# ANALYSIS OF MORTUARY VARIABILITY, DIET, AND AREA-OF-BIRTH AT THE EARLY BRONZE AGE CEMETERY OF KHUZHIR-NUGE XIV, CIS-BAIKAL, SIBERIA

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By

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## PERMISSION TO USE



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**ABSTRACT**

This thesis explores mortuary and biogeochemical correlates at the Early Bronze Age (4597+/-76 to 3726+/-34 cal. BP; Weber et al. 2016) cemetery of Khuzhir-Nuge XIV (K14) in the Little Sea microregion of Cis-Baikal, Siberia. Previous research using the *bioarchaeology of life histories* approach (Zvelebil and Weber 2013) has indicated that there are mortuary correlates to diet and area-of-birth (Shepard 2016, and Weber and Goriunova 2013), however neither investigated the full range of mortuary treatment present at K14. Shepard (2016) analyzed area-of-birth and interment in similar rows of graves, and Weber and Goriunova (2013) analyzed diet, area-of-birth, interment with red deer canine pendants, and cluster in K14. This thesis investigates correlates with interment with nine artifact categories (implements, ornaments, kaolinite cylindrical beads, nephrite artifacts, lithic arrowheads, wood working implements, hide working implements, hunting implements, and meat butchering implements) and four mortuary treatment categories (fire use, head treatment, grave disturbance, and grave pit lining) using log linear models (Agresti 2007). Using log linear models (Agresti 2007), the relationships between the two previously identified diet categories (game-fish-seal; GFS, and game-fish; GF), the two areas-of-birth (broadly categorized as local (to the Little Sea) and nonlocal), and mortuary practices at K14 are identified and analyzed.

Each mortuary variable was tested three times in order to fully explore any possible relationship between that variable and (1) diet and area-of-birth, (2) diet and cluster in K14, and (3) area-of-birth and cluster in K14. Since cluster in K14 is consistently identified as an influential factor for mortuary treatment and has correlates to diet and area-of-birth, including it in these tests helped identify which mortuary treatment variables are related to cluster in K14 or are related to diet and/or area-of-birth. Interestingly, while diet and area-of-birth are consistently related to one another in every test performed, they are not related to the same mortuary variables. Furthermore, when cluster in K14 is included in the analysis, all mortuary variables (with the exception of grave disturbance and the relationship between diet and area-of-birth) are related to cluster in K14. This suggests that there are multiple, simultaneous influencing factors on mortuary treatment that are related to diet, area-of-birth, and cluster in K14. While there are undoubtedly other influencing factors on mortuary treatment for these individuals based on

aspects of their life histories that may never be fully understood or identified, understanding how diet and area-of-birth relate to mortuary treatment provides important information on Glazkovo lifeways in the Little Sea microregion and the Cis-Baikal in general.

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# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

In this thesis, I explore Early Bronze Age (4597+/-76 to 3726+/-34 cal. BP; Weber et al. 2016) hunter-gatherer lifeways in the Little Sea microregion of Lake Baikal by investigating relationships between variations in mortuary practices (e.g., area in the cemetery [called cluster in this thesis], grave goods, fire use, head treatment, grave disturbance, and grave architecture), and variation in diet and area-of-birth based on geochemical signatures from individuals interred at the cemetery of Khuzhir-Nuge XIV. As noted by Weber and Goriunova (2013), separately, these three lines of data have yielded considerable insights, but so far only there have been few attempts to synthesize these data.

It has been difficult to investigate the full extent to which differences and similarities in diet and area-of-birth manifest in mortuary treatment because mortuary and skeletal/dental data have been examined independently from diet and area-of-birth. Exceptions to this are publications by Shepard (2016) and Weber and Goriunova (2013). Shepard (2016) found that individuals interred in communal graves at Khuzhir-Nuge XIV (K14) generally had similar life histories of movement (based on strontium [$^{87}Sr/^{86}Sr$] isotope data), and individuals from graves within the same row also had similar life histories of movement but with some variation. Weber and Goriunova (2013) that found that while diet and area-of-birth are possible factors accounting for some variability in mortuary treatment at K14, namely spatial organization, they cannot be directly and unambiguously correlated to mortuary treatment. Other aspects of identity such as status, gender, and kinship, may have also played important roles (Weber and Goriunova 2013). Weber and Goriunova further note that the "…examination of the remaining body of mortuary variability in the context of the geochemical data are likely to reveal additional insights" (2013:16). This thesis is such an examination, and it increases the number of individuals from Weber and Goriunova's (2013) study (from 25 to 48) and Shephard's (2016) study (from 31 to 48).

All of the available mortuary and geochemical (i.e. diet and area-of-birth) data for this cemetery (e.g., Fraser-Shapiro 2012; Haverkort et al. 2008, 2010; McKenzie 2010a, 2010b; Metcalf 2006; Scharlotta et al. 2011, 2013; Scharlotta and Weber 2012, 2014; Weber and

Goriunova 2013; Weitzel 2007; Weitzel and McKenzie 2008) will be combined and analyzed using log-linear models (Agresti 2007). This will be done to test for the presence or absence of relationships between mortuary variables, diet, and area-of-birth, with a focus on cluster in K14 since there are already identified correlates between mortuary treatment, geochemical data (diet and area-of-birth), and cluster in K14 (Weber and Goriunova 2013).

Based on geochemical signatures from bones and teeth, two distinct dietary patterns (GFS=game-fish-seal, and GF=game-fish) and two broad areas-of-birth (locally-born in the Little Sea microregion, and nonlocally-born elsewhere in the Cis-Baikal region) have been identified (Weber and Goriunova 2013). Furthermore, previous research at Khuzhir-Nuge XIV (hereafter referred to as K14) found that all individuals local to (i.e. born in) the Little Sea microregion appear to have followed the GFS diet, while those nonlocal to (i.e., born elsewhere) the Little Sea microregion follow both the GFS or the GF diets (Weber et al. 2011). This results in three geochemical categories of individuals in K14: GFS-Locals, GFS-Nonlocals, and GF-Nonlocals (Weber et al. 2011). These categories will be referred to as *geochemical categories* throughout this thesis because they are identifiable on the basis of geochemical data from stable isotopes, strontium, and trace elements (Fraser-Shapiro 2012; Haverkort et al. 2008, 2010; Katzenberg et al. 2009, 2010, 2012; Scharlotta et al. 2011, 2013; Scharlotta and Weber 2012, 2014; Weber 1995, 2002; Weber et al. 2011).

### 1.2 Geographic and Environmental Context

Lake Baikal is a unique body of water located in the southern part of eastern Siberia, between 52° and 58°N latitude, and 99°E and 110°E longitude (see Figure 1.1; Michael 1958). The Cis-Baikal Region is the greater geographic context for the research examined in this thesis, and it is delineated by the larger dashed-line box in Figure 1.2 (Shepard 2012).

Geographically, the Cis-Baikal region is defined as the area north and west of Lake Baikal, specifically the area that includes the Angara River basin from its source to Ust'Ilimsk, the upper Lena River drainage to Kirensk, and the west coast of Lake Baikal including Ol'khon Island, the largest island on the lake (Figure 1.2; Michael 1958). The Cis-Baikal is often divided into four microregions: 1) the Angara River valley from its source at Lake Baikal; 2) the upper Lena River from its source in the Baikal Range mountains, north of Lake Baikal; 3) South Baikal

Figure 1.1 Map of geographic location of Lake Baikal. Map used with permission of Dr. Christian Lupe (FU Berlin).

to the southwest of the lake; and 4) the Little Sea microregion (Figure 1.2; Weber and Bettinger 2010). The Little Sea microregion is the area between and including Ol'khon Island and the mainland (Michael 1958). It is sometimes also referred to as Ol'khon region (see Figure 1.2) or *Priol'khon'e* (in Russian literature), but for this thesis it will referred to as the Little Sea microregion. K14 is the largest Early Bronze Age cemetery in this area (McKenzie 2010a), and it has a great degree of variability in mortuary treatment between the different clusters of the cemetery (McKenzie 2010a) and between the different geochemical groups (Shepard 2016 and Weber and Goriunova 2013).

The Little Sea microregion has the most arid microclimate of the entire Cis-Baikal (Bezrukova et al. 2013; Vorob'eva 1990 as cited in Weber and Link 1998). The mainland is a transitional taiga-steppe zone with birch and conifer vegetation (Tarasov et al. 2007), while Ol'khon Island is classified as a steppe or forest-steppe ecosystem (Tarasov et al. 2007) with a dry steppe microclimate along its western side and conifer of Siberian larch (*Larix sibirica*) and

Scots Pine (*Pinus sylvestris*) forests to the north and east (Bezrukova et al. 2013; Kozhov 1963). The environment of the Little Sea microregion would have provided good hunting grounds and fisheries due to the shallow and protected nature of the water, abundant fresh water, and access to terrestrial game for inhabitants and visitors (Katzenberg and Weber 1999; Kozhov 1963; Losey et al. 2008; Nomokonova et al. 2013; Thomas et al. 1982; Weber et al. 2002 citing Shvetsov and colleagues 1984 and Sokolov 1959). Also, Lake Baikal is home to the Baikal Seal (*Phoca sibirica*), an endemic species of freshwater seal that was procured for food in the Early Bronze Age or EBA (Katzenberg et al. 2009, 2010).

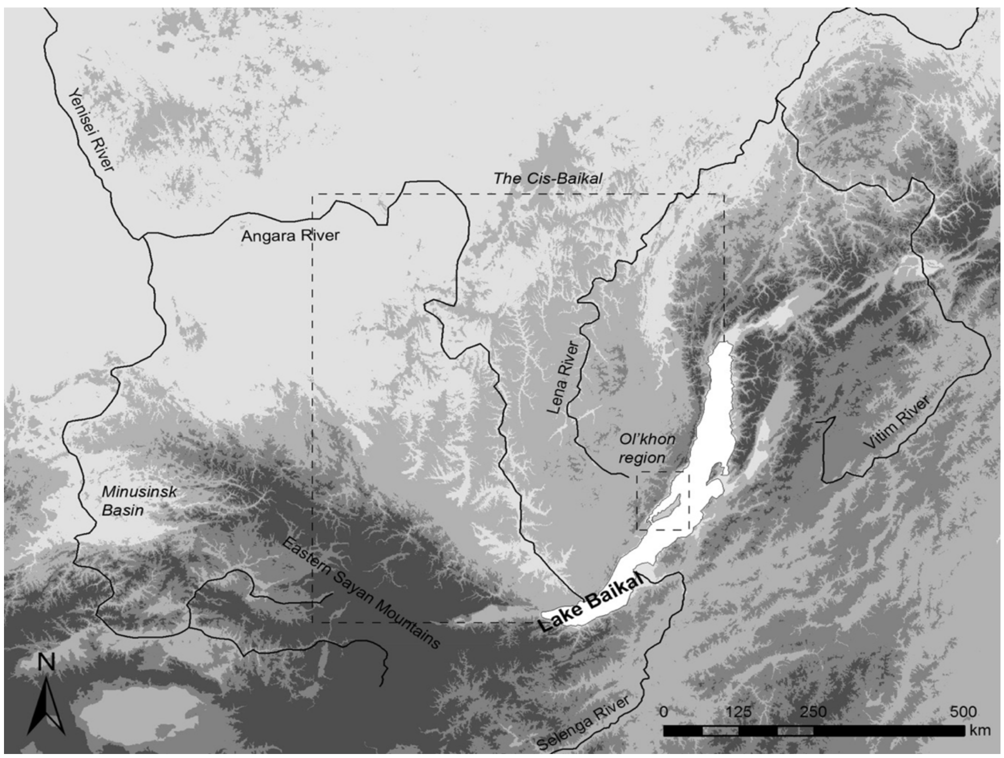


Figure 1.2. Map showing the Cis-Baikal Region delineated in the large dashed-line box, and the Little Sea microregion, also called the Ol'khon Region, delineated in the small dashed-line box, reproduced from Shepard (2012). Map used with permission from Ben Shepard.

### 1.3 History of Archaeological Research in the Cis-Baikal and Little Sea Microregion

Until the 1990's the archaeological literature of the Cis-Baikal had been almost exclusively in Russian so, unless otherwise stated, this review will rely on English language reviews, such as that by Goriunova and Novikov (2010). Archaeological research in the Cis-Baikal began in 1850 when the Siberian Branch of the Imperial Russian Geographical Society opened in Irkutsk, eastern Siberia's largest city (Goriunova and Novikov 2010). This early research focused on the large number of Bronze Age mortuary sites in the region, identified by copper and bronze grave inclusions (Goriunova and Novikov 2010). In 1912 archaeological research began on the shores of Lake Baikal, and beginning in 1956, sites in the Little Sea microregion, (Figure 1.3), were included in such investigations (Goriunova and Novikov 2010; Okladnikov 1959, 1955). This later field work was conducted by the Leningrad Branch of the USSR Academy of Sciences Institute of Archaeology, and the subsequent publications (Okladnikov 1959, 1955) represent the first mention of Early Bronze Age mortuary tradition (i.e., Glazkovo) graves in the Little Sea microregion (Goriunova and Novikov 2010).

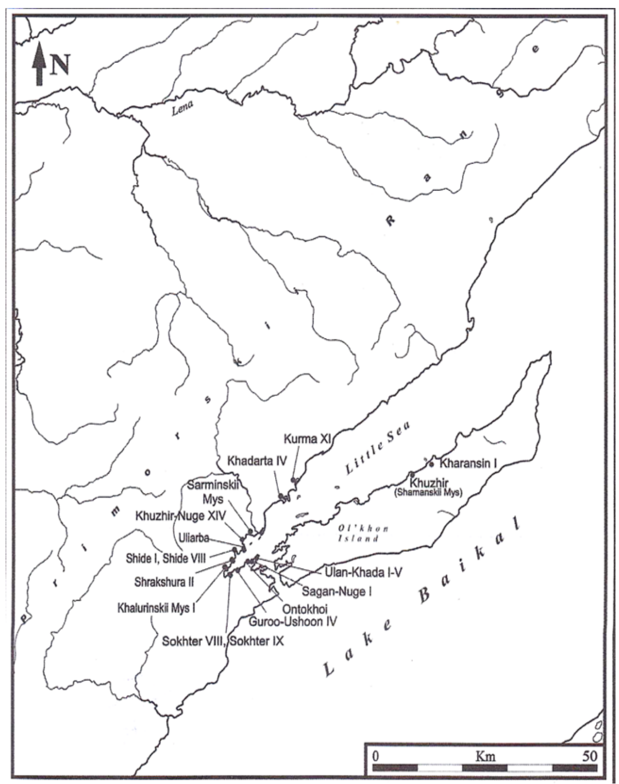


Figure 1.3 Map of the Little Sea microregion showing 15 Glazkovo cemeteries, including K14. Map used with permission from McKenzie 2010a.

During the 1950s, one of the most extensive culture-histories for the Cis-Baikal and Little Sea microregion was published (Okladnikov 1955, 1959). This chronology was primarily based on mortuary practices and artifact typology, and it grew to incorporate early bioarchaeological research such as craniometrics (Alekseev and Mamonova 1979; Mamonova 1973; both in

Russian). Early metallurgic research concluded that the copper/bronze artifacts found within Glazkovo graves were likely composed metals from local sources and could therefore be considered unique to the Cis-Baikal, when compared to the rest of Siberia (Goriunova and Novikov 2010). Foundational research to this thesis in the Cis-Baikal began with the Russian-Canadian Archaeological Expedition (1997-2003) that focused on the Late Neolithic (5571+/-88 to 4597+/-79 cal. BP, LN)-EBA Glazkovo cemeteries of K14 and Kurma XI, both located in the Little Sea microregion (Figure 1.3; Goriunova and Novikov [2010]). The Baikal Archaeology Project (BAP) and Baikal- Hokkaido Archaeology Project (BHAP), led by the University of Alberta and Irkutsk State University, formed next in 2001, followed by the Small Cemeteries Project (2013-2016), of which this thesis is a part. The University of Saskatchewan, MacEwan University (Edmonton, Alberta), and Irkutsk State University were the three institutions involved with the Small Cemeteries Project. Data used in this thesis are from these three projects.

**1.4 Significance of Research**

To date, investigating correlations in mortuary treatment to diet and area-of-birth has only been undertaken by two other research publications (i.e., Shepard [2016] and Weber and Goriunova [2013]). Weber and Goriunova's (2013) work explored the relationship between spatial organization and red deer canine pendants with diet and area-of-birth, and Shepard's (2016) looked at the relationship between life histories of movement, interment in double or communal graves, and interment in rows.

Following Weber and Goriunova (2013), detailed spatial analysis will be a primary focus of this thesis as previous studies have indicated not only the mortuary and skeletal/dental significance of spatial analysis (McKenzie 2010a), but also diet and area-of-birth correlates (Weber and Goriunova 2013). Analyses integrates the remaining body of mortuary data from K14 with diet and area-of-birth from a greater number of individuals (i.e., N=48 versus N=25 from Weber and Goriunova [2013] and N=31 from Shepard [2016])

Interestingly, previous studies have indicated that merely correlating basic skeletal/dental data (e.g., age at death and sex) with mortuary treatment does not fully explain the wide range of mortuary variability seen in K14 (McKenzie 2010a; Weber and Goriunova 2013). This is partly due to the issues of preservation of human remains that sometimes prevent accurate sex and age-at-death determination (Lieverse 2007a). For those individuals where specific age-at-death data are available, there is still a great deal of unexplained mortuary variability (McKenzie et al. 2008). It is with these observations in mind that mortuary variability between different diets and areas-of-birth will be analyzed.

Even though analysis is limited to one cemetery (i.e., K14), the research in this thesis will still yield valuable insight for the rest of the Little Sea microregion because it is the largest Glazkovo cemetery, and it may represent a large sample of the wider population using cemeteries in this area. Lastly, previous BAP/BHAP research has been undertaken with the intent of global comparison to other subarctic and northern boreal forest hunter-gatherer research (Weber et al. 2010a). As there are few other research projects that allow for such extensive examinations on northern hunter-gatherer human remains and mortuary sites, this research will contribute to a global understanding of northern hunter-gatherer lifeways and cemetery use (Weber et al. 2010a).

### 1.5 Research Question

Since I explore mortuary treatment correlates to diet and area-of-birth, analyses will focus on answering the following question.

1) Do previously identified geochemical variables of diet and area-of-birth (i.e., GFS-Local, GFS-Nonlocal, and GF-Nonlocal) correlate to variation in mortuary practices (e.g., cluster, types of grave inclusions, mortuary use of fire, head treatment, etc.) at K14?

Answering this question will supplement previous and ongoing research on Glazkovo cemeteries in the Cis-Baikal region, as the full extent to which differences and similarities in diet and area-of-birth correlate to mortuary variability remains unclear. Also, this thesis is one of the first projects on this topic to fully integrate all data and analyze them using log-linear models (Agresti 2007). These findings will be discussed in relation to existing understandings of K14 and EBA in the Little Sea microregion.

### 1.6 Thesis Outline

Chapter 2 reviews the existing literature on K14, as well as the EBA Glazkovo mortuary tradition in the Little Sea microregion as a whole to provide culture-historical context for K14 and the 48 individuals with diet and area-of-birth data analyzed in this thesis. It also explains the significance of geochemical diet and area-of-birth data to existing interpretations of K14.

Chapter 3 explains the *bioarchaeology of life histories* approach (Zvelebil and Weber 2013), the materials and methods used, and log linear model analysis (Agresti 2007). Chapter 4 presents the log-linear analysis of the relationships between mortuary variables, diet, and area-of-birth at K14. In Chapter 5 these patterns and relationships are discussed with reference to the theories and approaches introduced in Chapter 3. Chapter 6 concludes the thesis with a summary of the results and interpretations, and with suggestions for future research directions.

# CHAPTER 2: REVIEW OF LITERATURE

## 2.1 Introduction

This chapter provides an overview of the Early Bronze Age (Glazkovo) mortuary tradition in the Little Sea microregion, mortuary and skeletal/dental research, and current understandings of diet and area-of-birth at K14. This includes discussing the few instances where these data are integrated, in part to point out the importance of integrating diet and area-of-birth data into mortuary and skeletal/dental research, and also to lay out the foundation of this thesis. Where Little Sea microregion data are lacking, data concerning the Glazkovo populations elsewhere in the Cis-Baikal are used. In addition, this chapter introduces the cemetery analyzed in this thesis, Khuzhir-Nuge XIV (K14).

## 2.2 The Cis-Baikal Glazkovo Mortuary Tradition: Mortuary Research

The Glazkovo mortuary tradition refers to a distinct set of mortuary practices found throughout the Cis-Baikal region during the EBA, between 4597+/-76 to 3726+/- 34 calibrated $^{14}$C BP (date for entire Cis-Baikal; Weber et al. 2016). These dates have been corrected from earlier radiocarbon calculations (Weber et al. 2005, 2006, 2010b) because of a freshwater carbon reservoir effect in Lake Baikal (Nomokonova et al. 2013; Schulting et al. 2014, 2015; Weber et al. 2016). A summary of the Glazkovo, and other middle Holocene Cis-Baikal mortuary traditions in the Cis-Baikal is presented in Table 2.1.

The Glazkovo tradition is defined through typological analysis of grave goods and mortuary treatment (Okladnikov 1959). Characteristic artifacts include nephrite axes, harpoons/spears, cylindrical beads, white nephrite rings, stone bars (weights), disks of nephrite and calcite, typological changes in arrowheads, and the introduction of metal (copper and bronze) (Okladnikov 1959). Common, but not necessarily characteristic, artifacts include implements such as lithic knives and bone needles, lithic flakes and blades, green nephrite artifacts, faunal tools, abraders, microlithic inserts for composite tools, and ornaments such as red deer canine pendants and boar tusk pendants (McKenzie 2006, 2010a; Weber et al. 2006). Rare artifacts include ceramic vessels, fishing-related gear (such as harpoons, fishhooks, and fishhook shanks), and metal items (McKenzie 2006; Weber et al. 2016).

