical waste - DNA sampling unknown	2.542	0.111	-
trash - autopsy, full	2.264	0.132	-
trash - autopsy, cranial	-	**0.010**	-
trash - no autopsy	0.009	0.924	-
trash - autopsy unknown	-	1.000	-
trash - DNA sampled	-	0.737	-
trash - not DNA sampled	0.238	0.625	-
trash - DNA sampling unknown	-	0.455	-

APPENDIX S:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR ADDITONAL CASE INFO AND CONDITION OF REMAINS

Case Info Types by Completeness and State of Decomposition (df=1, N=99)	X^2	p	Cramer's V
total case info - complete remains	0.500	0.479	-
total case info - partial remains	0.500	0.479	-
total case info - early decomp	-	0.304	-
total case info - advanced decomp	0.425	0.514	-
total case info - mummified	-	**0.031**	-
total case info - skeletonized	2.082	0.149	-
writing on container - complete remains	-	0.225	-
writing on container - partial remains	-	0.225	-
writing on container - early decomp	-	0.436	-
writing on container - advanced decomp	-	0.457	-
writing on container - mummified	-	0.602	-
writing on container - skeletonized	-	0.209	-
tags - complete remains	0.180	0.672	-
tags - partial remains	0.180	0.672	-
tags - early decomp	-	0.299	-
tags - advanced decomp	0.668	0.414	-
tags - mummified	-	**0.012**	-
tags - skeletonized	2.063	0.151	-
other documentation - complete remains	-	1.000	-
other documentation - partial remains	-	1.000	-
other documentation - early decomp	-	0.050	-
other documentation - advanced decomp	-	0.418	-
other documentation - mummified	-	0.225	-
other documentation - skeletonized	-	**0.015**	-

APPENDIX S (CONTINUED)

Case Info by Autopsy and DNA Sampling (df=1, N=98)	X^2	p	Cramer's V
total case info - autopsy, full	0.048	0.826	-
total case info - autopsy, cranial	-	0.731	-
total case info - no autopsy	0.142	0.707	-
total case info - autopsy unknown	-	0.638	-
total case info - DNA sampled	3.366	0.067	-
total case info - not DNA sampled	1.301	0.254	-
total case info - DNA sampling unknown	0.252	0.616	-
writing on container - autopsy, full	-	0.761	-
writing on container - autopsy, cranial	-	0.602	-
writing on container - no autopsy	2.460	0.117	-
writing on container - autopsy unknown	-	1.000	-
writing on container - DNA sampled	-	1.000	-
writing on container - not DNA sampled	-	0.211	-
writing on container - DNA sampling unknown	-	0.204	-
tags - autopsy, full	0.141	0.707	-
tags - autopsy, cranial	-	0.703	-
tags - no autopsy	0.307	0.580	-
tags - autopsy unknown	-	1.000	-
tags - DNA sampled	-	**0.001**	-
tags - not DNA sampled	8.889	**0.003**	0.301
tags - DNA sampling unknown	-	1.000	-
other documentation - autopsy, full	-	0.496	-
other documentation - autopsy, cranial	-	1.000	-
other documentation - no autopsy	-	0.741	-
other documentation - autopsy unknown	-	1.000	-
other documentation - DNA sampled	-	0.683	-
other documentation - not DNA sampled	-	1.000	-
other documentation - DNA sampling unknown	-	0.632	-

APPENDIX S (CONTINUED)

Case Info Content by Autopsy and DNA Sampling (df=1, N=98)	p
EDR/TDR - autopsy, full	0.525
EDR/TDR - autopsy, cranial	1.000
EDR/TDR - no autopsy	0.237
EDR/TDR - autopsy unknown	1.000
EDR/TDR - DNA sampled	1.000
EDR/TDR - not DNA sampled	1.000
EDR/TDR - DNA sampling unknown	1.000
case number - autopsy, full	0.421
case number - autopsy, cranial	0.502
case number - no autopsy	0.436
case number - autopsy unknown	1.000
case number - DNA sampled	**0.002**
case number - not DNA sampled	**0.000**
case number - DNA sampling unknown	0.261
funeral home - autopsy, full	0.471
funeral home - autopsy, cranial	0.551
funeral home - no autopsy	0.715
funeral home - autopsy unknown	1.000
funeral home - DNA sampled	0.637
funeral home - not DNA sampled	1.000
funeral home - DNA sampling unknown	0.597