Table 2.1 Summary of the culture-history of the Cis-Baikal, modified from Weber and Bettinger (2010), using corrected radiocarbon dates from Weber and colleagues (2016)

| Period | Cultural Pattern |
|---|---|
| Late Mesolithic, 8277+/-176 to 7503+/-14 cal. BP | Lack of mortuary and skeletal/dental data |
| Early Neolithic, 7503+/-14 to 7027+/-33 cal. BP | Kitoi mortuary tradition; Cemeteries, hunting, fishing and sealing, large and unevenly distributed population, physical and physiological stress, differential mobility, substantial social differentiation. Cultural heterogeneity, sexual divisions of labour, high reliance on fishing. |
| Middle Neolithic, 7027+/-33 to 5571+/-88 cal. BP | Lack of mortuary and skeletal/dental data |
| Late Neolithic, 5571+/-88 to 4597+/-79 cal. BP | Serovo mortuary tradition; Cemeteries, hunting, fishing and sealing, larger and evenly distributed population genetically different from EN, moderate physical and physiological stress, moderate mobility and social differentiation |
| Early Bronze Age, 4597+/-76 to 3726+/- 34 cal. BP | Glazkovo mortuary tradition; Cemeteries, hunting, fishing and sealing, large and evenly distributed population genetically continuous with LN, moderate physical and physiological stress, moderate mobility and social differentiation. Cultural homogeneity, high reliance on game hunting |

Common Glazkovo mortuary treatments include fire use, placement of the interred individual in an extended supine position, and in the Little Sea microregion specifically, a change in grave orientation from north-south (characteristic of the previous Late Neolithic Serovo tradition, see Table 2.1) to east-west (McKenzie 2006; Michael 1958; Okladnikov 1959). The vast majority of Glazkovo burials in the Little Sea microregion are primary interments (in their original location, see Weber et al. [1995]), although there are a few burials that could be secondary interments (interred elsewhere then moved, see McKenzie [2006]). In this analysis, the term *grave* refers to the feature that houses the *burial,* which refers to the interred individual (Lieverse et al. 2006; McKenzie 2006).

Glazkovo graves within the Little Sea microregion display a large range of variation in grave goods, as some individuals are interred with hundreds of artifacts and many others are interred with nothing (McKenzie 2006, 2010a; Metcalf 2006; Weber et al. 2008). Spatial organization within cemeteries appears to have been a key component of mortuary treatment, as demonstrated by extensive micro-scale research at K14 (McKenzie 2010a; Weber and Goriunova 2013). This research suggests that at K14, "spatial organization corresponds to social units at a sub-community level, such as clan, lineage, families, task, or status and rank groups" (Weber and Goriunova 2013:12).

Based on the above distinctions in artifacts and mortuary treatment, and backed by radiocarbon dating, fifteen Glazkovo cemeteries comprised of 189 graves and 203 burials have been documented in the Little Sea microregion (McKenzie 2006, 2010a; Weber and Bettinger 2010). McKenzie (2006, 2010a) proposed that these can be divided into two different types of cemeteries: *community cemeteries,* while not necessarily inclusive of everyone, do include a large range of age groups and both sexes, and a high level of diversity in grave goods, suggesting broader rules for eligibility in interment (McKenzie 2010a; Weber and Bettinger 2010); *specialized cemeteries*, in contrast, are those where interment appears to be more controlled, as reflected by fewer age groups being represented and less diversity in mortuary practices (McKenzie 2010a; Weber and Bettinger 2010). By this definition, K14 has been designated a community cemetery (McKenzie 2010a), and it is likely that determinations about who was, and who was not, interred at K14 was influenced by this distinction.

Glazkovo cemeteries in the Little Sea microregion are often located quite close together (e.g., K14 is within seven kilometers of two other Glazkovo cemeteries), and in the EBA they would have been highly visible on the landscape (Weber and Bettinger 2010). Since K14 is the only cemetery with a large number of individuals with diet and mobility data (N=48), it is the only one discussed in this thesis.

### 2.3 The Little Sea Glazkovo Mortuary Tradition: Skeletal/Dental Research

While I do not specifically analyze skeletal/dental data, it is important to include here because such research helps understand the individuals interred in K14. Activity reconstructions for Glazkovo individuals throughout the Cis-Baikal have been interpreted by evaluating prevalence and severity of osteoarthritis (Lieverse 2010; Lieverse et al. 2007b, 2016), differences in entheseal morphology (Lieverse et al. 2009, 2011, 2013), long bone robusticity (Lieverse et al. 2011; Stock and Macintosh 2016; Stock et al. 2010), dental modification (Waters-Rist et al. 2010), and dental pathology (Lieverse 2007, 2010; Lieverse et al. 2007a). While most of these observations are based on aggregate data from groups of individuals in the Cis-Baikal in general, this research provides the context for the individuals studied in this thesis. This is especially important considering the fact that preservation issues in the Little Sea microregion have prevented some individuals from detailed skeletal/dental assessment (Lieverse 2007). Using Glazkovo skeletal data, specifically upper and lower limb morphology, from elsewhere will provide this missing information, even if just as an analogy.

Cis-Baikal Glazkovo populations do not exhibit considerable differences in upper limb morphology between the sexes, suggesting that workload involving the upper limbs such as overhead throwing—and even watercraft use—were undertaken by the majority of the population (Lieverse et al. 2009, 2011; Stock et al. 2010). The latter is interesting, as there has been no direct archaeological evidence for watercraft use in the Cis-Baikal found so far (Lieverse et al. 2011). Upper limb morphology from individuals from community versus specialized cemeteries also exhibit no significant differences (Lieverse et al. 2009).

Data from lower limb entheseal morphology and long bone robusticity indicate that some tasks were organized by sex and possibly by age, as lower limb morphology for males exhibit age-based differences between younger and older individuals, while female lower limb morphology does not (Stock and Macintosh 2016). Furthermore, when entheseal scores from older adults and males throughout the Cis-Baikal are compared with younger adults and females, the former have higher scores than the latter (Lieverse et al. 2013). In addition, the differences between male and female aggregate entheseal scores increase with higher age-at-death (Lieverse et al. 2013). These data are interpreted as possibly indicating either slight activity differences between males and females over time, or larger changes in sex-based activity throughout adulthood (Lieverse et al. 2013). Indeed, Lieverse and colleagues (2016) note that analysis of osteoarthritis indicate that males may have had higher workloads either induration or intensity.

While I do not directly address the above data, it is important to understand in order to lay a biological context for the individuals discussed in Chapter 4. Based on the above data, the population interred at K14 belonged to a fairly egalitarian community (Lieverse et al. 2007a) with little observable differentiation in workload (Lieverse et al. 2013). This suggests that the differences seen in mortuary treatment may not be strongly correlated to workload but to other social differences such as diet and area-of-birth.

### 2.4 Diet in the Little Sea Microregion

Two distinct diets (GFS and GF) in the Little Sea microregion have been interpreted primarily through analysis of stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopes of human remains from the Little Sea microregion, and flora and fauna from modern and EBA Glazkovo samples in the Little Sea microregion and elsewhere in the Cis-Baikal (Haverkort et al. 2008; Katzenberg and Weber 1999; Katzenberg et al. 2006, 2010, 2012; Scharlotta et al. 2013; Weber et al. 2002, 2011).

The biggest difference between these two diets is the aquatic sources (Weber et al. 2011), specifically Baikal seal (*Phoca sibirica*), which have been identified through high levels of nitrogen ($\delta^{15}N$, Katzenberg et al. 2010). However, when this isotopic component in the GFS diet (i.e., the high nitrogen level) is subtracted, the remaining aquatic components (i.e. $\delta^{13}C$) are isotopically distinct from the aquatic components of the GF diet (Weber et al. 2011). These differences could be related to the difference in fish species inhabiting Lake Baikal and adjacent the rivers where the GFS-diet followers and GF-diet followers fished (Losey et al. 2012), or distinct fishing areas for those individuals who following the two diet types (Katzenberg et al. 2012). As will be discussed in Section 2.5, a possible origin for the GF individuals is the upper Lena microregion (Scharlotta et al. 2013; Scharlotta and Weber 2012; see Figure 1.2), so perhaps these individuals were relatively new to the Little Sea microregion, and/or they transported upper Lena microregion foods with them. The former is more likely than the latter, as these two diets are quite discrete with little isotopic evidence for a gradual transition from one to the other (Scharlotta and Weber 2014).

High levels of nitrogen ($\delta^{15}N$) indicate the use of aquatic sources for subsistence but does not preclude the use of terrestrial sources as well, since they would have lower nitrogen ($\delta^{15}N$) levels that are masked by the high aquatic nitrogen ($\delta^{15}N$) levels (Katzenberg et al. 2010). Other aquatic food sources, such as the northern pike (*Esox lucius*) and the Baikal sturgeon (*Acipenser baerii*) could also contribute to high nitrogen levels (Katzenberg et al. 2010). Zooarchaeological analysis of faunal remains from habitation sites within and nearby the Little Sea microregion (Losey et al. 2008, 2012; Nomokonova 2011), and the presence of certain artifacts related to food procurement activities such as fishing (Losey et al. 2008 citing Okladnikov 1955, Weber et al. 2011), also provide data on subsistence activities such as the consumption of seal (Weber et al. 1998; Nomokonova 2011). Unfortunately, stratigraphic levels within the habitation sites have yet to be associated with cemetery use so indirect evidence of seal (and fish) consumption through stable isotope analysis (high nitrogen levels), is used (Katzenberg et al. 2010; Kaztenberg et al. 2010) instead of artifacts and ecofacts from food processing areas.

Glazkovo people of both dietary preferences (i.e., GFS and GF) most likely hunted ungulate taxa such as red deer (*Cervus elaphus*), elk (*Alces alces*), roe deer (C*apreolus capreolus*), and reindeer (*Rangifer tarandus Linné*), to name a few (Katzenberg and Weber 1999). It is unclear whether these species comprise the majority of meat in both diets (Weber et al. 2002; Weber et al. 2011) or if terrestrial meat was less important than aquatic sources (Katzenberg et al. 2012). Other sources of food such as plants (Clarke 2015; Katzenberg et al. 2012; Katzenberg and Weber 1999) and birds (Katzenberg et al. 2010, 2012) were also used; however, they were likely minor, supplemental food sources (Clarke 2015; Katzenberg et al. 2012).

There is little dietary variation seen in the Little Sea microregion between the Early Neolithic (EN) to the EBA, and what regional variation is seen could be partly due to family groups or lineages fishing in certain locations (Katzenberg et al. 2012). It is unclear whether differences in diet correlate to differences in skeletal/dental factors such as age and sex, cultural factors such as mortuary treatment (Katzenberg et al. 2009), or both. While the goal of this thesis will address this question, part of the answer to this lack of clarity is perhaps already published, as diet at K14 can more confidently be linked to area-of-birth rather than to grave assemblages considered ‘rich’ (Weber and Goriunova 2013). Furthermore, seal remains and possible sealing tools have been found in a specialized Glazkovo cemetery called Shamanskii Mys, located on Ol’khon Island, which further suggests the social significance of seal consumption (Okladnikov and Konopatskiy 1974/75; Weber et al. 1993, 1998).

The existence of two general diets could therefore be the result of social and/or regional preferences of diet (Katzenberg et al. 2012), seasonality of movement of GF diet following individuals into the Little Sea microregion (Weber et al. 2011), or social correlations to diet that have yet to be recognized. Seal is considered to be a seasonal meat and may have been available to most members of the population, as the GFS diet is present in all cemeteries that have been analyzed so far (Weber et al. 2002). The presence of the GF diet, however, suggests that it may not have been equally available to everybody (Weber 2012; Weber and Goriunova 2013; Weber et al. 2011, 2016).

### 2.5 Area-of-Birth and Mobility in the Little Sea Microregion

Area-of-birth and mobility have been extensively researched for individuals interred at K14 using strontium ($^{87}Sr/^{86}Sr$), and trace elements rhenium (Re), cesium (Cs), and barium (Ba) (see Table 2.2; Fraser-Shapiro 2012, Haverkort et al. 2008, 2010; Scharlotta et al. 2011, 2013; Scharlotta and Weber 2012, 2014; Weber 1995; Weber et al. 2002, 2011). Since the Little Sea microregion has clearly distinguishable $^{87}Sr/^{86}Sr$ values from other areas within the Cis-Baikal (Haverkort et al. 2008), $^{87}Sr/^{86}Sr$ research has identified two general patterns of individual movement as defined by area-of-birth. Analyses of Re, Cs, and Ba have identified more specific patterns of movement within these two general local and nonlocal patterns (Fraser-Shapiro 2012; Scharlotta and Weber 2012). These are described in Table 2.2.

As Table 2.2 demonstrates, simple classifications of ‘local’ and ‘nonlocal’ mask the variable nature of individual movement throughout the Cis-Baikal. In this thesis, local and nonlocal individuals are defined on their area-of-birth following Weber and Goriunova (2013), so only those individuals with strontium data from the crown of their first permanent molar (M1) will be used. The crown of M1 forms between birth and ~3.6 years old (Moorrees et al. 1963). Scharlotta and Weber (2014) interpret these data as representing the area-of-birth and early childhood. However, it is important to know that despite being labeled ‘local’ or ‘nonlocal’ based on their area-of-birth, these individuals’ life histories (as indicated by strontium values from all three permanent molars, M1, M2, and M3) are much more varied and complex. Therefore, these individuals will be termed locally or nonlocally-born in order to be specific about what ‘movement’ means in this thesis.

The five main movement patterns described in Table 2.2 provide some possible interpretations on movement in and out of the Little Sea, which will help understand the mortuary relationships to local or nonlocal birth. Individuals at K14 likely made two or three major moves during their lives, likely between the Little Sea and upper Lena microregions, with

Table 2.2. Summary of the five mobility patterns documented at Khuzhir-Nuge XIV based on Re, Cs, and Ba data (identified from Fraser-Shapiro [2012] and Scharlotta and colleagues [2013]), compared to mobility pattern designation used in this thesis ($^{87}Sr/^{86}Sr$ data; Haverkort et al. 2008; Weber and Goriunova 2013).

| Area-of-birth (Haverkort et al. 2008, Weber and Goriunova 2013) | Burial (Master ID Number) | Mobility Pattern Designation (Fraser-Shapiro 2012, Scharlotta et al. 2013) | Mobility Pattern Description (Fraser-Shapiro 2012, Scharlotta et al. 2013) |
|---|---|---|---|
| Nonlocal<br>Nonlocal<br>Nonlocal<br>Nonlocal<br>Nonlocal | K14_1997.010<br>K14_1998.035.01<br>K14_1998.038<br>K14_1999.046<br>(K14_1998.035.02) | Pattern 1<br>Pattern 1<br>Pattern 1<br>Pattern 1<br>Pattern 1 | Large procurement ranges in Angara or upper Lena, equally active in the entire Cis-Baikal. K14_1998.035.02 likely made three or four major moves in their life (Scharlotta et al. 2013), and K14_1998.035.01 likely made two major moves (Scharlotta et al. 2013). |
| Local<br>Local<br>Local<br>Local<br>Local<br>Local<br>Local | K14_1997.012<br>K14_1997.014<br>K14_1999.059.02<br>K14_2000.063<br>K14_2000.064<br>(K14_1997.016)<br>(K14_1999.045) | Pattern 2a<br>Pattern 2a<br>Pattern 2a<br>Pattern 2a<br>Pattern 2a<br>Pattern 2a<br>Pattern 2a | Born and lived their subadult years in the Little Sea. Patterns in adulthood similar to those seen in Pattern 1. K14_1999.045 made three significant moves into the Little Sea region, then out, then back in (Scharlotta et al. 2013). |
| Nonlocal<br>Nonlocal<br>Nonlocal<br>Nonlocal<br>Local | K14_1998.036.01<br>K14_1999_51<br>K14_1999.057.02<br>(K14_1998.037.02)<br>(K14_1998.039) | Pattern 2b<br>Pattern 2b<br>Pattern 2b<br>Pattern 2b<br>Pattern 2b | Born and lived their subadult years in the Angara or upper Lena. Adulthood patterns similar to those seen in Patterns 1 and 2a. K14_1998.039 and K14_1999.057.02 likely made three or two (respectively), major moves in their life (Scharlotta et al. 2013). K14_1999.057.02 also may have stayed in the same geochemical region throughout their life (Scharlotta et al. 2013). |
| Local<br>Nonlocal<br>Local<br>Nonlocal | K14_1997.011<br>K14_1998.027.01<br>K14_1999.055<br>K14_2000.077 | Pattern 3<br>Pattern 3<br>Pattern 3<br>Pattern 3 | Restricted movement in childhood, two in the Little Sea (K14_1997.011 and K14_1999.055) and two elsewhere (K14_1998.027.1 and K14_2000.077). Moved to or stayed in the Little Sea during adulthood until death. K14_1998.027.01 likely made three major moves (Scharlotta et al. 2013), or stayed in the same geochemical area (Scharlotta et al. 2013). |

| | | | |
|---|---|---|---|
| Local<br>Nonlocal<br>Local | K14_1997.015<br>K14_1997.019<br>K14_1999.044 | Pattern 4<br>Pattern 4<br>Pattern 4 | Variable mobility histories. Generally, all are considered to have died elsewhere from where they were born. K14_1997.019 from an unknown region outside the Little Sea other two similar to Pattern 2a and are ambiguous in their M1 results. |
| *Subadult individuals (<20 years at death) are indicated in parentheses because they are considered separately by Haverkort and colleagues (2008). These individuals do not have clear pattern categorizations but are placed in the most likely category based on their mobile history. | | | |

a few exceptions (Scharlotta et al. 2013).

Possible exchange networks between these areas appear to be temporally and geographically asymmetrical with more movement into the Little Sea microregion than out of it (Scharlotta and Weber 2012; Weber et al. 2011). The temporal asymmetry could suggest two rounds of seasonal movement between the Little Sea and the upper Lena microregions (Weber and Goriunova 2013; Weber et al. 2011), resulting in the two diets mentioned earlier. However, if all individuals within the Little Sea microregion followed the same rounds of seasonal movement, they would have similar $^{87}Sr/^{86}Sr$ values, and this is not the case (Weber and Goriunova 2013). Table 2.2. also shows that there are individuals who had very limited mobility and stayed in the Little Sea for most or all of their lives.

These observations suggest that movement of Glazkovo individuals throughout the Cis-Baikal was likely more complex and due to more factors than just subsistence or economics (Weber et al. 2002). Indeed, Fraser-Shapiro (2012:252) notes that "the presence of multiple mobility strategies within the regional [i.e. Cis-Baikal] population … could possibly reflect different social or cultural groups within Cis-Baikal." He also suggests that exogamous kin structures are the most likely explanation for such variability in mobile histories. Understanding how variable travel was for Glazkovo individuals in the Little Sea microregion may help explain some of the variability in mortuary treatment observed for locally and nonlocally-born individuals interred at K14.

### 2.6 Khuzhir-Nuge XIV (K14)

#### 2.6.1 Mortuary Characteristics

K14 (5304'58''N, 10648'21''E) is the largest, and most extensively studied Glazkovo cemetery in the Little Sea microregion (McKenzie 2006; Weber et al. 2006; Weber and Goriunova 2013). Eighty-nine individuals were interred in 79 graves (McKenzie 2006). All individuals except one, Burial 7 (K14_1997.007), are associated with the EBA Glazkovo mortuary tradition (McKenzie 2006). Burial 7 (K14_1997.007) is associated with the Late Neolithic Serovo mortuary tradition (McKenzie 2006; see Table 2.1 in Section 2.1), and is therefore excluded from this analysis.

K14 is located on the northwest shore of the Little Sea cove of Lake Baikal (see Figure 1.3; Weber et al. 2002, 2006), on the southeast slope of a hill between two exposed bedrock ridges (80 m apart in the west and 150 m apart in the east) that run northeast-southwest (McKenzie 2006; Weber et al. 2006). It is about 15−30 m above the lake surface (McKenzie 2006). The boundary of the cemetery extends 260 m west to east, with 77 of the 79 graves condensed in an area 200 m long east-west and 35 m wide north-south (McKenzie 2006). These graves are organized into three main clusters (West, Centre, and East), and then further divided into rows, arrangements, sub-clusters, and scatters (Figure 2.1; Weber and Goriunova 2013), with two graves (K14_1993.002 and K14_1997.07) spatially separate from the main cemetery and from one another (Figure 2.1).

Initial analysis of radiocarbon dates from K14 indicate that all areas of the cemetery were used contemporaneously (Weber et al. 2010b). This observation held true when these dates were updated to account for the freshwater carbon reservoir effect (Weber et al. 2016) as first identified by Nomokonova and colleagues (2013). Diet and area-of-birth have yet to be accounted for in chronological research at K14, and the wide margins of error on the new dates precludes their inclusion in this thesis. Furthermore, understanding how the freshwater reservoir effect impacts dietary values is a complex subject of ongoing research (Schulting et al. 2014, 2015; Weber et al. 2016). However, it is important to note that there is little to suggest that the different sectors of K14 represent different chronological phases of use.

Skeletal/dental research at K14 has focused on 83 individuals from 78 Glazkovo graves excavated between 1997 and 2001 by the BAP (Baikal Archaeology Project), so this remaining section only discusses those 83 (Lieverse 2007). Out of these 83 individuals, only 81 yielded age and sex data (Lieverse 2007). Of these 81, 27 are adult (20+ years) male, five are adult female,

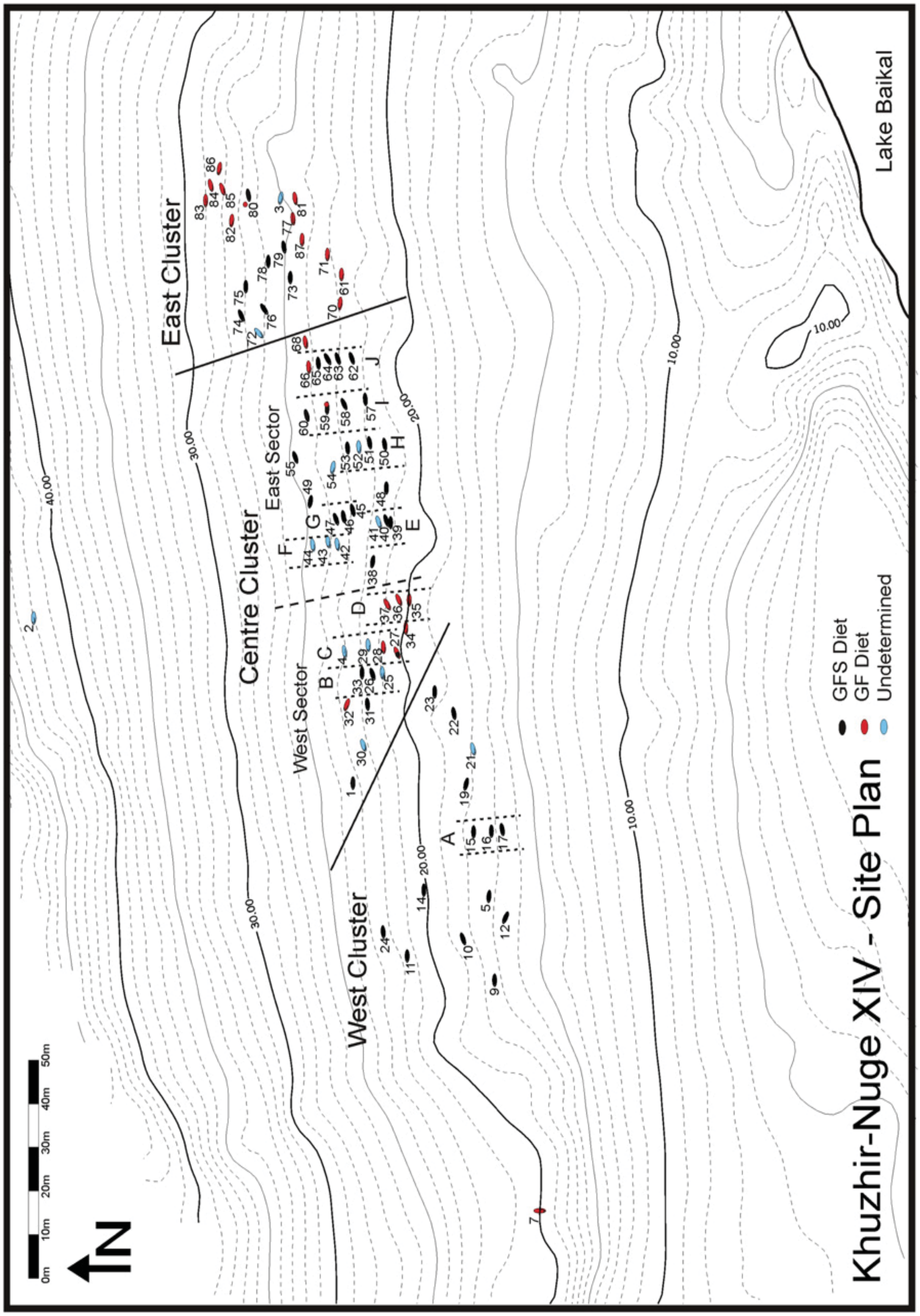


Figure 2.1 Map of K14 illustrating the clusters in K14 where GFS and GF diet followers are interred in Weber and Goriunova's (2013) analysis. Map used with permission from Weber and Goriunova (2013).

26 are adults of undeterminable sex, and 23 are subadults (<20 years of age at death) (Lieverse 2007). Individuals of all ages were interred at K14 (Lieverse 2007). According to McKenzie

(2010a) and McKenzie and colleagues (2008), most individuals were interred in an extended supine position (N=61), with only two interred in what have been interpreted as bundles or 2008). When all 88 Glazkovo burials are considered, 64 appear to be primary, 10 secondary, and the remaining 14 are indeterminable (McKenzie 2010a; McKenzie et al. 2008). According to Lieverse and colleagues (2006 and 2007c), who only included analysis from 83 individuals, 61 are interred in an extended supine position, seven in a semi-flexed position, and 15 are undeterminable. Of these, there are 71 primary burials, only four secondary burials, and the remaining eight are undeterminable (Lieverse et al. 2006, 2007c). Due to the subjective nature of determining body position and burial type with remains in poor taphonomic condition, body position and burial type are excluded from this analysis. However, it is important to note that the vast majority of individuals at K14 are primary interments in an extended supine position.

There appears to be no evidence for sexual differentiation in terms of interment (McKenzie 2006, 2010a), as it is statistically proven that males do not outnumber females at K14, meaning it possible that most of the adults of undeterminable sex are actually female (Lieverse 2007). There are only five females positively identified through osteological analysis (Lieverse 2007), so any further investigation of sexual differentiation of mortuary treatment is not possible. As a community cemetery, individuals of a wide range of ages are represented; however, there appears to be age-related differences in mortuary treatment in terms of both spatial organization of K14 and grave good inclusions (McKenzie 2010a; McKenzie et al. 2008). Subadults (those under the age of 15 years at death) were not interred with implement-type artifacts of any kind but were often interred with ornament-type artifacts. Also, subadults were more likely to be interred in double or triple burials than adults, and these graves are most often found in rows (McKenzie et al. 2008). Furthermore, adults between the ages of 20 and 35 years are associated with larger and more varied artifact assemblages than adults who died over the age of 50 years, which may be evidence of different social roles of adults at different stages of their life course (McKenzie 2010a). The individuals interred at K14, despite differences in area-of-birth, have been interpreted as members of the same Glazkovo community within the larger Glazkovo population of the Little Sea microregion (Weber and Goriunova 2013). The nature of this community is still unknown.

The different grave types in K14 include 69 single interments, seven double interments, and two triple interments (McKenzie et al. 2008). K14 graves were typically dug down to bedrock, upon which the individual was laid before being covered in backfill and stones and demarcated by a cairn made of naturally flat stone slabs and angular or block stones (Drouin 2005; Weber et al. 2008). Graves were, on average, 30 cm deep, but ranged from 15–50 cm deep, depending on how deep the bedrock was from the surface (Drouin 2005). Differences in cairn size appear to be related to the size of the individual(s) interred (i.e., males generally had larger cairns than females, and double and triple graves had larger cairns than single graves, see Drouin [2005]). An exception to this is a group of graves in the east part of the cemetery (the East Cluster), that generally had larger cairns than graves elsewhere at K14 (Drouin 2005). The size, location, and visibility of K14 from both land and water make it reasonable to assume that it would have been a locus for cultural activity, and possibly would have been frequently visited (Weber and Goriunova 2013).

In K14, Robertson (2006) and Robertson and colleagues (2008) found that the disturbed graves, as indicated through analysis of grave architecture, were also the graves with the largest cairns, suggesting that they belong to individuals of greater social importance. Also, the disturbed graves contained burials with larger grave good assemblages relative to those associated with undisturbed or inconclusive graves. Such graves will be referred to as 'inconclusively disturbed' going forward. This observation suggests that disturbed graves belong to individuals of greater or at least different social importance or meaning than those in undisturbed or inconclusively disturbed graves (Robertson 2006). Robertson (2006) and Robertson and colleagues (2008) concluded that grave disturbance at K14 is a secondary mortuary ritual not motivated by political or economic gains. It appears to have prescribed a specific set of actions such as waiting a certain period of time before reopening the graves from their southwest ends of individuals between the ages of 20-50 years at death, and in some cases removing skulls.

Mortuary use of fire at K14 has also been analyzed. Traces of fire use were observed in 40 graves, 24 of which had fire at the burial level (Weitzel and McKenzie 2008). Within these 24 graves, fire affected the skeletons of 22 burials (Weitzel and McKenzie 2008). Fire use at K14 is interpreted as symbolic, rather than as a corpse disposal method (Weitzel and McKenzie 2008); however, these two uses of fire are not mutually exclusive.

Past research on grave goods in K14 separated artifacts into 'implement' type and 'ornament' type based on interpreted uses. Implements, unlike ornaments, are artifacts for which a clear utilitarian function can be discerned (McKenzie et al. 2008). These classifications may not represent the reality of these artifacts to those buried with them, and some artifacts may be both ornamental and utilitarian, as McKenzie and colleagues (2008:244) notes, classifying an artifact as an implement "does not imply that such objects would have been devoid of symbolic meaning." Ornaments are those artifacts without a clear utilitarian function (McKenzie et al. 2008). With these understandings in mind, implements are considered one group of artifacts, and ornaments as another.

Use-wear, or tracelogical, analysis of 345 lithic artifacts found throughout K14 indicates that the majority of stone tools were created for mortuary interment (N=260), or were 'renewed' (retouched or resharpened; N=32) before interment in a grave (Kungurova et al. 2008). Only 53 artifacts show long-time use (Kungurova et al. 2008). Kungurova and colleagues (2008) also divided all lithic tools into their function. Hunting tools (e.g., blank blades, composite projectile inserts, and arrowheads) are the most plentiful (N=78), followed by tools for working hides (e.g., end, side, and round scrapers, and perforators; N=27) and tools for working wood (e.g., notched scrapers, drills, burins, axe blanks, knives either not used or for cutting birch bark, and other chopping or cutting implements; N=25; Kungurova et al. 2008).

Aside from being the largest Glazkovo cemetery in the Little Sea microregion, K14 is a typical cemetery, with all the general Glazkovo mortuary characteristics that are mentioned above. Mortuary treatment is largely represented by primary interments in single graves, bodies in an extended supine position oriented east-west, and, as discussed above, the occasional use of fire (McKenzie 2006, 2010a; McKenzie et al. 2008). However, there are intra-cemetery differences based on spatial analysis of this site (McKenzie 2010a; Weber and Goriunova 2013). K14 is broadly organized into three different spatial clusters, the East, Centre, and West Clusters (McKenzie 2010a; Figure 2.2), with a possible division of the Centre Cluster into a Centre-West and Center-East sub-clusters based on geochemical data (Figure 2.2 called 'sectors' by Weber and Goriunova 2013). These clusters are comprised of rows, arrangements, and scatters of graves (Weber and Goriunova 2013). A row of graves is classified as three or more graves parallel to one another in a somewhat straight line (McKenzie 2006). Arrangements are distinct groups of graves that are either spatially distinct or differ in mortuary treatments from the other graves in that cemetery. Scattered graves are those that exist outside of rows and arrangements. These terms are adapted from Weber and Goriunova (2013).

When the two Centre sub-clusters are considered as one, the East, Centre, and West were used simultaneously with distinct mortuary characteristics (McKenzie 2010a). The East Cluster has large stone cairns, the most abundant and diverse grave good assemblages with rare items, no subadult interments, and the highest occurrence of skeletal disturbance by way of skull removal (McKenzie 2010a). The Centre Cluster has the most subadults (13/18 total subadults in K14), is spatially organized into rows, double or triple graves, extensive fire use (skeletal charring), and numerous cylindrical beads (McKenzie 2010a). The West Cluster is distinct in its lack of mortuary characteristics common in the other two clusters (e.g., subadults, fire use, and "comparatively fewer artifacts and artifact classes"; McKenzie [2010a:90]). The fact that each cluster has different mortuary and demographic characteristics has been interpreted indicating different social distinctions between the individuals in each cluster (McKenzie 2010a).

### 2.6.2 Diet, Area-of-Birth, and Mortuary Variability at K14

As mentioned earlier, the mobility patterns described in Table 2.2 could help explain some of the mortuary variability seen at K14. Already, diet and area-of-birth data, as well as more detailed spatial analysis at K14, has yielded some interesting results (Shepard 2016; Weber and Goriunova 2013). To reiterate from Chapter 1, all locally-born individuals (N=16) and about a third of the nonlocally-born individuals (N=11) followed the GFS diet, and the remaining nonlocally-born individuals (N=23) followed the GF diet (Weber and Goriunova 2013; Weber et al. 2011,). Also, individuals interred in communal graves, and individuals whose graves are in the same row, tend to have similar life histories of movement (Shepard 2016).

Weber's and Goriunova's 2013 publication is the foundation for this thesis. They found that GFS diet followers (N=45) outnumber GF diet followers (N= 26), and that GFS individuals are found in every cluster of K14, but GF individuals are only found in the Centre and East Clusters (Weber and Goriunova 2013). In the East Cluster, GF individuals dominate two of the three arrangements of graves (Weber and Goriunova 2013). Within the Centre Cluster, GFS individuals outnumber GF individuals in the Centre-East Sub-Cluster (called the East sub-Cluster in the cited literature; Weber and Goriunova 2013). Weber and Goriunova (2013) also note that only GFS individuals appeared to have been interred in the West Cluster. Also, the GFS diet is more common among individuals in burials arranged rows, but some rows are almost exclusively GF individuals (Weber and Goriunova 2013). At the time of Weber's and

Goriunova's (2013) study, area-of-birth data were only available for 25 individuals, and both diet and area-of-birth data available for 23 individuals. These individuals were broken down into 11 GFS locally-born, six GFS nonlocally-born, and six GF nonlocally-born (Weber and Goriunova 2013).

Based on this group of 23, they found that individuals in the same row, arrangement, or group of scattered graves are usually similar in both diet and area-of-birth with only a few exceptions (Weber and Goriunova 2013). The individuals interred in scattered graves are equally locally and nonlocally-born, and the majority followed the GF diet (Weber and Goriunova 2013). Individuals in the East Cluster likely had a greater emphasis on terrestrial game in their diet than individuals in the West Cluster, who likely had a greater emphasis on seals and littoral fish (Katzenberg et al. 2009, 2012; Weber and Goriunova 2013).

When diet and area-of-birth were considered together, Weber and Goriunova (2013) found that Red Deer canine pendants were most frequently found with GF individuals in terms of both quantity and presence. In terms of presence, GF individuals in the Centre and East Clusters had similar frequencies of Red Deer canine pendants; however, in terms of quantity, most pendants are associated with GF individuals interred in the Centre Cluster (N=23 pendants, 70% versus N=7 pendants, 21%, respectively) (Weber and Goriunova 2013). This is possibly due to the extensive burial disturbance in the East Cluster (Weber and Goriunova 2013). Where area-of-birth data are available, Red Deer canine pendants are associated with five nonlocally-born individuals (four of whom followed the GF diet), and three locally-born (Weber and Goriunova 2013). In terms of quantity, nonlocally-born individuals are associated with significantly more canine pendants than locally-born individuals (N=80 with nonlocally-born and N=6 with locally-born, see Weber and Goriunova [2013]). Based on the above, Weber and Goriunova (2013) suggest that diet appears to be more related to area-of-birth than to proxies of social status such interment with Red Deer canine pendants. Furthermore, internment with Red Deer canines does not appear to be linked to area-of-birth either (Weber and Goriunova 2013).

Shepard's (2016) dissertation, the second body of work to explicitly discuss diet, area-of-birth, and mortuary treatment, found that individuals with similar life histories were often interred in the same communal graves or in the same row, with two exceptions. This is not to say that there are no differences in life histories between these individuals, as Weber and Goriunova (2013) clearly show otherwise. Indeed, Shepard (2016) notes that there are two instances where there is a difference in life histories between individuals interred within the same grave (i.e. K14_1998.027.01, K14_1998.027.02, K14_1998.027.03 and K14_1999.059.01, K14_1999.059.02). Shepard (2016) concludes that K14 was organized around groups or rows of individuals of similar life histories (based on area-of-birth) within and between which variation still occurred, and that in the EBA, mortuary treatment was used to "distinguish – rather than homogenize – segments of society on the basis of individuals' life histories" (2016:134). He suggested that the individuals using and interred at K14 were part of a network political strategy (Shepard 2016). Network political strategies focus on individuals, specifically "development and maintenance of individual-centered exchange relations established primarily outside one's local group" (Blanton et al. 1996:4).

### 2.7 Chapter Summary

In sum, past research conducted on Glazkovo cemeteries in the Little Sea microregion provides a rich context in which to place the life histories of individuals (Zvelebil and Weber 2013). Throughout this review, variation in not only the mortuary treatment, as well as skeletal/dental and geochemical data of Glazkovo individuals has been described. This high level of variability in Glazkovo cemeteries in the Little Sea microregion is especially interesting as there is also a broader, Cis-Baikal-wide, Glazkovo mortuary tradition (McKenzie 2010a; Okladnikov 1959). The next chapter indicates that the compilation of such detailed data in as many areas of research as possible, as has been done for K14, creates ideal circumstances to discuss larger questions of social structure, specifically mortuary correlates to diet and area-of-birth, using small groups of people and individuals. This thesis is the third body of work to specifically synthesize these data, after Shepard (2016) and Weber and Goriunova (2013).

# CHAPTER 3: THEORY AND METHODS

## 3.1 Introduction

As noted in Chapter 1, the goal of this thesis is to investigate whether previously identified geochemical variables of diet and area-of-birth correlate to variation in mortuary treatment, especially spatial organization of K14. To do so, I follow Weber and Goriunova's (2013) use of the *bioarchaeology of individual life histories* approach (Zevebil and Weber 2013), which interpreted mortuary research at K14 through diet and area-of-birth. New to this is the use of log-linear models (Agresti 2007) which is discussed below.

## 3.2 The *Bioarchaeology of Individual Life Histories* Approach

The purpose of the *bioarchaeology of individual life histories* approach is threefold; 1) it focuses on reconstructing the life histories of *individuals*, 2) which facilitates research and analysis in human behavior that is then, 3) contextualized within the social and natural environments of that individual (Zevebil and Weber 2013). It relies upon the integration or synthesis of skeletal/dental (or in the case of this thesis, geochemical) and mortuary data in order to reconstruct an individuals' life from birth to death (Zvelebil and Weber 2013).

This approach is ideal for cemetery populations because cemeteries have several lines of evidence necessary to construct life histories of individuals: skeletal remains, cultural items, and mortuary treatment (which reflects the behavior of the surviving population). Zvelebil and Weber suggest that analyzing these lines of evidence and following this approach "permit examination of additional aspects of individual life histories, including their social positions, symbolic systems, and interactions with their social and natural environment, and their own biological condition" (2013:276).

Zvelebil and Weber (2013) also suggest (as many have before) that mortuary treatment can be informative on worldviews as well as social organization of the population interred at and using a cemetery, often through the lens of social identities (Binford 1971; Brown 1981; Saxe 1970).

This approach does not preclude investigation of populations, and in many cases, researching individuals and populations are not mutually exclusive (Cheung et al. 2017; Eriksson and Lidén 2013; Zvelebil and Pettitt 2013). Weber and Zvelebil note that “individuals form… the individually diverse constituents of broader social groups, spatially defined communities, self-aware units…, and broader populations” (2013:277). Furthermore, Eriksson and Lidén (2013) note that culture is performed through and by individuals and Shepard (2016) suggests that burial practices (using EBA Glazkovo cemeteries in the Little Sea micro-region as a case study) served to distinguish smaller groups of the society using the cemetery based on the life histories of the individuals interred there.

Studying individuals’ life histories through their diet and area-of-birth (for this thesis) and integrating mortuary treatment data, can reveal socially differentiated roles since the individual’s biological life and social life are combined (Clayton 2011; Sofaer 2011; Torres-Ruff and Knudson 2017). To understand past social organization in mortuary populations, archaeologists must focus on how the human experience is socially constructed and embodied and to do so, skeletal/dental and biogeochemical data must be integrated with mortuary data (Knudson and Stojanowski 2008) since identity (group or individual) is a combination of social and biological factors (Torres-Ruff and Knudson 2017). The latter is particularly important as artifacts can become symbolically connected to certain events in an individuals’ life course (Gilchrist 2000).

Another benefit of this approach is that behavioural variation can be observed over small timescales (Zvelebil and Weber 2013). For K14, the focus is on behavioural variation between contemporaneous interments of individuals of different life histories. Looking at behavioural variation at small chronological scales, such as the time period of cemetery use at K14, helps identify variables of mortuary treatment, which can aid in our understanding of the community using the cemetery. For example, it was hypothesized that the earliest examples of agro-pastoralism in Europe outside of the Balkans (at the site of Verdovice, Czech Republic) was evidence of a colonization event (Zvelebil and Pettitt 2013). However, integrating skeletal/dental and mortuary data by using the *individual life histories* approach led Zvelebil and Pettitt (2013) to discover that the population of Verdovice was not a colonizing population, but instead was a contemporaneous mix of locals and non-locals from many different areas. Similarly, Cheung and colleagues (2017) found that integrating dietary data with mortuary treatment illuminated otherwise hidden social differences among individuals within the same cemetery, but with slight variations in mortuary treatment. In the Little Sea, it is possible that the mortuary behavioural variation seen in the Glazkovo cemeteries is the result of a heterogeneous population with different life histories (see Shepard 2012, 2016; and below).

**3.3 Materials**

Analysis specifically includes grave goods, mortuary treatment (body treatment and grave structure), and geochemical data. Mortuary data will focus heavily on artifacts comprising grave good assemblages, body treatment (i.e., fire use, presence of cranium), grave architecture, and spatial placement in K14. The implement type artifacts examined in this thesis include the presence of implements in general, lithic arrowheads, hunting implements, wood working implements, meat butchering implements, and hide working implements. Ornament type artifacts examined in this thesis include cylindrical beads, red deer canine pendants, and the presence of ornaments in general.

Biogeochemical data, as mentioned above, will focus on diet (GFS versus GF), and area-of-birth (locally and nonlocally born). The area-of-birth data for this thesis are taken from the crowns of the first molars (M1) of 55 individuals interred at K14. Therefore, while Scharlotta and Weber (2012) and Scharlotta and colleagues' (2013) mobility histories from Chapter 2 will be used to supplement and help explain the results from the log-linear analysis in Chapter 4, only mobility data that represent area-of-birth (i.e., taken from M1; Weber and Goriunova [2013]) will be used in the main analysis in Chapter 4. Individuals whose diet data are only taken from their M1 are excluded from any analysis that includes diet since those values reflect the diet of their mother, or the women who were nursing them as infants. However, they are included in the area-of-birth data since these data are obtained from the M1. As Waters-Rist and colleagues (2010) explain, it is difficult to identify the diet of subadults since changes in stable carbon and nitrogen isotopes may also reflect weaning (cessation of breastfeeding). The diet data for individuals included in this thesis were derived from bone samples (Katzenberg et al. 2009, 2010).