APPENDIX T:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR ADDITONAL CASE INFO TYPES AND NAMUS RECORDS

Case Info Types by NamUs Records and NamUs DNA (df=1, N=103)	X^2	p	Cramer's V
total case info - NamUs records	9.034	**0.003**	0.296
total case info - NamUs DNA complete	-	0.647	-
total case info - NamUs DNA submitted	-	0.070	-
total case info - NamUs no DNA info	-	0.080	-
writing on container - NamUs records	-	0.686	-
writing on container - NamUs DNA complete	-	1.000	-
writing on container - NamUs DNA submitted	-	1.000	-
writing on container - NamUs no DNA info	-	1.000	-
			-
tags - NamUs records	-	**0.000**	-
tags - NamUs DNA complete	-	0.123	-
tags - NamUs DNA submitted	-	**0.019**	-
tags - NamUs no DNA info	-	**0.005**	-
other documentation - NamUs records	-	1.000	-
other documentation - NamUs DNA complete	-	0.406	-
other documentation - NamUs DNA submitted	-	1.000	-
other documentation - NamUs no DNA info	-	1.000	-

APPENDIX U:
RESULTS OF CHI-SQUARE AND FISHER'S EXACT TESTS FOR CONDITION OF REMAINS AND NAMUS RECORDS

Completeness and State of Decomposition by NamUs Records and NamUs DNA (df=1, N=99)	X^2	p	Cramer's V
complete remains - NamUs records	0.019	0.890	-
complete remains - NamUs DNA complete	-	0.648	-
complete remains - NamUs DNA submitted	-	0.291	-
complete remains - NamUs no DNA info	-	0.193	-
partial remains - NamUs records	0.019	0.890	-
partial remains - NamUs DNA complete	-	0.648	-
partial remains - NamUs DNA submitted	-	0.291	-
partial remains - NamUs no DNA info	-	0.193	-
early decomp - NamUs records	-	0.095	-
early decomp - NamUs DNA complete	-	0.190	-
early decomp - NamUs DNA submitted	-	0.118	-
early decomp- NamUs no DNA info	-	1.000	-
advanced decomp - NamUs records	-	0.289	-
advanced decomp - NamUs DNA complete	-	0.580	-
advanced decomp - NamUs DNA submitted	-	1.000	-
advanced decomp - NamUs no DNA info	-	1.000	-
mummified - NamUs records	-	0.113	-
mummified - NamUs DNA complete	-	0.386	-
mummified - NamUs DNA submitted	-	**0.021**	-
mummified - NamUs no DNA info	-	1.000	-
skeletonized - NamUs records	-	0.542	-
skeletonized - NamUs DNA complete	-	1.000	-
skeletonized - NamUs DNA submitted	-	0.035	-
skeletonized - NamUs no DNA info	-	0.660	-

APPENDIX U (CONTINUED)

Autopsy and DNA sampling by NamUs Records and NamUs DNA (df=1, N=99)	X^2	p	Cramer's V
autopsy, full - NamUs records	2.612	0.106	-
autopsy, full - NamUs DNA complete	-	0.066	-
autopsy, full - NamUs DNA submitted	-	1.000	-
autopsy, full - NamUs no DNA info	-	0.670	-
autopsy, cranial - NamUs records	-	0.350	-
autopsy, cranial - NamUs DNA complete	-	1.000	-
autopsy, cranial - NamUs DNA submitted	-	1.000	-
autopsy, cranial - NamUs no DNA info	-	1.000	-
no autopsy - NamUs records	0.245	0.621	-
no autopsy - NamUs DNA complete	-	0.362	-
no autopsy - NamUs DNA submitted	-	0.613	-
no autopsy - NamUs no DNA info	-	1.000	-
	-		
autopsy unknown - NamUs records	-	1.000	-
autopsy unknown - NamUs DNA complete	-	1.000	-
autopsy unknown - NamUs DNA submitted	-	1.000	-
autopsy unknown - NamUs no DNA info	-	1.000	-
DNA sampled - NamUs records	-	**0.000**	-
DNA sampled - NamUs DNA complete	-	**0.004**	-
DNA sampled - NamUs DNA submitted	-	**0.005**	-
DNA sampled - NamUs no DNA info	-	1.000	-
not DNA sampled - NamUs records	-	**0.012**	-
not DNA sampled - NamUs DNA complete	-	**0.038**	-
not DNA sampled - NamUs DNA submitted	-	**0.033**	-
not DNA sampled - NamUs no DNA info	-	1.000	-
DNA sampling unknown - NamUs records	-	0.685	-
DNA sampling unknown - NamUs DNA complete	-	1.000	-
DNA sampling unknown - NamUs DNA submitted	-	1.000	-
DNA sampling unknown - NamUs no DNA info	-	1.000	-

REFERENCES

Anderson, B. E. (2008). Identifying the dead: methods utilized by the Pima County (Arizona) office of the medical examiner for undocumented border crossers: 2001-2006. *Journal of Forensic Sciences, 53*(1), 8-15.