Since spatial cluster in K14 is a major variable in this research, the isolated individual (K14_1993.002) visible in Figures 3.1 and 3.2 is excluded in order to facilitate the use of log linear models. Furthermore, Weber and Goriunova's (2013) division of the two Centre clusters will be used in order to test whether or not these two clusters are distinct as would be seen by

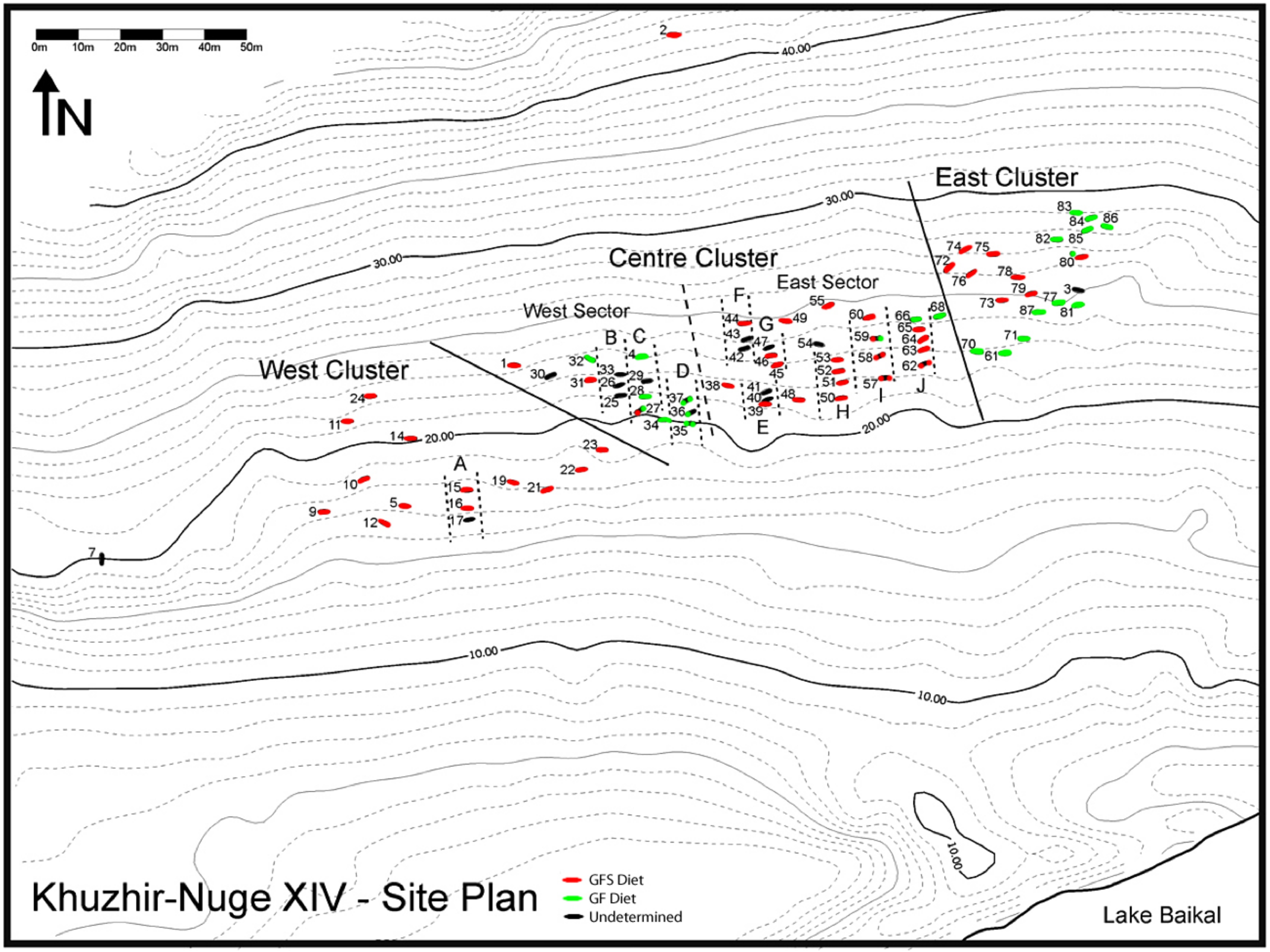


Figure 3.1 Map of K14 illustrating the clusters in K14 where GFS and GF diet followers are interred. Map used and modified with permission from Weber and Goriunova 2013.

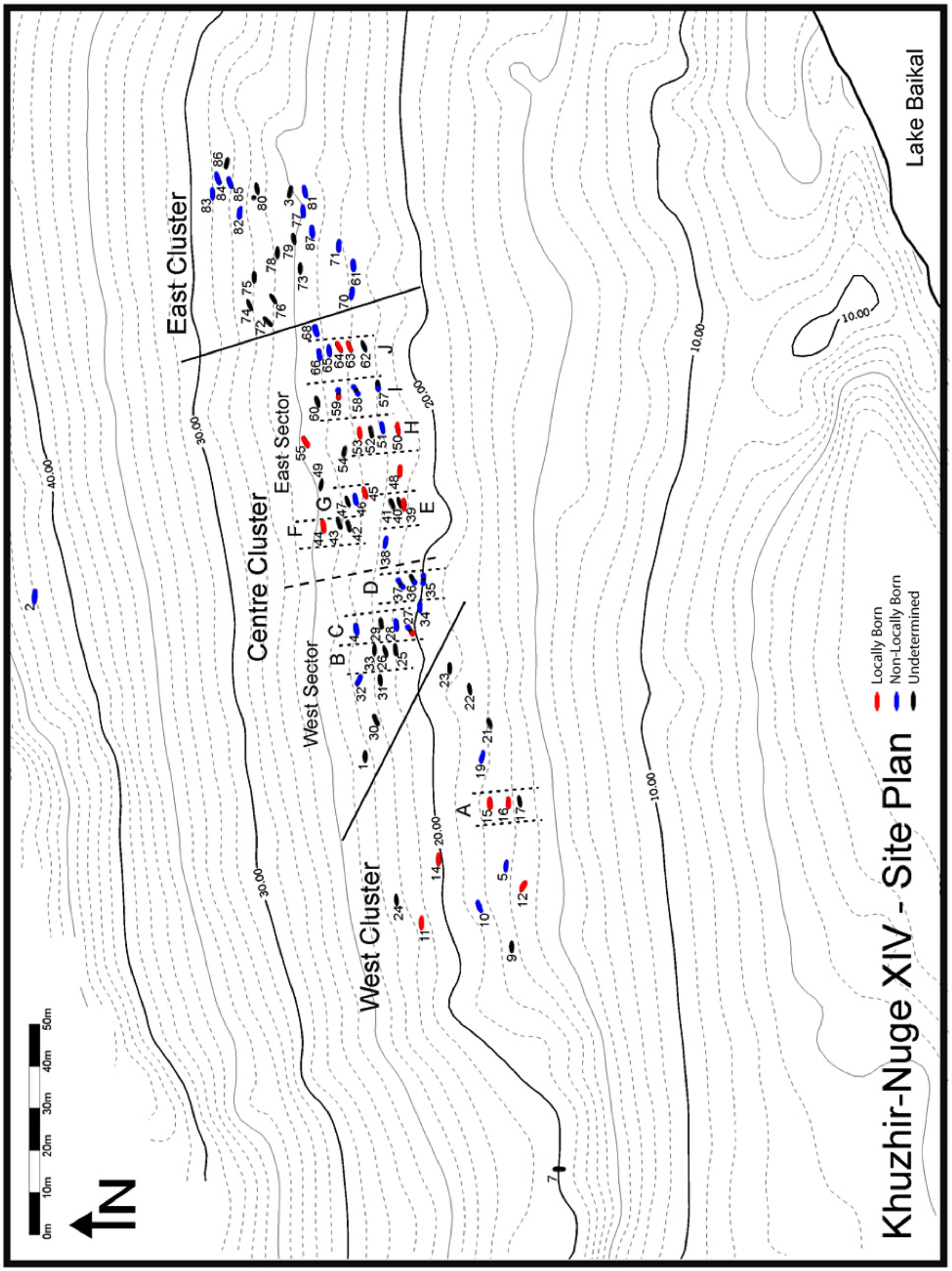


Figure 3.2 Map of K14 illustrating the clusters in K14 where Locally and Non-Locally born individuals are interred. Map used and modified with permission from Weber and Goriunova 2013.

different mortuary and geochemical patterns. If these two clusters should be lumped back together into one, then there should be little or no difference.

The number of individuals with both diet and area-of-birth data number 48. The number of individuals with just diet data number 71, and the number of individuals with just area-of-birth data number 55. These three test groups (diet and area-of-birth together, diet alone, and area-of-birth alone) will be analyzed since the discrepancy in group number may mask mortuary patterns that testing the other two groups may reveal. This is further explained in Section 3.8.

The relationships between biogeochemical data and cluster in K14, specifically interment in the East Cluster, Centre-East Sub-cluster, Centre-West sub-cluster, and West Clusters, also play an integral part in this thesis since there are strong correlations between cluster in K14, interment with Red Deer canine pendants, and biogeochemical data (Weber and Goriunova 2013). Figures 3.1 and 3.2 show the pattern of distribution of individuals of each diet and area-of-birth these Clusters in K14. Since this research builds off of Weber and Goriunova (2013), the Centre Cluster will be split into the Centre-East and Centre-West Sub-Clusters. Therefore, the spatial analysis will focus on interment in the East, Centre-East, Centre-West, and West Clusters. This directly builds off of Weber and Goriunova (2013), but it includes more individuals with diet and/or area-of-birth data, as well as a greater number of mortuary variables.

### 3.4 Methods

While the Little Sea microregion has detailed skeletal/dental, mortuary, and biogeochemical data, the full population that was considered applicable for this thesis number only 48 in total. As such, analysis will rely on descriptive statistical data (e.g., Cheung et al. 2017; Honch et al. 2006; Marsteller 2015; Rodrigues 2005; and Stantis et al. 2015), focus on individuals (e.g., Stodder and Palkovich 2012; Torres-Rouff and Knudsun 2007; Zvelebil and Pettitt 2013), and use log-linear models (Agresti 2007) to identify if any relationships exist between diet, area-of-birth, and mortuary treatment.

Log-linear models are a statistical method that allows us to understand the relationship between multiple variables in contingency tables (Agresti 2007). Log-linear models requires three assumptions. First, the observations in the contingency tables must be independent from one another. Second, all observations must be identically distributed, meaning that they were all gathered the same way. For this thesis, that means that they were all gathered using the same archaeological methods as outlined in the Baikal Archaeological Project. Third, there is a large enough group of individuals for analysis. Meaning, there needs to be five times as many data variables as there are areas in the contingency tables to get accurate results (Agresti 2007). Where there are fewer data variables, the results may be affected by the lower sample size and result in a lack of identifiable relationships. However, this does not preclude the ability to identify relationships. It merely can serve as an explanation for when relationships are not identifiable in the models. While this is a limitation of using log linear models, the method is ideal to this type of research since it is designed to investigate relationships between more than two variables (Agresti 2007). Those variables applicable to only one or two individuals in each biogeochemical category are not included. For example, analyzing interment with *white nephrite rings* is too small a sample size since only one individual with geochemical data is interred with a white nephrite ring. Therefore, not every mortuary variable observed at K14 (McKenzie et al. 2008) is included.

Hierarchical log-linear models include all combinations of the possible interactions between the variables (Agresti 2007). The use of log-linear models depends on identifying which model to use which will identify the dependency structure of the data being analyzed (Agresti 2007). These data are analyzed as a three-way function, where the variables are A, B, and C. The models considered here are saturated models where all possible interactions are present (i.e. A+B+C+AB+AC+BC+ABC), and all variables are assumed to be associated with one another, and independence models (A+B+C) where there are no interactions. Where there are tables of similarities, for example, for the model AB+BC, the relationship between variables A and B (AB) are independent of variable C. Meaning, once variable C is chosen, the relationship between variables A and B does not change. Similarly, the relationship between variables B and C (BC) are independent of variable A. The missing association in this model (AC) is considered to be dependent of the third variable (B). In other words, as variable B changes (i.e. if B represented difference clusters in K14), the relationship between variables A and C changes. If the relationship between variables A and C were independent of B, it would appear in the log-linear model.

The saturated model and AB+AC+BC are only considered if no other model fits because these results are from overfitting the data. Overfitting the data means that there are so many interaction terms in the model that the predicted counts are forced to be similar to the actual counts, thereby indicating a good fit with the degrees of freedom, deviance, and p-values (Agresti 2007). These models are only considered if no other model is a good fit to the data as overfitting the data will often indicate a good fit even though it masks more specific relationships.

The model that fits the data best is the one where the deviance divided by the degrees of freedom (df) is as close to 1 as possible but no greater than 2.5, and where the p-value is as close to 1 as possible (Agresti 2007). If this value is under 1, the model is also considered a possible fit (Agresti 2007) if the other parameters are met. If there are multiple models that fit these parameters, there are no strong associations between the tested data, and/or there are multiple and unclear dependency structures that exist within the data (Agresti 2007). If only one model fits, a strong statistical relationship can be identified and interpreted (Agresti 2007). How strong or significant the relationship is cannot be identified; the strength is only in relation to whether or not there are other models of good fits (Agresti 2007). The data tested were chosen for their interpretative value for this cemetery (e.g., nephrite artifacts, lithic arrowheads), and their sample size (e.g., kaolinite cylindrical beads, presence of fire, presence of ornaments, presence of implements). Data are coded numerically, and artifacts are counted as either present or absent in order to facilitate log-linear analysis (Agresti 2007).

There are three steps for every variable tested. First, diet and area-of-birth and a third variable are analyzed; next, the third variable, diet, and cluster in K14 are analyzed; and finally, the third variable, area-of-birth, and cluster in K14 are analyzed. This structure was chosen because previous research has identified both a relationship between diet and area-of-birth with cluster at K14 and red deer canine pendants (Weber and Goriunova 2013), and a relationship between mortuary treatment and cluster in K14 (McKenzie 2008 et al. 2010). The log-linear models will illustrate whether or not the chosen mortuary variables are related to diet and area-of-birth together, just diet, just area-of-birth, cluster in K14, and any combination of these. The proportions of individuals of each diet and area-of-birth category with each variable present will also be compared. These data come from the bar graphs that the models generate. This thesis, at its core, wants to test for the association between three variables or observations: diet, area-of-birth, and either cluster in K14 (to test for spatial associations) or mortuary treatment (to test for association between diet or area-of-birth and mortuary treatment). Therefore, log-linear models are a good fit for this thesis.

### 3.5 Chapter Summary

Using log-linear models under the framework of the *bioarchaeology of individual life histories* approach (Zevebil and Weber 2013), the research in this thesis aims to identify aspects of K14 mortuary treatment that are related to diet and/or area-of-birth as a way to find further meaning for the variability in mortuary treatment between the different diets and areas-of-birth that Weber and Goriunova (2013) observed. This will also expand on Shepard's (2016) and McKenzie's (2010a) understandings of K14.

# CHAPTER 4: LOG-LINEAR ANALYSIS OF K14 BIOGEOCHEMICAL AND MORTUARY DATA

## 4.1 Introduction

This chapter uses log linear models to investigate and identify relationships between diet, area-of-birth, and mortuary data, specifically spatial organization of K14. As previous research has shown that cluster in K14 is related to both mortuary treatment (McKenzie 2010) and to diet and area-of-birth (Weber and Goriunova 2013), I expand on those analyses by seeking to identify other relationships in these data. Are other diet, area-of-birth, and spatial correlates present in mortuary treatment at K14?

## 4.2 Cluster in K14

### 4.2.1 Association between diet, area-of-birth, and cluster in K14

Figure 4.1 shows that in the East and Centre-West, most individuals are GF-Nonlocals (100%, 10/10, and 91%, 10/11 respectively). In the Centre-East and West, there are an equal or slightly higher number of GFS-Locals (50%, 10/20 and 63%, 5/8 respectively) than GFS-Nonlocals (35%, 7/20 and 38%, 3/8 respectively) and GF-Nonlocals (15%, 3/20 and 0/8, 0% respectively).

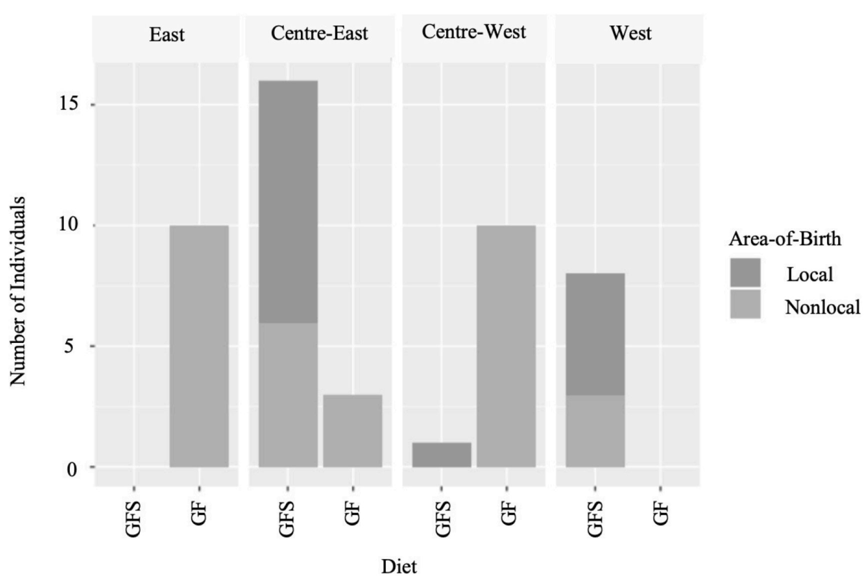


Figure 4.1 Number of individuals of each diet and area-of-birth category in each cluster in K14

Interestingly, if the two eastern clusters and the two western clusters were merged, there is a very similar pattern of distribution between the two halves with 30% (10/30) of GFS-Locals, 23% (7/30) of GFS-Nonlocals, and 43% (13/30) of GF-Nonlocals in the eastern half, and 32% (6/19) GFS-Locals, 16% (3/19) GFS-Nonlocals, and 53% (10/19) GF-Nonlocals in the western half. Table 4.1 shows that there is one log-linear model that fits these data, DB+DS, where the relationship between diet and area-of-birth is independent of cluster in K14, and that the relationship between diet and cluster in K14 is independent of area-of-birth. Furthermore, since BS (the relationship between area-of-birth and cluster in K14) is missing from this model, the relationship between *area-of-birth and cluster in K14* depends diet.

Table 4.1 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| DB+BS+DS | 3 | 0.00 | 1.0000 |
| DB+DS | 6 | 0.92 | 0.9886 |
| DB+BS | 6 | 26.57 | 0.0002 |
| DS+BS | 4 | 11.82 | 0.0187 |
| DB | 9 | 44.10 | 0.0000 |
| DS | 7 | 29.35 | 0.9999 |
| BS | 7 | 55.00 | 1.0000 |
| No Interaction | 10 | 72.53 | 1.0000 |

Legend: D= diet, B= area-of-birth, S= cluster in K14

### 4.3 Interment with Implements

#### 4.3.1 Association between diet, area-of-birth, and interment with implements

Figure 4.2 shows that almost half of all GF-Nonlocals (48%, 11/23) and GFS-Nonlocals (44%, 4/9) are interred with implements. Less than one third (31%, 5/16) of GFS-Locals are interred with implements. Table 4.2 shows that there are three possible log-linear models that fit these data, BD+BI, BD+DI, and BD. The predicted and actual counts suggest models BD+BI and BD+DI are equally good fits (see Table A.2). BD+BI says that the relationship between *area-of- birth and diet* is independent of interment with implements and the relationship between *area-of-birth and interment with implements* is independent of diet. BD+DI says that the relationship between *area-of-birth and diet* is independent of interment with implements and the relationship between *diet and interment with implements* is independent of area-of-birth. This means that the relationship between these three variables is not strong, that there is more than one dependence structure, or that more than one relationship exists between these variables. This fits the bar graph observations in Figure 4.2.

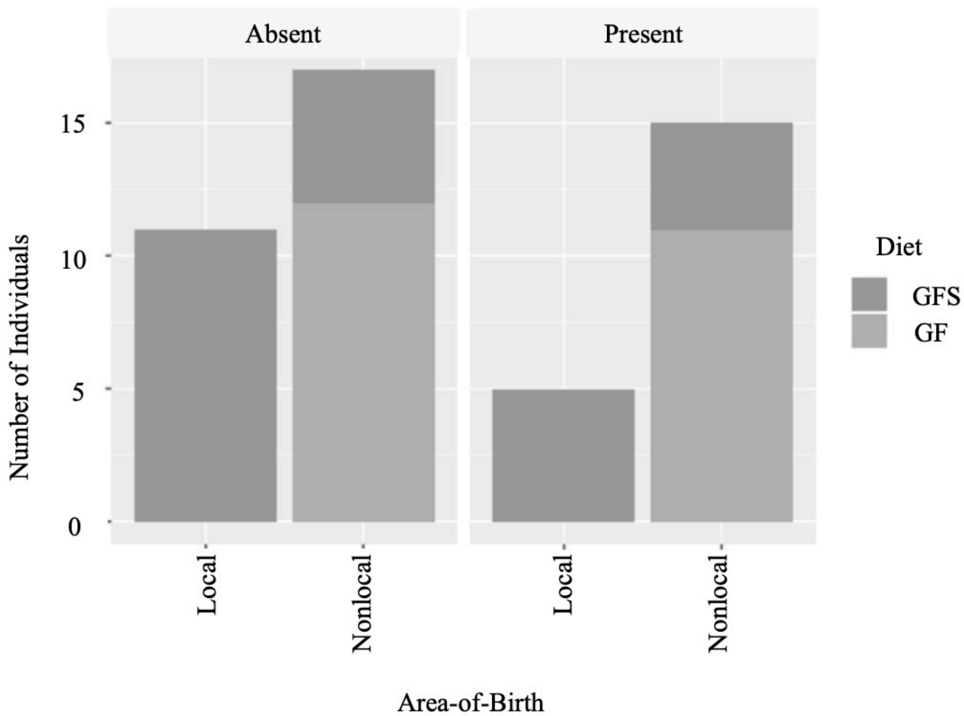


Figure 4.2 Number of individuals of each diet and area-of-birth category interred with and without implements

Table 4.2 Degrees of freedom, Deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and interment with implements

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DI+BI | 1 | 0.00 | 1.0000 |
| BD+BI | 2 | 0.03 | 0.9852 |
| BD+DI | 2 | 0.43 | 0.8062 |
| BI+DI | 2 | 27.77 | 0.0000 |
| BD | 3 | 1.12 | 0.7720 |
| BI | 3 | 28.46 | 1.0000 |
| DI | 3 | 28.87 | 1.0000 |
| No Interaction | 4 | 29.56 | 1.0000 |

Legend: B= area-of-birth, D= diet, I= interment with implements

### 4.3.2 Association between interment with implements, diet, and cluster in K14

Figure 4.3 shows that the East cluster is unique because a larger number of GF diet followers in this cluster are interred with implements (67%, 8/12) than without, which is inverse of both the other clusters of the cemetery and of the GFS diet within those clusters. Most GF diet followers in the Centre-East (67%, 2/3) and Centre-West (70%, 7/10) clusters are not interred with implements. All eight GFS diet followers in the East are interred with implements, whereas only about a third of GFS diet followers in the Centre-East (32%, 7/22), Centre-West (33%, 1/3), and West (38%, 5/13) are. There are no GF diet followers interred in the West. Overall, 46% (21/46) of GFS diet followers and 48% (12/25) of GF diet followers are interred with implements.

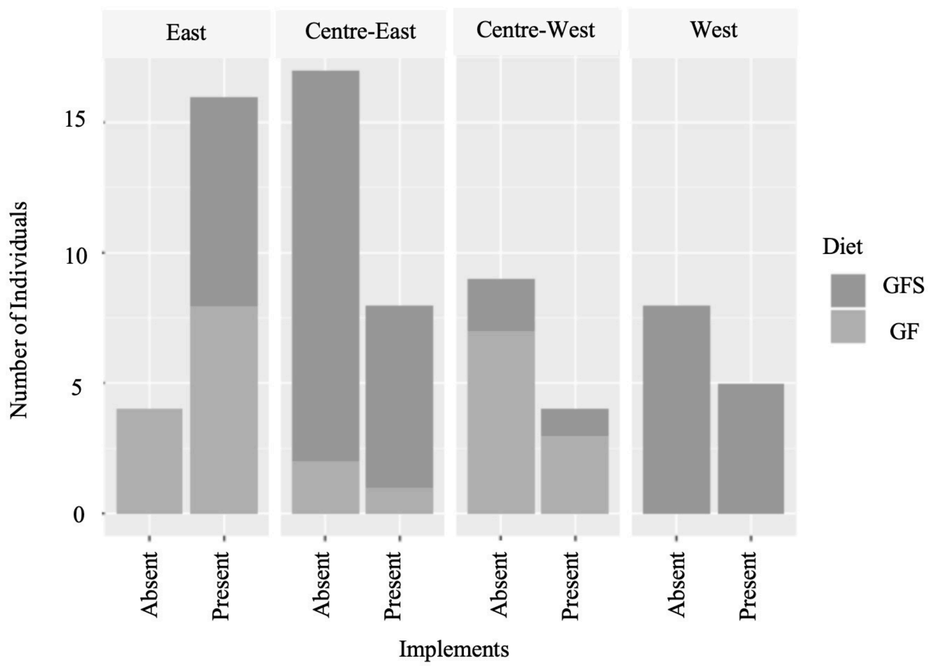


Figure 4.3 Number of individuals of both diet categories interred with and without implements in each cluster in K14

Table 4.3 shows that there is one model that fits these data, IS+DS. IS+DS says that the relationship between *interment with implements and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of interment with implements, and that the relationship between *interment with implements and diet* depends on cluster in K14. This model is illustrated in Figure 4.3.

Table 4.3 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables area-of-birth, interment with implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| ID+DS+IS | 3 | 3.23 | 0.3575 |
| ID+IS | 6 | 37.53 | 0.0000 |
| ID+DS | 6 | 18.06 | 0.0061 |
| IS+DS | 4 | 4.75 | 0.3134 |
| ID | 9 | 50.87 | 0.0000 |
| IS | 7 | 37.56 | 1.0000 |
| DS | 7 | 18.10 | 0.9885 |
| No Interaction | 10 | 50.91 | 1.0000 |

Legend: I= interment with implements, D= diet, S= cluster in K14

### 4.3.3 Association between interment with implements, area-of-birth, and cluster in K14

Figure 4.4 shows that the Centre-East and West are the only two clusters where locally-born individuals are interred with implements (27%, 3/11 and 33%, 2/6, respectively). In these

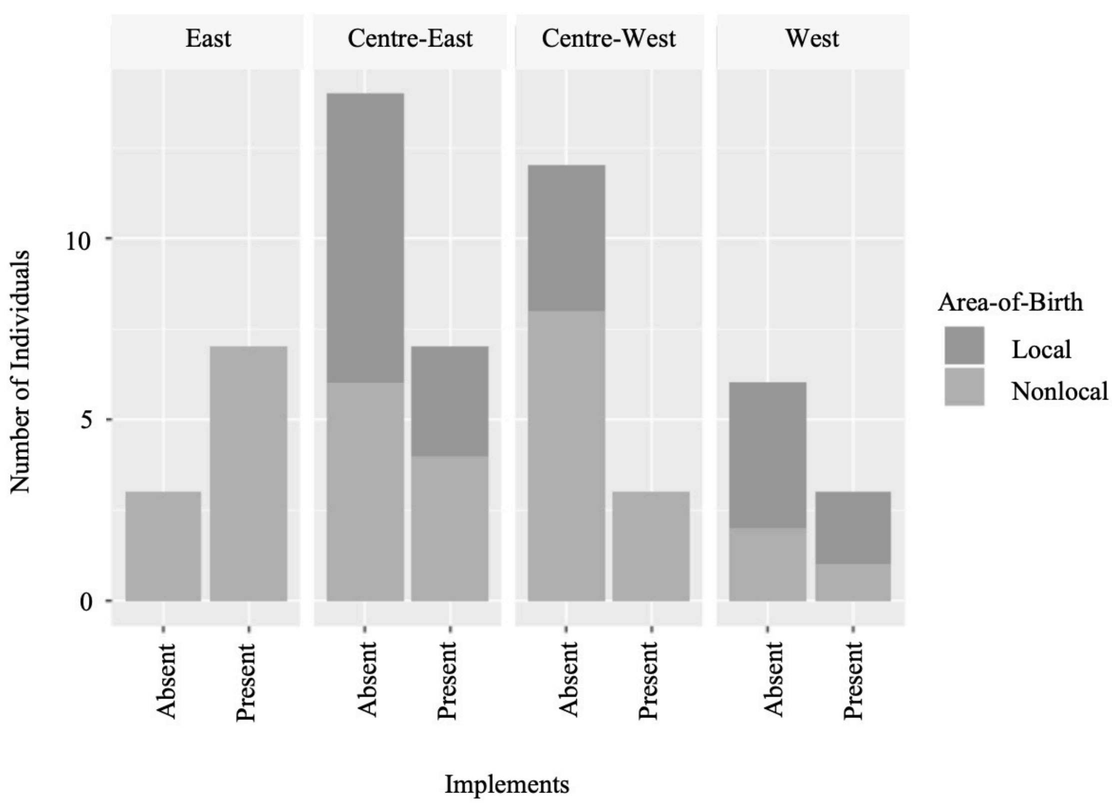


Figure 4.4 Number of individuals of each area-of-birth category interred with and without implements in each cluster in K14

two clusters, 40% (4/10) and 33% (1/3) of nonlocally-born individuals have implements, respectively. The East, however, does not conform to this pattern; first, there are no locally-born individuals interred in this cluster and second, there are more nonlocally-born individuals interred with implements (70%, 7/10) than without (30%, 3/10).This is opposite of the Centre-East and West clusters. In the Centre-West, locally-born individuals are present, but interestingly, none of them are interred with implements. In the Centre-West nonlocally-born individuals (27%, 3/11) in the Centre-West are interred with implements. Overall at K14, 24% (5/21) of locally-born individuals and 44% (15/34) of nonlocally-born individuals are interred with implements.

Table 4.4 says that there are two models that fit these data, IS+BS and BS. The predicted and actual counts of these models (see Table A.4) says that IS+BS is a better fit. This model says that the relationship between *interment with implements and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of interment with implements, and that the relationship between *interment with implements and area-of-birth* depends on cluster in K14. This model is illustrated in Figure 4.4.

Table 4.4 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| IB+BS+IS | 3 | 1.45 | 0.6932 |
| IB+IS | 6 | 15.34 | 0.0178 |
| IB+BS | 6 | 6.80 | 0.3399 |
| IS+BS | 4 | 2.50 | 0.6440 |
| IB | 9 | 22.02 | 0.0088 |
| IS | 7 | 17.73 | 0.9867 |
| BS | 7 | 9.19 | 0.7604 |
| No Interaction | 10 | 24.41 | 0.9934 |

Legend: I= interment with implements, B= area-of-birth, S= cluster in K14

### 4.4 Interment with Ornaments

#### 4.4.1 Association between diet, area-of-birth, and interment with ornaments

Figure 4.5 shows that 88% (14/16) of GFS-Locals, 78% (18/23) of GF-Nonlocals, and 67% (6/9) of GFS-Nonlocals are interred with ornaments. Table 4.5 says that there is one possible log-linear model that fits these data, BD+BO. This model says that the relationship between *area-of-birth and diet* is independent of interment with ornaments, the relationship between *area-of-birth and ornaments* is independent of diet, and that the relationship between *diet and interment with ornaments* depends on area-of-birth. Figure 4.5 illustrates this model.

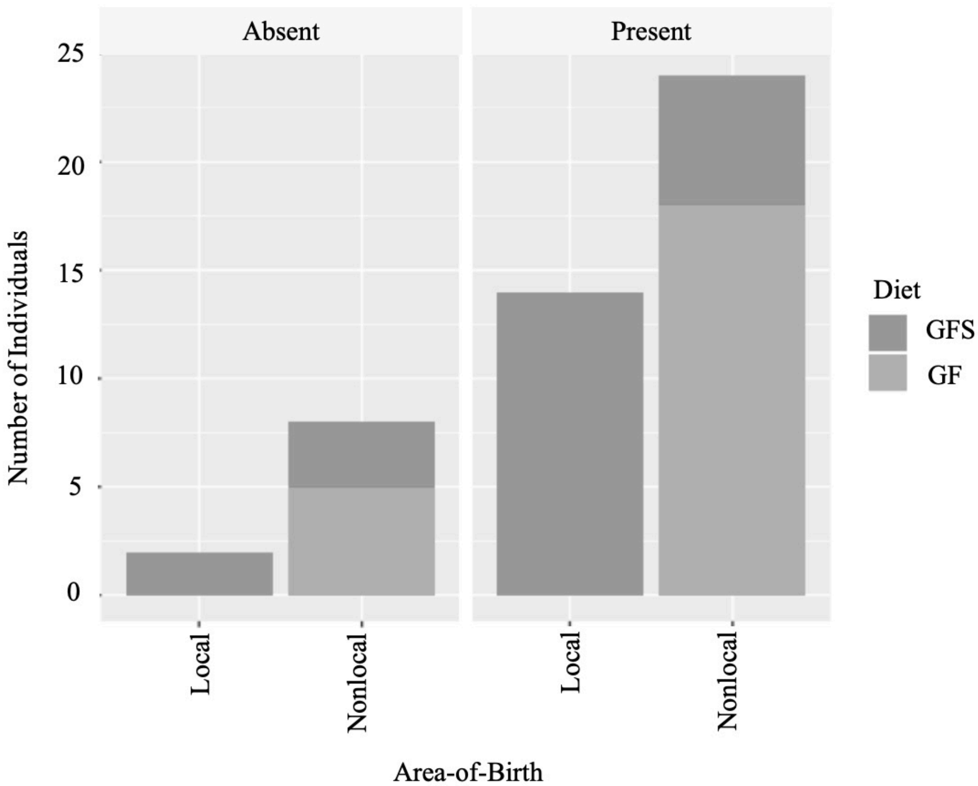


Figure 4.5 Number of individuals of each diet and area-of-birth category interred with and without ornaments

Table 4.5 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and interment with ornaments

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DO+BO | 1 | 0.00 | 1.0000 |
| BD+BO | 2 | 0.45 | 0.7996 |
| BD+DO | 2 | 1.51 | 0.4709 |
| BO+DO | 2 | 28.86 | 0.0000 |
| BD | 3 | 1.53 | 0.6758 |
| BO | 3 | 28.88 | 1.0000 |
| DO | 3 | 29.94 | 1.0000 |
| No Interaction | 4 | 29.96 | 1.0000 |

Legend: B= area-of-birth, D= diet, O= interment with ornaments

### 4.4.2 Association between interment with ornaments, diet, and cluster in K14

Figure 4.6 shows that in the East, 58% (7/12) of GF diet followers and 63% (5/8) of GFS diet followers are interred with ornaments. In the Centre-West, 90% (9/10) of GF diet followers and 33% (1/3) of GFS diet followers are interred with ornaments. In the Centre-East, 91% (20/22) of GFS diet followers and 67% (2/3) of GF diet followers are interred with ornaments.

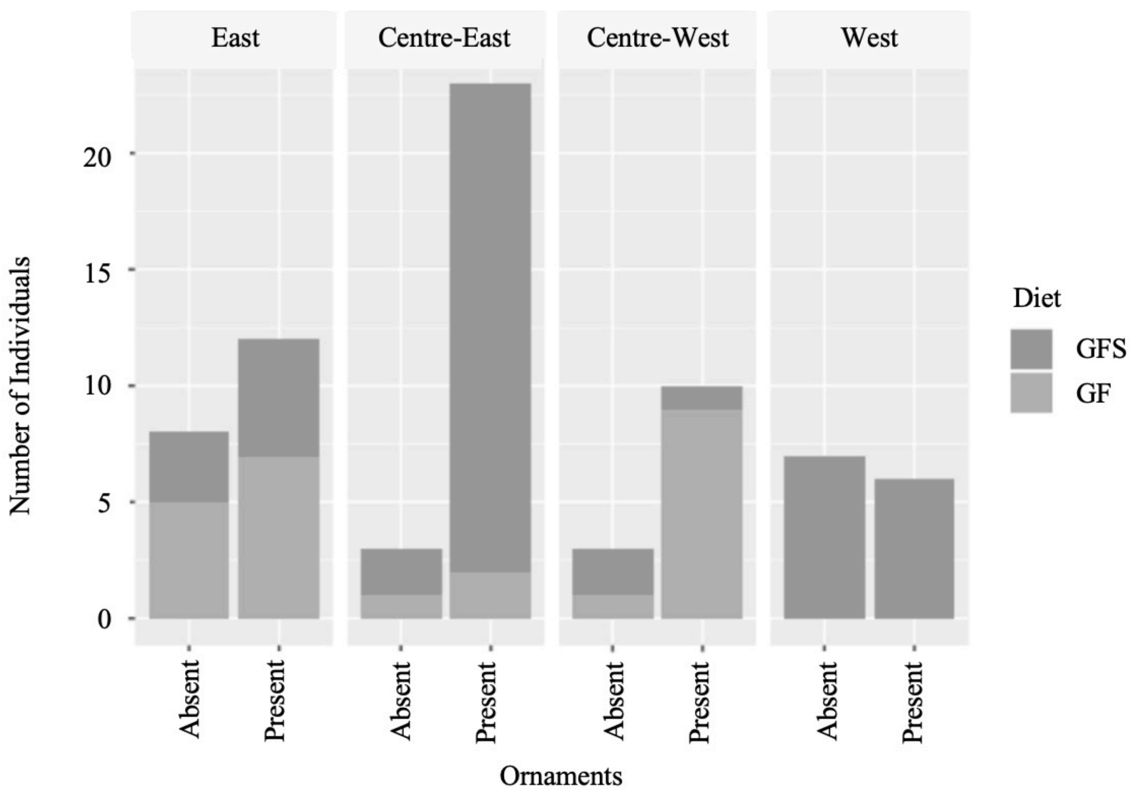


Figure 4.6 Number of individuals of each diet category interred with and without ornaments in each cluster in K14

There are no GF diet followers in the West, and 46% (6/13) of GFS diet followers are interred with ornaments. Overall, 70% (32/46) of GFS diet followers and 72% (18/25) of GF diet followers are interred with ornaments. Table 4.6 says that there are two possible log-linear models that apply to these data, OS+DC and DS. The predicted and actual counts of these models suggest OS+DS is a better fit (see Table A.6). OS+DS says that the relationship between *interment with ornaments and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of interment with ornaments, and the relationship between *interment with ornaments and diet* depends on cluster in K14. Figure 4.6 illustrates this model.

Table 4.6 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, interment with ornaments, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| OD+DS+OS | 3 | 4.76 | 0.1899 |
| OD+OS | 6 | 37.65 | 0.0000 |
| OD+DS | 6 | 13.81 | 0.0319 |
| OS+DS | 4 | 4.88 | 0.2996 |
| OD | 9 | 46.62 | 0.0000 |
| OS | 7 | 37.69 | 1.0000 |
| DS | 7 | 13.85 | 0.9462 |
| No Interaction | 10 | 46.66 | 1.0000 |

Legend: O= interment with ornaments, D= diet, S= cluster in K14

### 4.4.3 Association between interment with ornaments, area-of-birth, and cluster in K14

Figure 4.7 shows that, there are no locally-born individuals interred in the East, and 70% (7/10) of nonlocally-born individuals interred here have ornaments. In the Centre-East, all

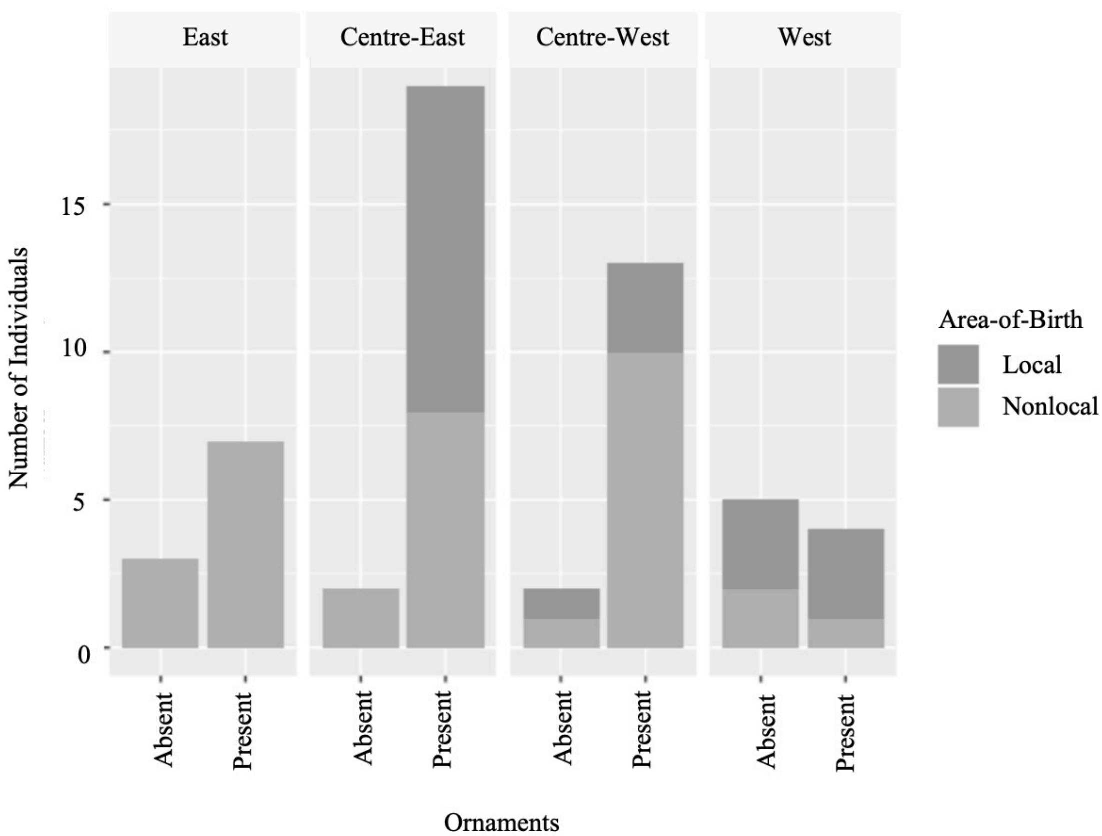


Figure 4.7 Number of individuals of each area-of-birth category interred with and without ornaments in each cluster in K14

locally-born individuals, and 80% (8/10) of nonlocally-born individuals have ornaments. In the Centre-West, 75% (3/4) of locally-born and 91% (10/11) of nonlocally-born individuals have ornaments. In the West, 50% (3/6) of locally-born and 33% (1/3) of nonlocally-born individuals have ornaments. Overall, 81% (17/21) of locally-born individuals and 75% (26/34) of nonlocally-born individuals have ornaments.

Table 4.7 says that there are two possible log-linear models that fit these data, OS+BS and BS. The predicted and actual counts of these models and data suggest that model OS+BS is a better fit (see Table A.7). OS+BS says the relationship between *ornaments and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of interment with ornaments, and the relationship between *interment with ornaments and area-of-birth* depends on cluster of K14. This model is illustrated by Figure 4.7.