Anderson, B. E., & Spradley, M. K. (2016). The role of the anthropologist in the identification of migrant remains in the American Southwest. *Academic Forensic Pathology 6*(3), 432-438.

Beck, J., Ostericher, I., Sollish, G., & De León, J. (2015). Animal scavenging and scattering and the implications for documenting the deaths of undocumented border crossers in the Sonoran Desert. *Journal of Forensic Sciences, 60*(s1), S11-S20.

De León, J. (2015). *The land of open graves: Living and dying on the migrant trail*. Oakland, CA: University of California Press.

Department of Anthropology, Texas State University. (2018). *Identifying migrant death in South Texas.* Retrieved from https://www.txstate.edu/anthropology/centers-projects/op-id.html

Fleischman, J. M., Kendell, A. E., Eggers, C. C., & Fulginiti, L. C. (2017). Undocumented border crosser deaths in Arizona: Expanding intrastate collaborative efforts in identification. *Journal of Forensic Sciences, 62*(4), 840-849.

Frey, J. C. (2015). Graves of shame: New evidence indicates wrongdoing in the handling of migrant remains in Brooks County. *The Texas Observer*. Retrieved from https://www.texasobserver.org/illegal-mass-graves-of-migrant-remains-found-in-south-texas/

Galloway, A., Birkby, W. H., Jones, A. M., Henry, T. E., & Parks, B. O. (1989). Decay rates of human remains in an arid environment. *Journal of Forensic Sciences, 34(*3), 607-616.

Gocha, T. P., Spradley, M. K., & Strand, R. (2018). Bodies in limbo: Issues in identification and repatriation of migrant remains in South Texas. In K. E. Latham & A. J. O'Daniel (Eds.), *Sociopolitics of migrant death and repatriation: Perspectives from forensic science* pp. 143-156. Cham, Switzerland: Springer International Publishing.

Hinkes, M. J. (2008). Migrant deaths along the California–Mexico border: An anthropological perspective. *Journal of Forensic Sciences, 53*(1), 16-20.

Holland, T. D. (2015). Since I must please those below: Human skeletal remains research and the law. *American Journal of Law & Medicine, 41*(4), 617-655.

Hughes, C. E., Algee-Hewitt, B. F. B, Reineke, R., Clausing, E., & Anderson, B. E. (2017). Temporal patterns of Mexican migrant genetic ancestry: Implications for identification. *American Anthropologist, 119*(2), 193-208.

Humane Borders. (2018). *Map of migrant mortality*. Tucson, AZ: Humane Borders. Retrieved from https://humaneborders.org/migrant-death-mapping/

Interpol General Assembly. (1996). *Disaster victim identification. Resolution No. AGN/65/RES/13*. ICPO, Interpol General Assembly, 65th session. Retrieved from https://www.legal-tools.org/doc/d6aa95/pdf/

Junkins, E., & Carter, D. O. (2017). Relationships between human remains, graves and the depositional environment. In E. Schotsmans, N. Márquez-Grant, & S. L. Forbes (Eds.), *Taphonomy of human remains: Forensic analysis of the dead and the depositional environment* pp. 143-154. UK: John Wiley & Sons Ltd.

Kerwin, D. (2001). Migrant crossing deaths, immigrant families, and low-wage laborers on the U.S.-Mexico border. *In Defense of the Alien, 24*, 61-84.

Kielty, M., Nasser, L., Hunte, T., & Habte, B. (2018). Border trilogy. *Radiolab*. [Podcast]. New York: WNYC Studios. Retrieved from https://www.wnycstudios.org/story/border-trilogy-part-1

Kovic, C. (2013). *Searching for the living, the dead, and the new disappeared on the migrant trail in Texas: Preliminary report on migrant deaths in South Texas*. Retrieved from https://southtexashumanrights.files.wordpress.com/2013/09/migrant-deaths-report-edited.pdf

Kovic, C. (2018). Naming state crimes, naming the dead: Immigration policy, and "the new disappeared" in the United States and Mexico. In K. E. Latham & A. J. O'Daniel (Eds.), *Sociopolitics of migrant death and repatriation: Perspectives from forensic science* pp. 39-51. Cham, Switzerland: Springer International Publishing.

de Leeuwe, R., & Groen, M. W. (2017). A taphonomic study based on observations of 196 exhumations and 23 clandestine burials. In E. Schotsmans, N. Márquez-Grant, & S. L. Forbes (Eds.), *Taphonomy of human remains: Forensic analysis of the dead and the depositional environment* pp. 394-401. UK: John Wiley & Sons Ltd.

McConahay, M. J. (2007). They die in Brooks County. *The Texas Observer.* Retrieved from https://www.texasobserver.org/they-die-in-brooks-county-as-border-security-tightens-south-texas-becomes-a-graveyard-for-the-weak-and-the-unlucky/

McDaneld, C. P. (2016). *The effect of plastic tarps on the rate of human decomposition during the spring/summer in Central Texas* (Unpublished master's thesis). Texas State University, San Marcos, TX.

Mickleburgh, H. L., & Wescott, D. J. (2018). Controlled experimental observations on joint disarticulation and bone displacement of a human body in an open pit: Implications for funerary archaeology. *Journal of Archaeological Science, Reports, 20*, 158-167.

National Missing and Unidentified Persons System NamUs. (2020). U.S. Department of Justice. United States. Retrieved from https://www.namus.gov/About

O'Daniel, A. J. (2018). Follow the power lines until you hit a road: Contextualizing humanitarian forensic science in South Texas. In K. E. Latham & A. J. O'Daniel (Eds.), *Sociopolitics of migrant death and repatriation: Perspectives from forensic science* pp. 83-95. Cham, Switzerland: Springer International Publishing.

Ottoni, C., Bekaert, B., & Decorte, R. (2017). DNA degradation: Current knowledge and progress in DNA analysis. In E. Schotsmans, N. Márquez-Grant, & S. L. Forbes (Eds.), *Taphonomy of human remains: Forensic analysis of the dead and the depositional environment* pp. 65-80. UK: John Wiley & Sons Ltd.

Passalacqua, N. V., & Pilloud, M. A. (2018). The use of human subjects in forensic anthropology research. In N. V. Passalacqua & M. A. Pilloud (Eds.), *Ethics and professionalism in forensic anthropology* pp. 49-65. Academic Press, Elsevier Inc. Retrieved from https://doi.org/10.1016/B978-0-12-812065-1.00005-1

Pokines, J. T., Zinni, D.P., & Crowley, K. (2016). Taphonomic patterning of cemetery remains received at the Office of the Chief Medical Examiner, Boston, Massachusetts. *Journal of Forensic Sciences, 61*, S71-S81.

Rosenblatt, A. (2010). International forensic investigations and the human rights of the dead. *Human Rights Quarterly, 32*(4), 921-950.

Spradley, M. K., Hamilton, M. D., & Giordano, A. (2012). Spatial patterning of vulture scavenged human remains. *Forensic Science International, 219*(1), 57-63.

Spradley, M. K., Reineke, R., Doretti, M. C., & Anderson, B. E. (2016, February). *Death along the United States-Mexico border: A comparative view of policy and practice in Arizona and Texas*. Presented at the meeting of the American Academy of Forensic Sciences, Las Vegas, NV.

Spradley, M. K., Herrmann, N. P., Siegert, C. B., & McDaneld, C. P. (2018). Identifying migrant remains in South Texas: Policy and practice. *Forensic Sciences Research, 4*(1), 60-68.

Texas Constitution and Statutes. (2019a). Chapter 49: Inquests upon dead bodies *Code of Criminal Procedure, Title 1, Code of Criminal Procedure* pp. 1020-1049. Retrieved from https://statutes.capitol.texas.gov/Docs/SDocs/CODEOFCRIMINALPROCEDURE.pdf

Texas Constitution and Statutes. (2019b). Chapter 63, Subchapter B: University of North Texas Health Science Center Fort Worth missing persons DNA database. *Code of Criminal Procedure, Title 1, Code of Criminal Procedure* pp. 1399-1406. Retrieved from https://statutes.capitol.texas.gov/Docs/SDocs/CODEOFCRIMINALPROCEDURE.pdf

United Nations General Assembly. (2007). *Universal declaration of human rights: 60th anniversary special edition, 1948-2008*. New York: United Nations Publications.

United Nations General Assembly. (2016). New York declaration for refugees and migrants. *United Nations General Assembly seventy-first session, A/RES/71/1*. Retrieved from https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_71_1.pdf

U.S. Border Patrol. (2019). *Southwest border sector deaths FY 1998-FY 2019*. Retrieved from https://www.cbp.gov/sites/default/files/assets/documents/2020-Jan/U.S.%20Border%20Patrol%20Fiscal%20Year%20Southwest%20Border%20Sector%20Deaths%20%28FY%201998%20-%20FY%202019%29_0.pdf