Table 4.7 Degrees of freedom, deviance, and p-value for each possible log-linear model for variables area-of-birth, interment with ornaments, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| OB+BS+OS | 3 | 3.34 | 0.3428 |
| OB+OS | 6 | 19.08 | 0.0040 |
| OB+BS | 6 | 11.99 | 0.0622 |
| OS+BS | 4 | 4.01 | 0.4048 |
| OB | 9 | 27.21 | 0.0013 |
| OS | 7 | 19.23 | 0.9925 |
| BS | 7 | 12.14 | 0.9040 |
| No Interaction | 10 | 27.37 | 0.9977 |

Legend: O= interment with ornaments, B= area-of-birth, S= cluster in K14

### 4.5 Interment with Red Deer Canine Pendants

#### 4.5.1 Association between diet, area-of-birth, and interment with red deer canine pendants

Figure 4.8 shows that 35% (8/23) of GF-Nonlocals, 19% (3/16) of GFS-Locals, and one GFS-Nonlocal (out of 9, 11%) are interred with red deer canine pendants . Table 4.8 says that there is one possible log-linear model for these data, BD+DR. This model says that the relationship between *area-of-birth and diet* is independent of red deer canine pendants, and the relationship between *diet and Red Deer canine pendants* is independent of area-of-birth. Also, the association between *area-of-birth and red deer canine pendants* depends on diet. This model is illustrated in Figure 4.8.

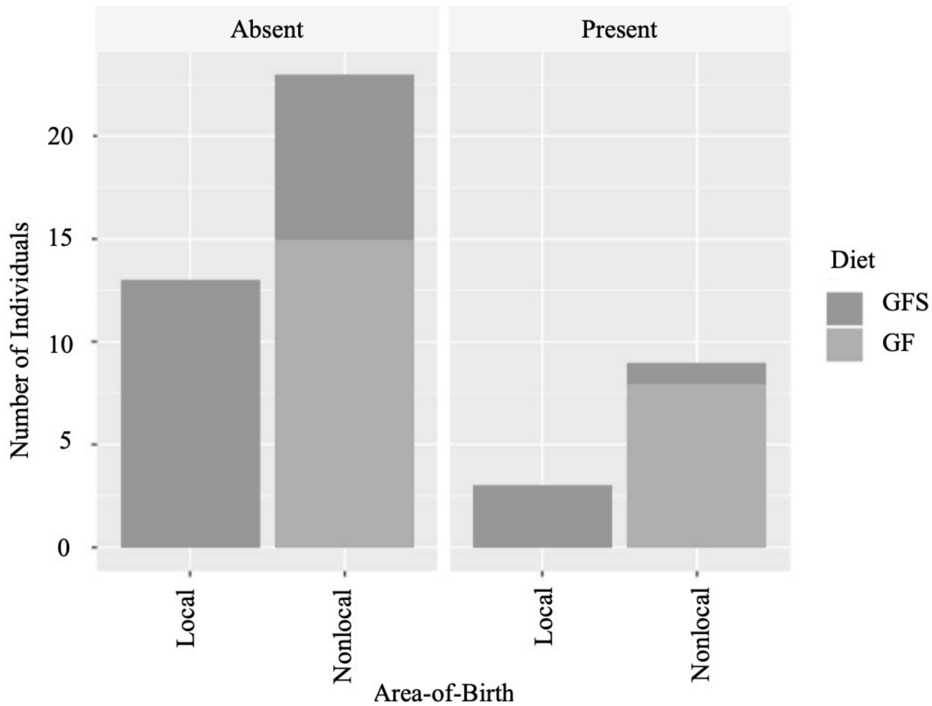


Figure 4.8 Number of individuals of each diet and area-of-birth category interred with and without Red Deer canine pendants

Table 4.8 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and interment with red deer canine pendants

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DR+BR | 1 | 0.00 | 1.0000 |
| BD+BR | 2 | 2.03 | 0.3633 |
| BD+DR | 2 | 0.26 | 0.8772 |
| BR+DR | 2 | 28.18 | 0.0000 |
| BD | 3 | 2.54 | 0.4677 |
| BR | 3 | 30.46 | 1.0000 |
| DR | 3 | 28.70 | 1.0000 |
| No Interaction | 4 | 30.98 | 1.0000 |

Legend: B= area-of-birth, D= diet, R= red deer canine pendants

**4.5.2 Association between interment with red deer canine pendants, diet, and cluster in K14**

Figure 4.9 shows that, in the East, 33% (4/12) of GF diet followers, and 25% (2/8) of GFS diet followers are interred with red deer canine pendants. In the Centre-East, one GF diet follower (out of three, 33%) and 18% (4/22) of GFS diet followers are interred with red deer canine pendants. In the Centre-West, 30% (3/10) of GF diet followers and no GFS diet followers (out of three) are interred with red deer canines. Lastly, in the West, 15% (2/13) of GFS diet followers are interred with red deer canines. There are no GF diet followers interred in the West. Overall, 17% (8/46) of GFS diet followers and 32% (8/35) of GF diet followers are interred with red deer canine pendants.

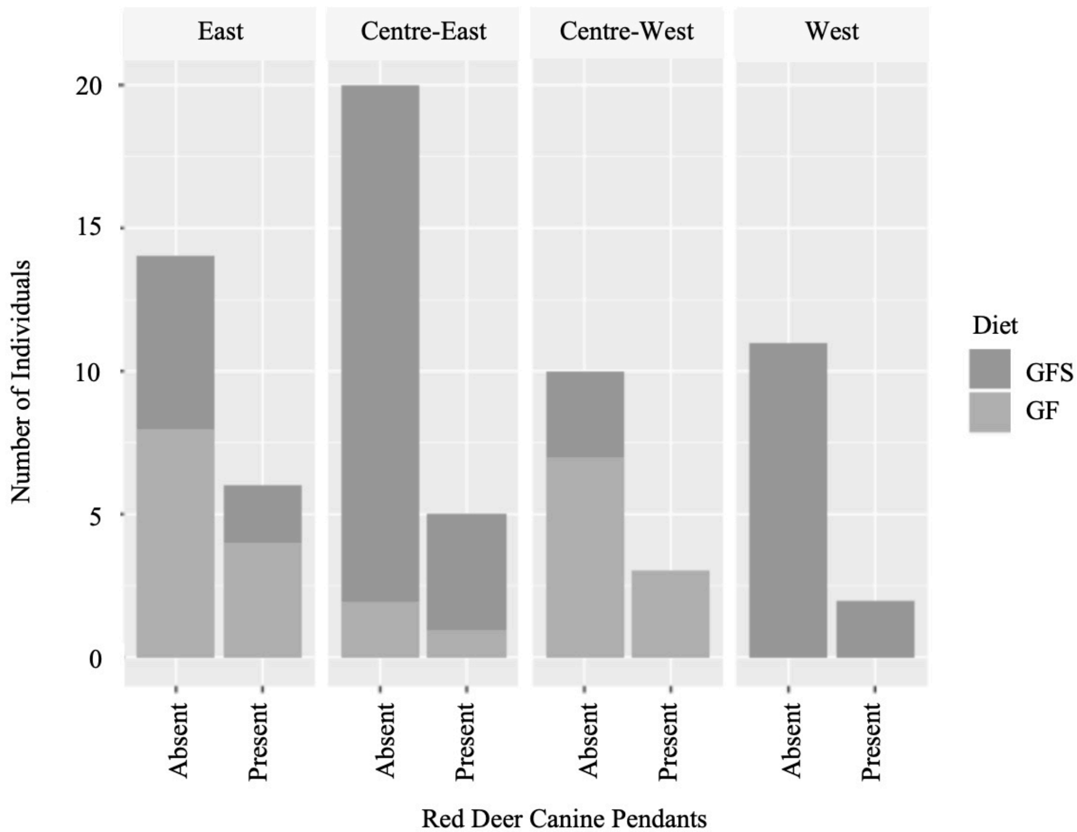


Figure 4.9 Numbers of individuals of each diet category interred with and without Red Deer canine pendants in each cluster in K14

Table 4.9 shows that there are two possible log-linear models that fit these data, RD+DS and RS+DS. The true and predicted counts of model RS+DS indicate a slightly better fit to these data (see Table A.9). RS+DS says that the relationship between *red deer canine pendants and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of red deer canine pendants, and the relationship between *red deer canine pendants and diet* depends on cluster in K14. Figure 4.9 illustrates this model.

Table 4.9 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and interment with red deer canine pendants

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| RD+DS+RS | 3 | 1.10 | 0.7759 |
| RD+RS | 6 | 33.22 | 0.0000 |
| RD+DS | 6 | 1.52 | 0.9584 |
| RS+DS | 4 | 2.33 | 0.6757 |
| RD | 9 | 34.33 | 0.0001 |
| RS | 7 | 35.14 | 1.0000 |
| DS | 7 | 3.44 | 0.1581 |
| No Interaction | 10 | 36.25 | 0.9999 |

Legend: R= red deer canine pendant, D= diet, S= cluster in K14

### 4.5.3 Association between interment with red deer canine pendants, area-of-birth, and cluster in K14

Figure 4.10 shows similar numbers of locally and nonlocally-born individuals (18%, 2/11, and 20%, 2/10, respectively) interred with red deer canine pendants in the Centre-East. The

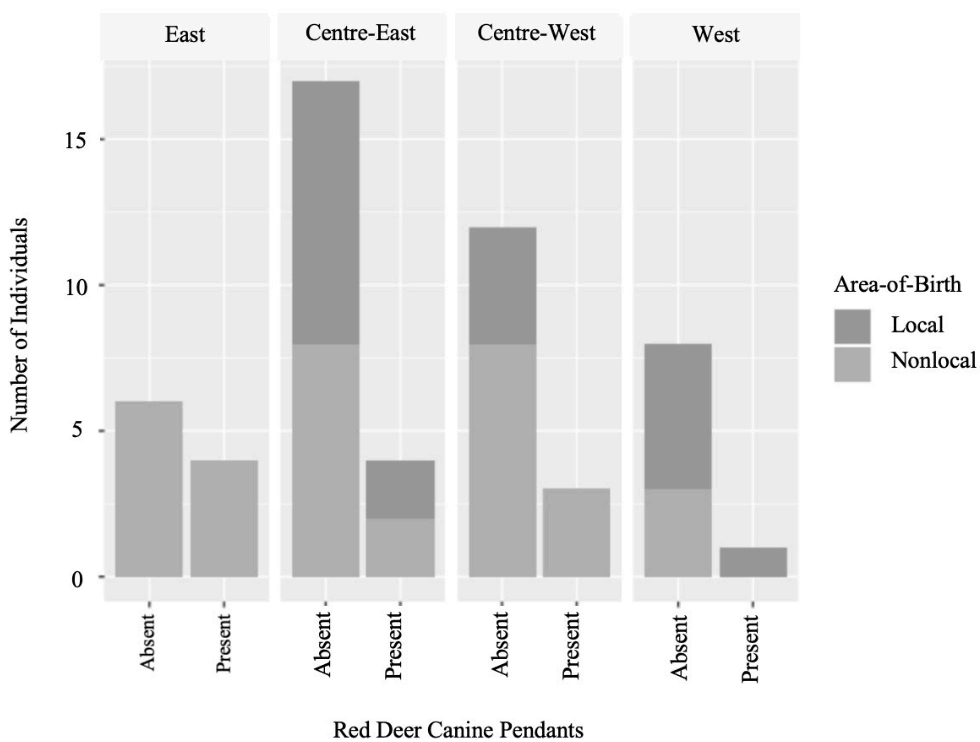


Figure 4.10 Number of individuals of each area-of-birth category interred with and without Red Deer canine pendants in each cluster in K14

West is similar only in that it is the only other cluster in K14 where locally-born individuals are interred with red deer canine pendants (one individual out of six, 17%). No nonlocally-born individuals (out of three) are interred with red deer canine pendants in the West. In the East and Centre-West, only nonlocally-born individuals are interred with these artifacts (40%, 4/10, and 27%, 3/11, respectively). There are no locally-born individuals interred in the East. Overall, 14% (3/21) of locally-born individuals and 27% (9/34) of nonlocally-born individuals have red deer canine pendants present.

Table 4.10 shows that there are two possible log-linear models that fit these data, RB+BS and RS+BS. The true and predicted counts of model RS+BS indicate a better fit to these data (see Table A.10). This model says that the relationship between *red deer canine pendants and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of red deer canine pendants, and that the relationship between *red deer canine pendants and area-of-birth* depends on cluster in K14. Figure 4.10 illustrates this model.

Table 4.10 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with red deer canine pendants, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| RB+BS+RS | 3 | 2.79 | 0.4254 |
| RB+RS | 6 | 17.05 | 0.0091 |
| RB+BS | 6 | 4.33 | 0.6326 |
| RS+BS | 4 | 3.00 | 0.5571 |
| RB | 9 | 19.55 | 0.0209 |
| RS | 7 | 18.23 | 0.9809 |
| BS | 7 | 5.51 | 0.4019 |
| No Interaction | 10 | 20.73 | 0.9770 |

Legend: R= red deer canine pendant, B= area-of-birth, S= cluster in K14

### 4.6 Interment with Kaolinite Cylindrical Beads

#### 4.6.1 Association between diet, area-of-birth, and interment with kaolinite cylindrical beads

Figure 4.11 shows that approximately half of GF Nonlocals and GFS-Nonlocals (48%, 11/23 and 56%, 5/9, respectively) are interred with beads, whereas over two thirds (69%, 11/16) of GFS Locals are. More specifically, it is interesting to see the difference between the locally and nonlocally-born individuals

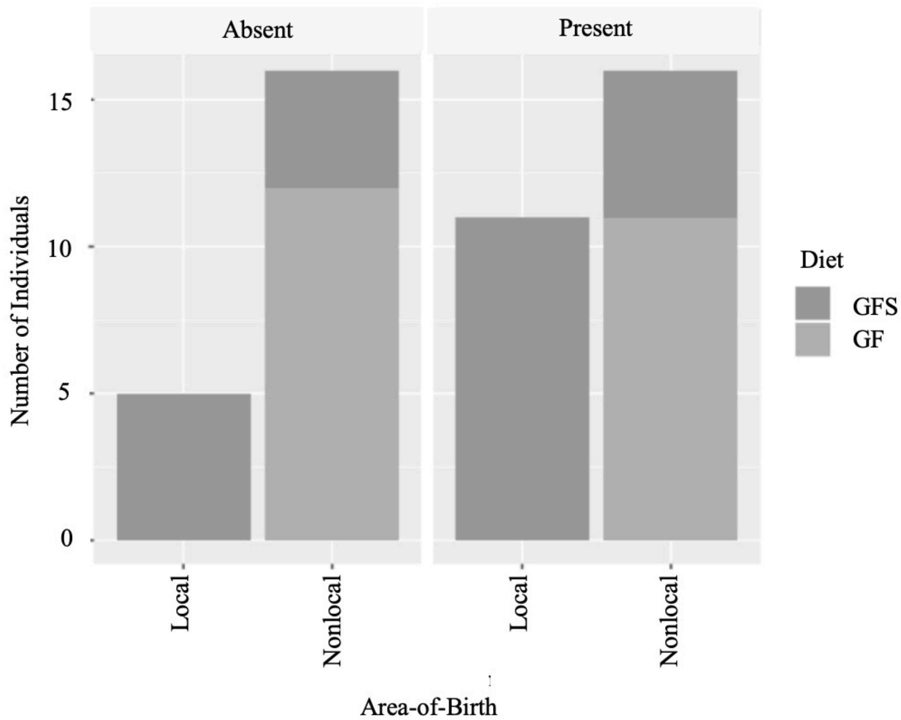


Figure 4.11 Number of individuals of each diet and area-of-birth category interred with and without kaolinite cylindrical beads

Table 4.11 shows that there are two possible log-linear models; BD+BK and BD+DK. The predicted and actual of these models indicate equally good fits (see Table A.11). BD+BK says that the relationship between *area-of-birth and diet* is independent of kaolinite cylindrical

Table 4.11 Degrees of freedom, deviance, and p-value for each possible log-linear model for variables diet, area-of-birth, and interment with kaolinite cylindrical beads

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DK+BK | 1 | 0.00 | 1.0000 |
| BD+BK | 2 | 0.15 | 0.9255 |
| BD+DK | 2 | 0.43 | 0.8062 |
| BK+DK | 2 | 27.31 | 0.0000 |
| BD | 3 | 1.71 | 0.6350 |
| BK | 3 | 28.59 | 1.0000 |
| DK | 3 | 28.87 | 1.0000 |
| No Interaction | 4 | 30.14 | 1.0000 |

Legend: B= area-of-birth, D= diet, K= kaolinite cylindrical beads

BD+DK says that the relationship between *area-of-birth and diet* is independent of kaolinite cylindrical beads, the relationship between *diet and kaolinite cylindrical beads* does is independent of area-of-birth, and the relationship between *area-of-birth and kaolinite cylindrical beads* depends on diet. Figure 4.11 illustrates both BD+BK and BD+DK. beads, the relationship between *area-of-birth and kaolinite cylindrical beads* is independent of diet, and the relationship between *diet and kaolinite cylindrical beads* depends on area-of-birth.

### 4.6.2 Association between interment with kaolinite cylindrical beads, diet, and cluster in K14

Figure 4.12 shows that, in the East and West, only one GFS diet follower in each cluster (out of 8, 13% and 13, 8%, respectively), and no GF diet followers (out of 12, 0% and 0, 0%,

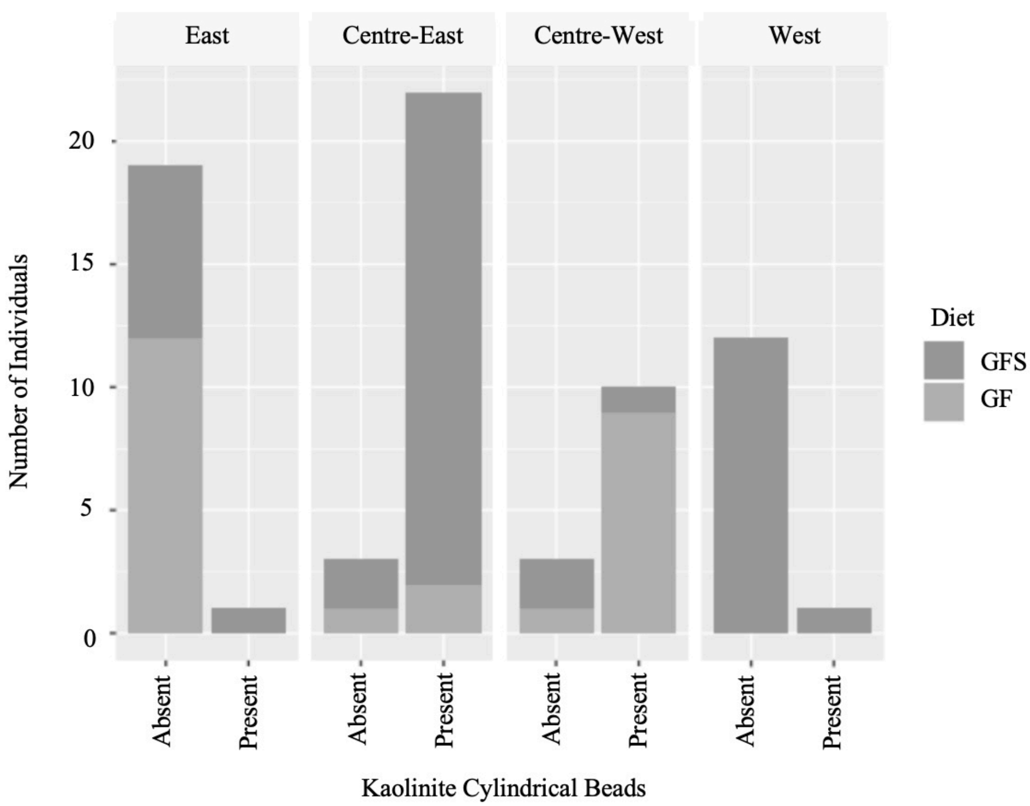


Figure 4.12 Number of individuals of each diet category interred with and without kaolinite cylindrical beads in each cluster in K14

respectively) are interred with kaolinite cylindrical beads. There are no GF diet followers interred in the West. Figure 4.12 also shows that 91% (20/22) of GFS diet followers, and 67%

(2/3) of GF diet followers are interred with cylindrical beads in the Centre-East, whereas in the Centre-West 33% (1/3) of GFS diet followers and 90% (9/10) of GF diet followers are interred with this artifact. Overall, 50% (23/46) of GFS diet followers and 44% (11/25) of GF diet followers have these artifacts present.

Table 4.12 shows that there is one model that fits these data; KS+DS. This model says that the relationship between *kaolinite cylindrical beads and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent of kaolinite cylindrical beads. This model also says that the association between *kaolinite cylindrical beads and diet* depends on cluster in K14. Figure 4.12 illustrates this model.

Table 4.12 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, interment with kaolinite cylindrical beads, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| KD+DS+KS | 3 | 6.76 | 0.0801 |
| KD+KS | 6 | 39.34 | 0.0000 |
| KD+DS | 6 | 57.44 | 0.0000 |
| KS+DS | 4 | 6.76 | 0.1491 |
| KD | 9 | 90.25 | 0.0000 |
| KS | 7 | 39.57 | 1.0000 |
| DS | 7 | 57.68 | 1.0000 |
| No Interaction | 10 | 90.49 | 1.0000 |

Legend: K= kaolinite cylindrical beads, D= diet, S= cluster in K14

**4.6.3 Association between interment with kaolinite cylindrical beads, area-of-birth, and cluster in K14**

Figure 4.13 shows that, in the Centre-East and Centre-West, 100% (11/11) of locally-born individuals in the Centre-East, and 75% (3/4) in the Centre-West are interred with kaolinite cylindrical beads. Most nonlocally-born individuals (80%, 8/10 in the Centre-East and 91%, 10/11 in the Centre-West) are also interred with kaolinite cylindrical beads. No individuals of either area-of-birth are interred with kaolinite cylindrical beads in the East (0/0 locally-born and 0/10 nonlocally-born) and West (0/6 locally-born and 0/3 nonlocally-born). Overall, 67% (14/21) of locally-born followers and 53% (18/34) of nonlocally-born are interred with beads present. Table 4.13 shows that there is one log-linear model that fits these data; KS+BS.

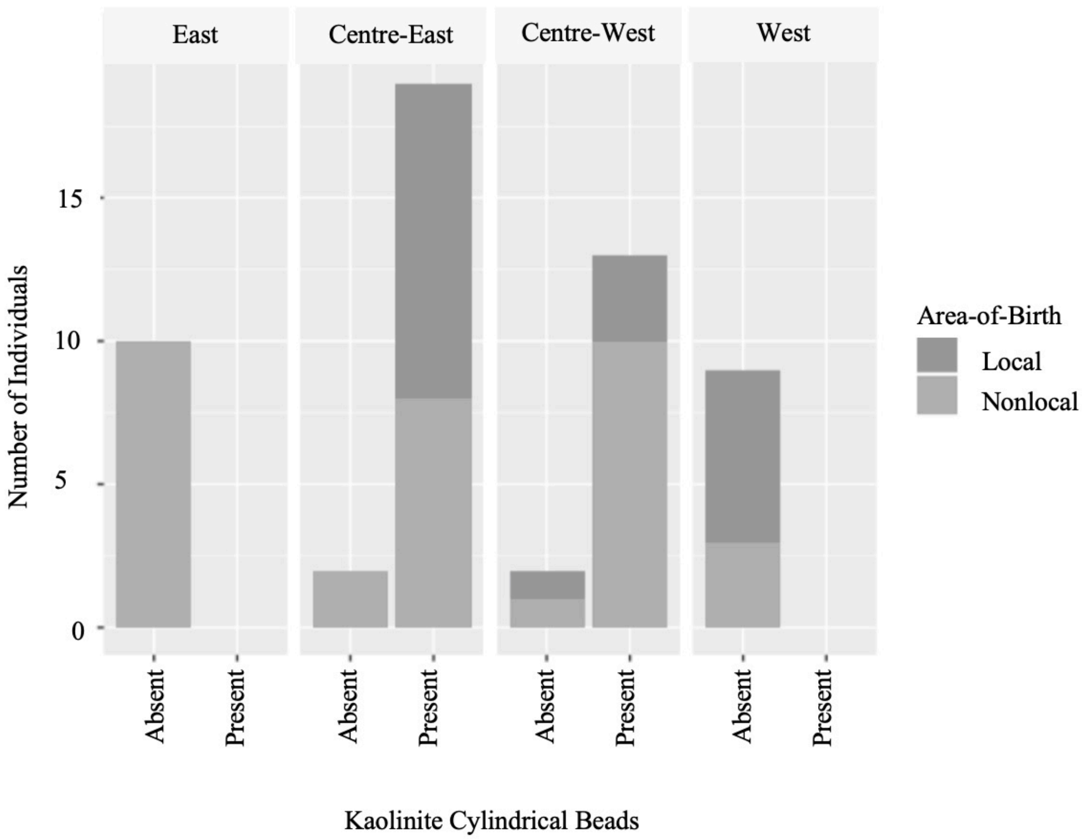


Figure 4.13 Number of individuals of each area-of-birth category interred with and without kaolinite cylindrical beads in each cluster in K14

Table 4.13 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with kaolinite cylindrical beads, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| KB+BS+KS | 3 | 3.33 | 0.3432 |
| KB+KS | 6 | 17.99 | 0.0063 |
| KB+BS | 6 | 52.54 | 0.0000 |
| KS+BS | 4 | 3.78 | 0.4366 |
| KB | 9 | 67.77 | 0.0000 |
| KS | 7 | 19.01 | 0.9918 |
| BS | 7 | 53.56 | 1.0000 |
| No Interaction | 10 | 68.78 | 1.0000 |

Legend: K= kaolinite cylindrical beads, B= area-of-birth, S= cluster in K14

This model says the relationship between *kaolinite cylindrical beads and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of kaolinite cylindrical beads, and the relationship between *kaolinite cylindrical beads and area-of-birth* depends on cluster in K14. Figure 4.13 illustrates this model.

### 4.7 Interment with Nephrite Artifacts

#### 4.7.1 Association Between Diet, Area-of-Birth, and Interment with Nephrite Artifacts

Figure 4.14 shows that 22% (5/23) of GF-Nonlocals, 19% (3/16) of GFS-Locals, and one (out of 9, 11%) GFS-Nonlocal have nephrite artifacts. Table 4.14 shows that there are three possible log-linear models that fit these data, BD+BN, BD+DN, and BD. All three models are similarly good fits based on the actual and predicted counts (see Table A.14). BD+BN says that the relationship between *area-of-birth and diet* is independent of nephrite, that the relationship between *area-of-birth and nephrite* is independent of diet, and that the association between *diet and nephrite* depends on area-of-birth. BD+DN says that the relationship between *area-of-birth*

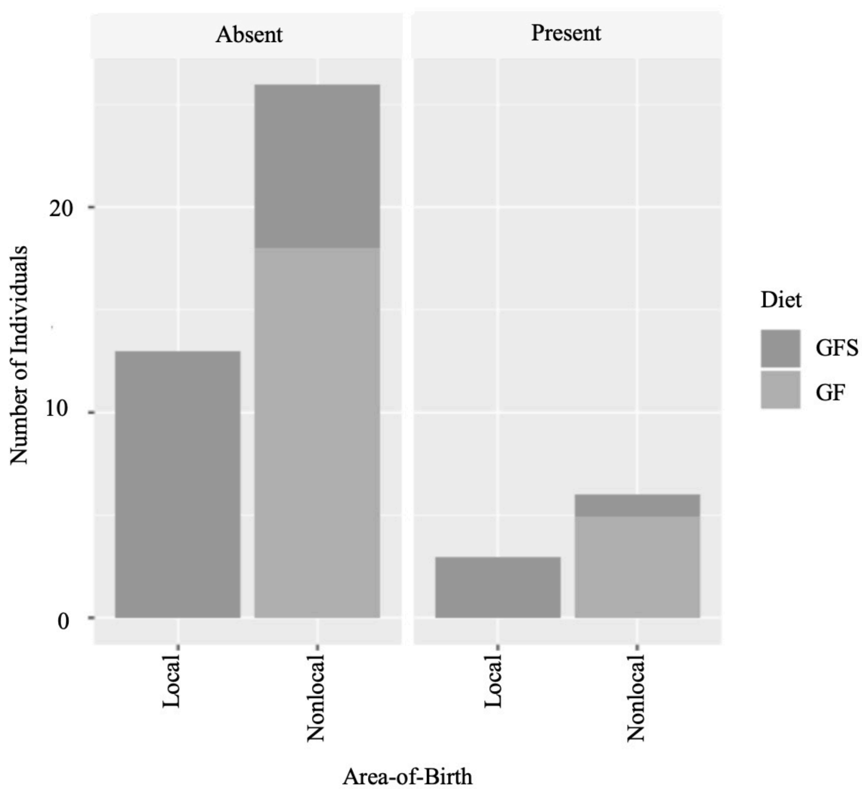


Figure 4.14 Number of individuals of each diet and area-of-birth category interred with and without nephrite artifacts

*and diet* is independent of nephrite, the relationship between *diet and nephrite* is independent of area-of-birth, and that the association between *area-of-birth and nephrite* depends on diet. BD says that the relationship between *area-of-birth and diet* is independent from nephrite. Figure 4.14 most clearly illustrates BD.

Table 4.14 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, area-of-birth, and interment with nephrite artifacts

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DN+BN | 1 | 0.00 | 1.0000 |
| BD+BN | 2 | 0.52 | 0.7707 |
| BD+DN | 2 | 0.26 | 0.8772 |
| BN+DN | 2 | 28.70 | 0.0000 |
| BD | 3 | 0.52 | 0.9143 |
| BN | 3 | 28.96 | 1.0000 |
| DN | 3 | 28.70 | 1.0000 |
| No Interaction | 4 | 28.96 | 1.0000 |

Legend: B= area-of-birth, D= diet, N= nephrite artifacts

**4.7.2 Association between interment with nephrite artifacts, diet, and cluster in K14**

Figure 4.15 shows that half of all GFS diet followers (50%, 4/8) and 25% of GF diet followers (3/12) in the East have nephrite artifacts, while 33% (1/3) of GFS diet followers and 30% (3/10) of GF diet followers in the Center-West have nephrite artifacts. Only GFS diet followers in the Centre-East (9%, 2/22) and the West (23%, 3/13) have nephrite artifacts. There are no GF diet followers interred in the West. Overall, 22% (10/46) of GFS diet followers and 25% (6/25) of GF diet followers have nephrite artifacts present.

Table 4.15 shows that there are two possible log-linear models that fit these data; NS+DS and DS. The predicted and actual counts of these data suggest that model NS+DS is a better fit (see Table A.15). NS+DS says that the relationship between *nephrite and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of nephrite and, the association between *diet and nephrite* depends on cluster in K14. Figure 4.15 illustrates this model.

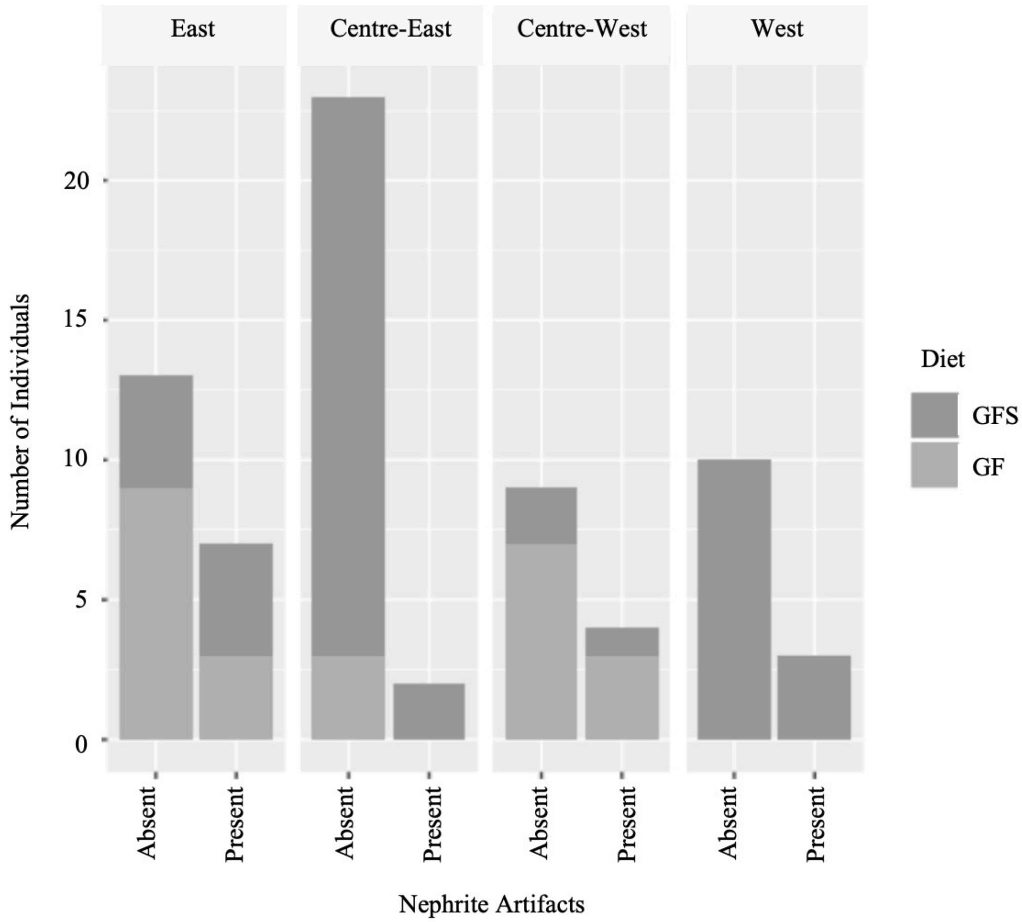


Figure 4.15 Number of individuals of each diet category interred with and without nephrite artifacts in each cluster in K14

Table 4.15 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, interment with nephrite artifacts, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| ND+DS+NS | 3 | 0.56 | 0.9052 |
| ND+NS | 6 | 34.62 | 0.0000 |
| ND+DS | 6 | 7.65 | 0.2647 |
| NS+DS | 4 | 1.86 | 0.7619 |
| ND | 9 | 40.46 | 0.0000 |
| NS | 7 | 34.67 | 1.0000 |
| DS | 7 | 7.70 | 0.6401 |
| No Interaction | 10 | 40.51 | 1.0000 |

Legend: N= nephrite artifact, D= diet, S= cluster in K14

### 4.7.3 Association between interment with nephrite artifacts, area of birth, and cluster in K14

Figure 4.16 shows that both locally-born (9%, 1/11) and nonlocally-born individuals (10%, 1/10) are interred with nephrite artifacts in the Centre-East. Both locally-born (25%, 1/4) and nonlocally-born individuals (27%, 3/11) are interred with nephrite artifacts in the Centre-West. In the West only locally-born individuals (17%, 1/6) are interred with nephrite artifacts, and in the East, only nonlocally-born individuals (20%, 2/10) are. There are no locally-born individuals interred in the East. Overall, 14% (3/21) of locally-born and 18% (6/34) of nonlocally-born individuals have nephrite artifacts present.

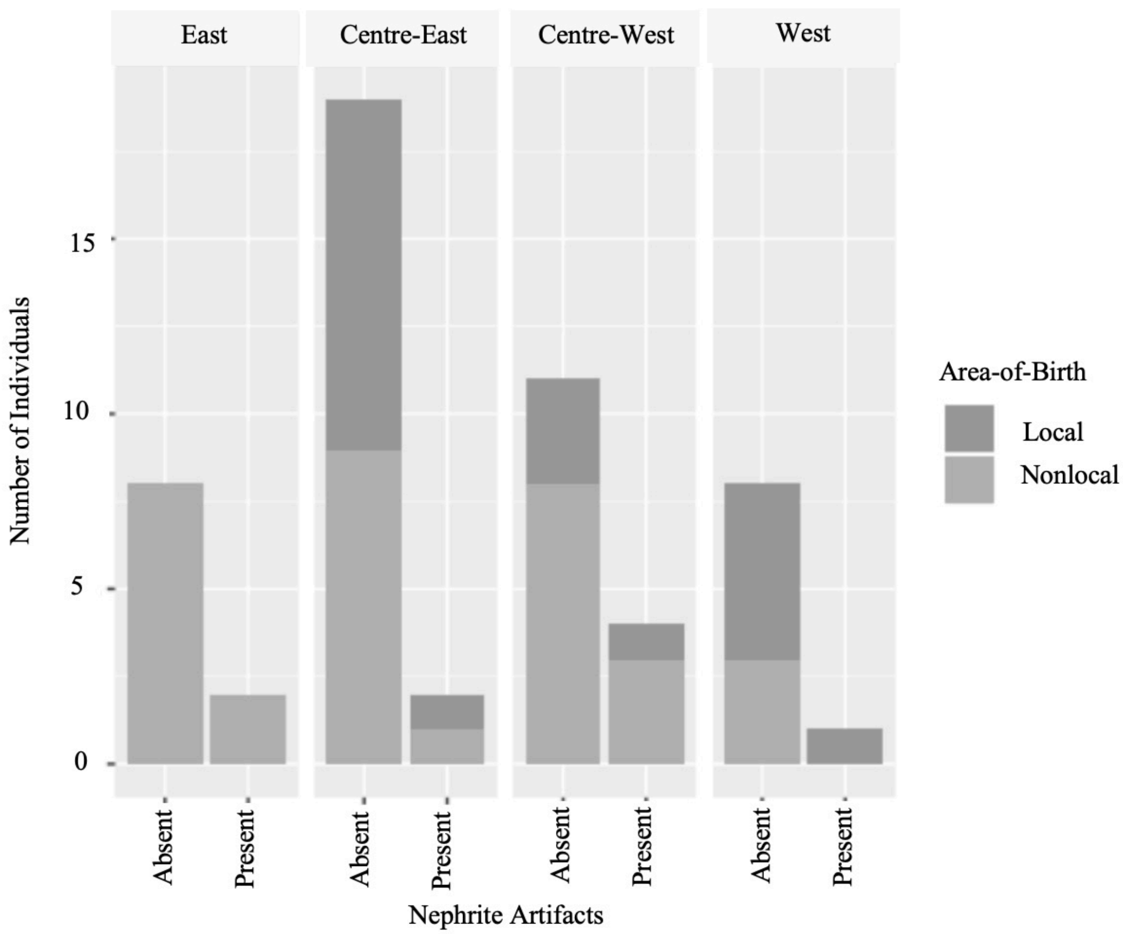


Figure 4.16 Number of individuals of each area-of-birth category interred with and without nephrite artifacts in each cluster in K14

Table 4.16 shows that there is one possible log-linear model, NS+BS. This model says that the relationship between *interment with nephrite and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of nephrite, and, the relationship between *nephrite and area-of-birth* depends on cluster in K14. Figure 4.16 illustrates this model.

Table 4.16 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables area-of-birth, interment with nephrite artifacts, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| NB+BS+NS | 3 | 0.85 | 0.8385 |
| NB+NS | 6 | 16.00 | 0.0137 |
| NB+BS | 6 | 2.90 | 0.8207 |
| NS+BS | 4 | 0.89 | 0.9267 |
| NB | 9 | 18.13 | 0.0337 |
| NS | 7 | 16.11 | 0.9759 |
| BS | 7 | 3.01 | 0.1163 |
| No Interaction | 10 | 18.24 | 0.9489 |

Legend: N= nephrite artifact, B= area-of-birth, S= cluster in K14

### 4.8 Interment with Lithic Arrowheads

#### 4.8.1 Association between diet, area-of-birth, and interment with lithic arrowheads

Figure 4.17 shows that 30% (7/23) of GF-Nonlocals, 22% (2/9) of GFS-Nonlocals, and one (out of 16, 6%) GFS-Local are interred with lithic arrowheads. Table 4.17 shows that there is

Table 4.17 Degrees of freedom, deviance and p-value for each possible log-linear model for variables diet, area-of-birth, and interment with lithic arrowheads

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DA+BA | 1 | 0.00 | 1.0000 |
| BD+BA | 2 | 0.22 | 0.8947 |
| BD+DA | 2 | 1.33 | 0.5142 |
| BA+DA | 2 | 26.14 | 0.0000 |
| BD | 3 | 3.84 | 0.2788 |
| BA | 3 | 28.66 | 1.0000 |
| DA | 3 | 29.76 | 1.0000 |
| No Interaction | 4 | 32.28 | 1.0000 |

Legend: B= area-of-birth, D= diet, A= interment with lithic arrowheads

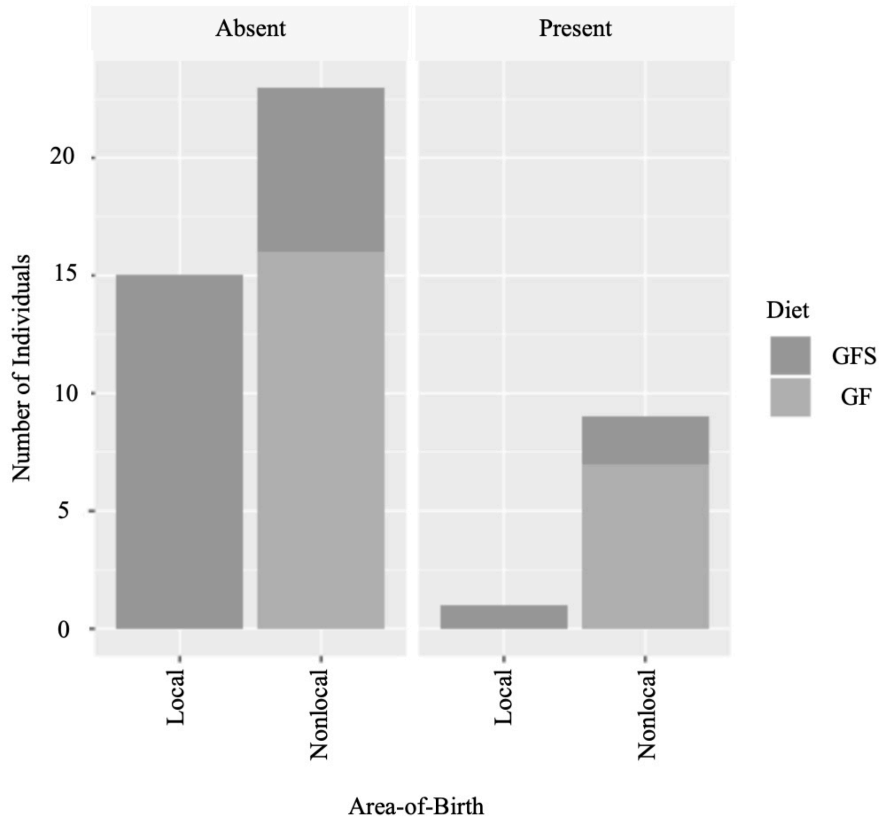


Figure 4.17 Number of individuals of each diet and each area-of-birth category interred with and without lithic arrowheads

one log-linear model that fits these data; BD+BA. This model says that the relationship between *area-of-birth and diet* is independent of lithic arrowheads, the relationship between *area-of-birth and lithic arrowheads* is independent of diet, and the association between *diet and lithic arrowheads* depends on area-of-birth. Figure 4.17 illustrates this model.

**4.8.2 Association between interment with lithic arrowheads, diet, and cluster in K14**

Figure 4.18 shows that, in the Centre-East, only GFS diet followers (18%, 4/22) are interred with lithic arrowheads and, in the Centre-West, only GF diet followers (30%, 3/10) are. In the West, only one GFS diet follower (out of 13, 8%) is interred with lithic arrowheads. There are no GF diet followers interred in the West. In the East, 38% (3/8) of GFS diet followers, and 42% (5/12) of GF diet followers are interred with lithic arrowheads. Overall, 17% (8/46) of GFS diet followers and 32% (8/25) of GF diet followers are interred with lithic arrowheads. Table 4.18 shows that there are two models that fit these data; AS+DS and DS. The predicted and

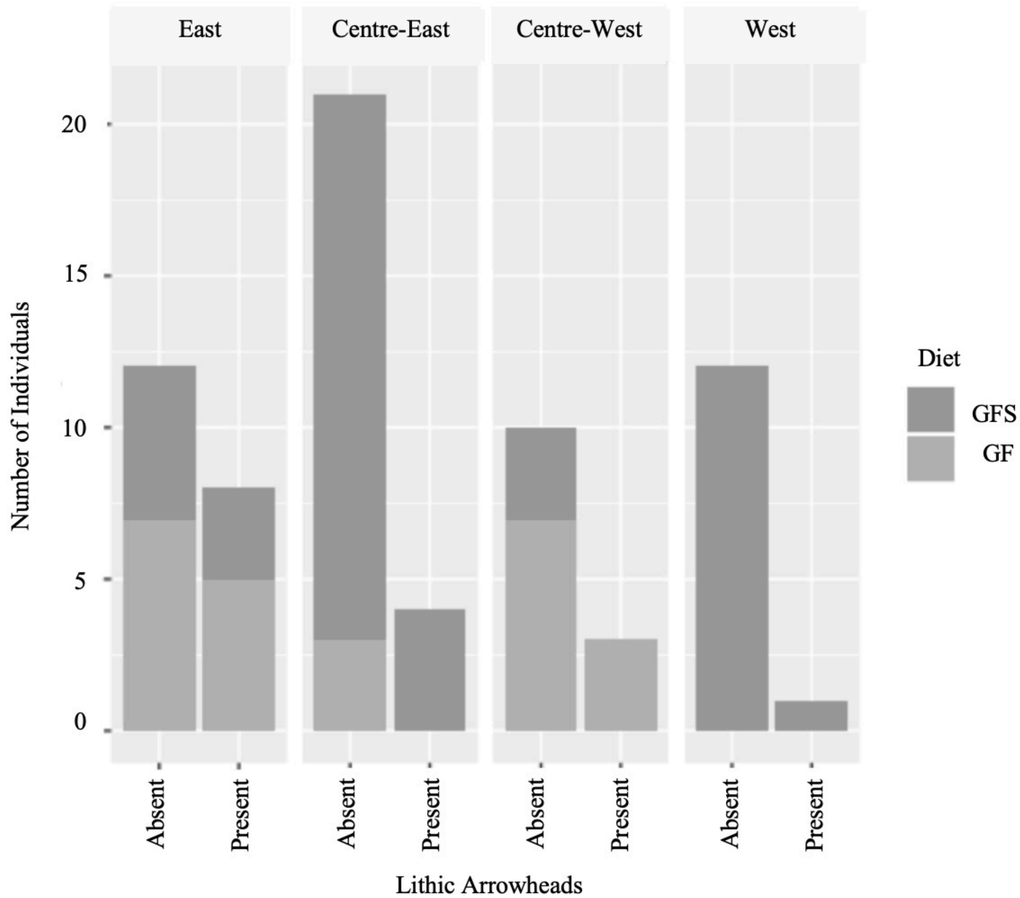


Figure 4.18 Number of individuals of each diet category interred with and without lithic arrowheads in each cluster in K14

Table 4.18 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables diet, interment with lithic arrowheads, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| AD+DS+AS | 3 | 2.90 | 0.4080 |
| AD+AS | 6 | 33.87 | 0.0000 |
| AD+DS | 6 | 6.83 | 0.3364 |
| AS+DS | 4 | 2.98 | 0.5605 |
| AD | 9 | 39.64 | 0.0000 |
| AS | 7 | 35.79 | 1.0000 |
| DS | 7 | 8.76 | 0.7293 |
| No Interaction | 10 | 41.56 | 1.0000 |

Legend: A= interment with lithic arrowheads, D= diet, S= cluster in K14 actual counts of these data suggest that model AS+DS is a better fit (see Table A.18). AS+DS says that the relationship between *lithic arrowheads and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent of lithic arrowheads. This model also says that the association between *diet and lithic arrowheads* depends on cluster in K14. Figure 4.18 illustrates this model.

### 4.8.3 Association between interment with lithic arrowheads, area-of-birth, and cluster in K14

Figure 4.19 shows that only nonlocally-born individuals are interred with lithic arrowheads in the East and Centre-West (40%, 4/10 and 27%, 3/11, respectively). There are no locally-born individuals interred in the East. In the Centre-East, 20% (2/10) of nonlocally-born and 9% (1/11) of locally-born individuals are interred with lithic arrowheads. There are no

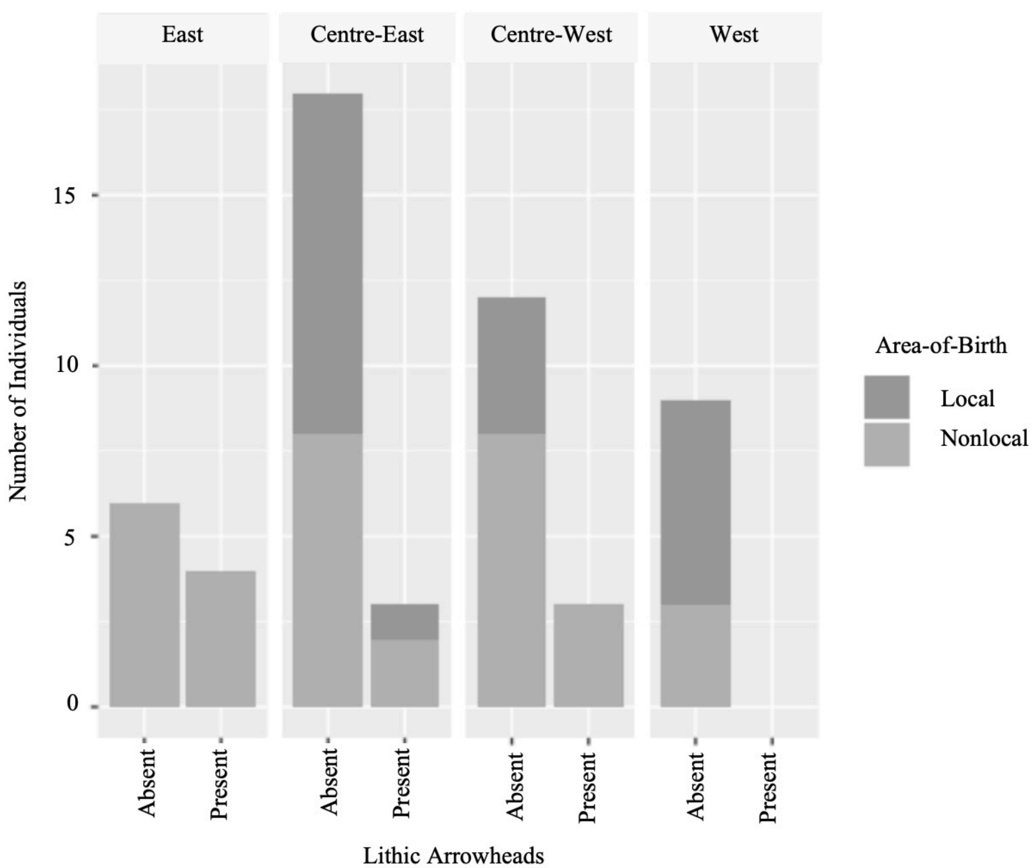


Figure 4.19 Number of individuals of each area-of-birth category interred with and without lithic arrowheads in each cluster in K14

individuals interred with lithic arrowheads in the West. Overall, 5% (1/21) of locally-born individuals and 27% (9/34) of nonlocally-born individuals are interred with lithic arrowheads present.

Table 4.19 show that there three possible models that fits these data; AB+BS, AS+BS, and BS. The predicted and actual counts of these models (see Table A.19) indicate that AS+BS is a better fit. This model says that the relationship between *lithic arrowheads and cluster in K14* is independent of area-of-birth and *area-of-birth and cluster in K14* is independent of lithic arrowheads. This model also says that the association between *lithic arrowheads and area-of-birth* depends on cluster in K14. Figure 4.19 illustrates this model.

Table 4.19 Degrees of freedom, deviance, and p-values for each possible log-linear model for variables area-of-birth, interment with lithic arrowheads, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| AB+BS+AS | 3 | 0.79 | 0.8523 |
| AB+AS | 6 | 13.04 | 0.0423 |
| AB+BS | 6 | 4.28 | 0.6391 |
| AS+BS | 4 | 2.64 | 0.6205 |
| AB | 9 | 19.50 | 0.0212 |
| AS | 7 | 17.86 | 0.9874 |
| BS | 7 | 9.09 | 0.7540 |
| No Interaction | 10 | 24.32 | 0.9932 |

Legend: A= interment with lithic arrowheads, B= area-of-birth, S= cluster in K14

### 4.9 Interment with Wood Working implements

#### 4.9.1 Association between diet, area-of-birth, and interment with wood working implements

Figure 4.20 shows that 22% (5/23) of GF-Nonlocals and one (out of 16, 6%) GFS-Local are interred with wood working implements. There are no GFS-Nonlocals interred with these artifacts (out of nine). Table 4.20 shows that there is one possible log linear model that fits these data; BD+DW. This model says that the relationship between *area-of-birth and diet* is independent of *wood working implements*, and the relationship between *diet and wood working implements* is independent of area-of-birth. This model also says that the relationship between *area-of-birth and wood working implements* depends on diet. Figure 4.20 illustrates this model.

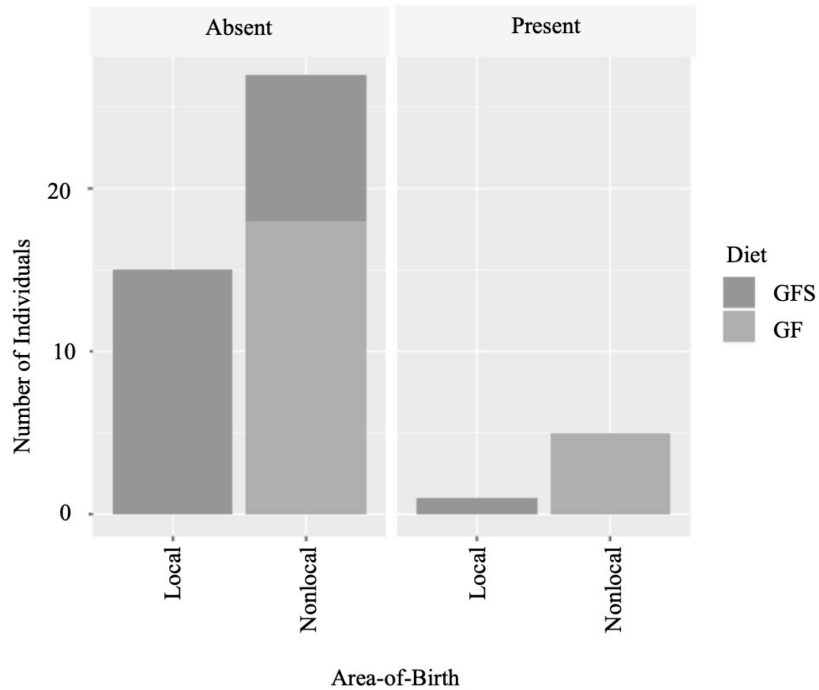


Figure 4.20 Number of individuals of each diet and area-of-birth category interred with and without wood working implements

Table 4.20 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and interment with wood working implements

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DW+BW | 1 | 0.00 | 1.0000 |
| BD+BW | 2 | 3.65 | 0.1610 |
| BD+DW | 2 | 0.92 | 0.6326 |
| BW+DW | 2 | 28.40 | 0.0000 |
| BD | 3 | 4.60 | 0.2032 |
| BW | 3 | 32.09 | 1.0000 |
| DW | 3 | 29.35 | 1.0000 |
| No Interaction | 4 | 33.04 | 1.0000 |

Legend: B= area-of-birth, D= diet, W= wood working implements

### 4.9.2 Association between wood working implements, diet, and cluster in K14

Figure 4.21 shows that only GFS diet followers are interred with wood working implements in the Centre-East and West (1/22, 5% and 1/13, 8%, respectively). There are no GF diet followers interred in the West. In the Center-West, the only individual interred with this artifact type is a GF diet follower (out of 10 GF diet followers, 10%). In the East, however, 50% (4/8) of GFS diet followers and 42% (5/12) of GF diet followers are interred with wood working implements. Overall, 13% (6/46) of GFS diet followers and 24% (6/25) of GF diet followers are interred with these implements.

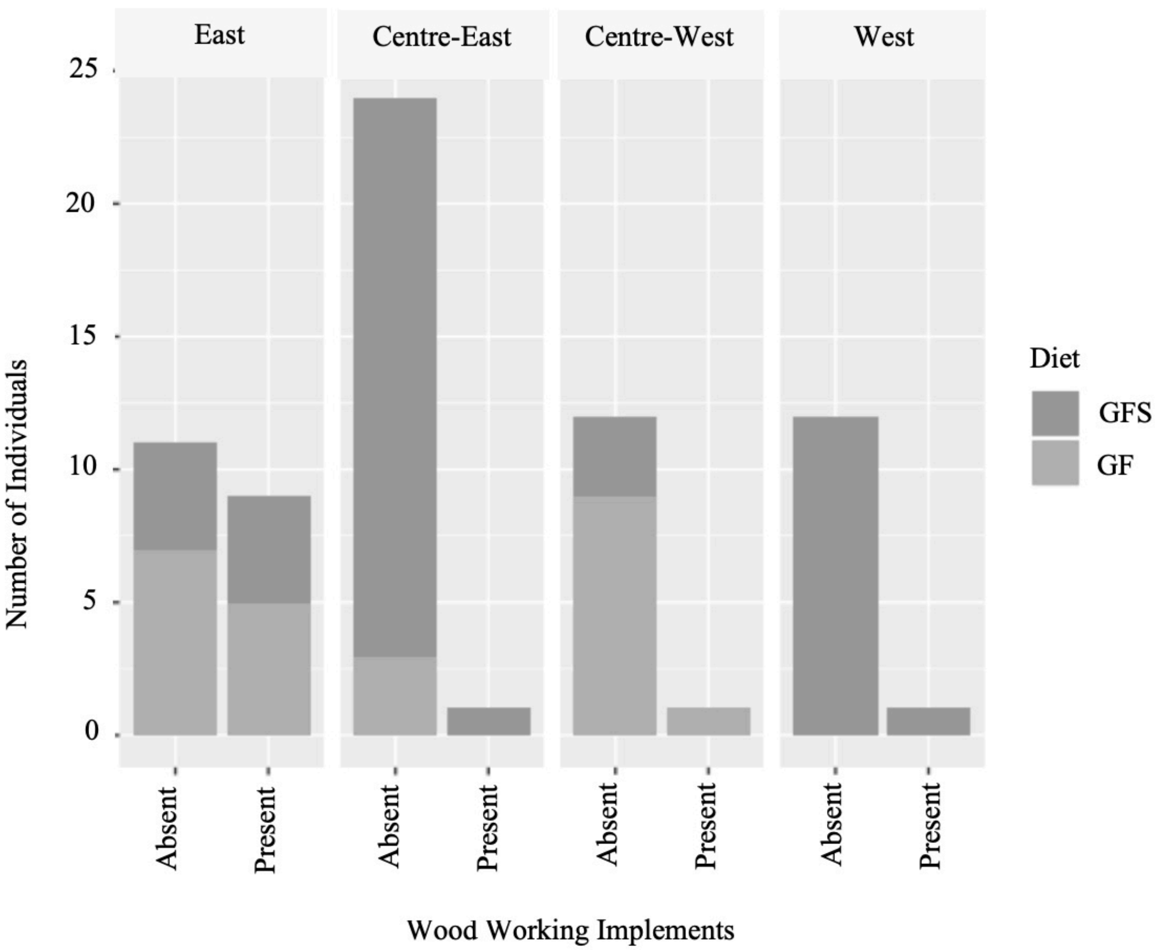


Figure 4.21 Number of individuals of each diet category interred with and without wood working implements in each cluster in K14

Table 4.21 shows that there is one log-linear model that fits these data; WS+DS. This model says that the relationship between *wood working implements and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent of interment with wood working implements. This model also says that the relationship between *diet and wood working implements* depends on cluster in K14. Figure 4.21 illustrates this model.

Table 4.21 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, interment with wood working implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| WD+DS+WS | 3 | 0.89 | 0.8284 |
| WD+WS | 6 | 32.42 | 0.0000 |
| WD+DS | 6 | 14.10 | 0.0286 |
| WS+DS | 4 | 0.95 | 0.9180 |
| WD | 9 | 46.91 | 0.0000 |
| WS | 7 | 33.75 | 1.0000 |
| DS | 7 | 15.43 | 0.9692 |
| No Interaction | 10 | 48.24 | 1.0000 |

Legend: W= wood working implements, D= diet, S= cluster in K14

### 4.9.3 Association between interment with wood working implements, area-of-birth, and cluster in K14

Figure 4.22 shows that only one individual in the Centre-East (locally-born), and one individual in the Centre-West (nonlocally-born) are interred with wood working implements. Almost half of all nonlocally-born individuals in the East (4/10, 40%) are interred with wood working implements. There are no locally-born individuals interred in the East. There are no individuals interred with wood working implements in the West. Overall, 5% (1/21) of locally-born individuals and 15% (5/34) of nonlocally-born individuals are interred with wood working implements. Table 4.22 shows that there is only one log-linear model that fits these data;

Table 4.22 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with wood working implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| WB+BS+WS | 3 | 1.88 | 0.5973 |
| WB+WS | 6 | 15.74 | 0.0152 |
| WB+BS | 6 | 9.57 | 0.1439 |
| WS+BS | 4 | 1.98 | 0.7386 |
| WB | 9 | 24.80 | 0.0032 |
| WS | 7 | 17.21 | 0.9839 |
| BS | 7 | 11.04 | 0.8632 |
| No Interaction | 10 | 26.27 | 0.9966 |

Legend: W= wood working implements, B= area-of-birth, S= cluster in K14

WS+BS. This model says that the relationship between *wood working implements and cluster in K14* is independent of area-of-birth, and the relationship between *area-of-birth and cluster in K14* does is independent of interment with wood working implements. This model also says that the relationship between *area-of-birth and wood working implements* depends on cluster in K14. Figure 4.22 illustrates this model.

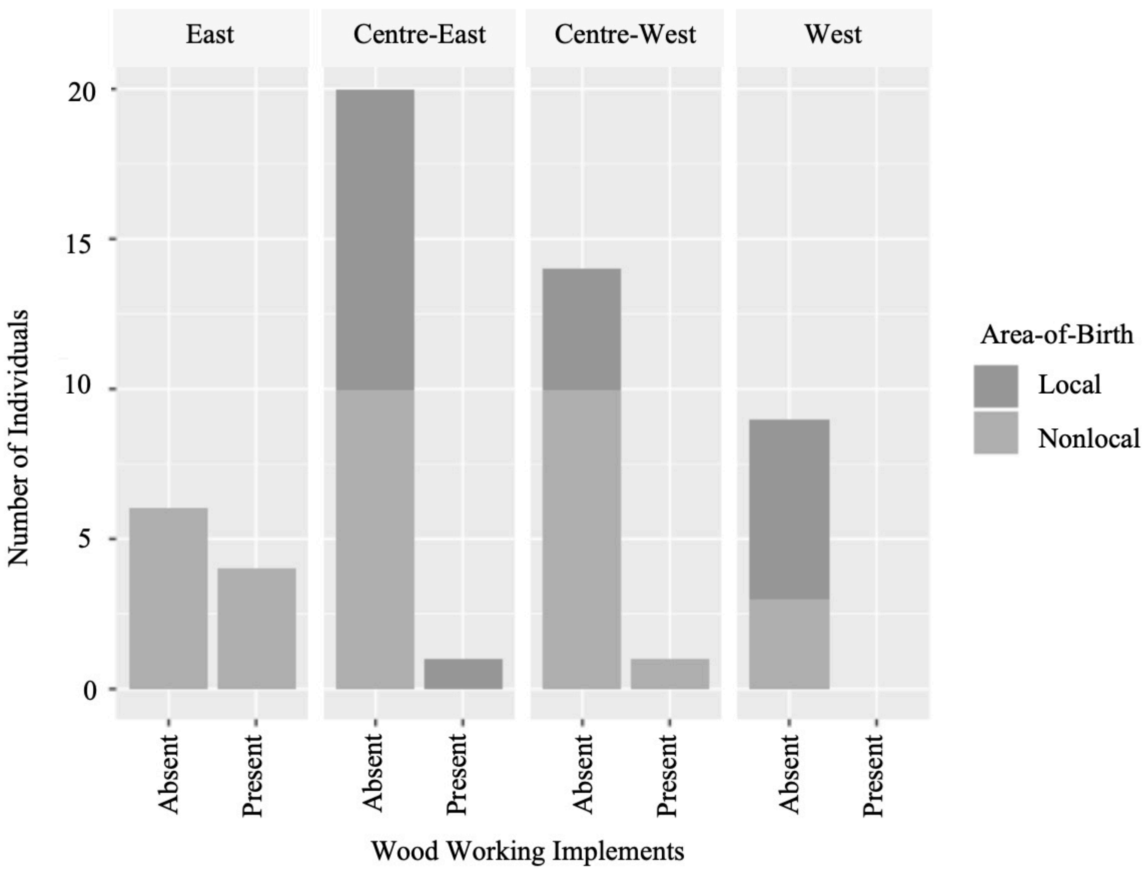


Figure 4.22 Number of individuals of each area-of-birth category interred with and without wood working implements in each cluster in K14

### 4.10 Interment with Hide Working implements

#### 4.10.1 Association between diet, area-of-birth, and interment with hide working implements

Figure 4.23 shows that 17% (4/23) of GF-Nonlocals, 13% (2/16) of GFS-Locals, and 22% (2/9) of GFS-Nonlocals are interred with hide working implements. Table 4.23 shows that there are three possible log-linear models that fit these data; BD+BT, BD+DT, and BD. The predicted and actual counts of these models (see Table A.23) show that both BD+BT and BD+DT are similarly good fits.

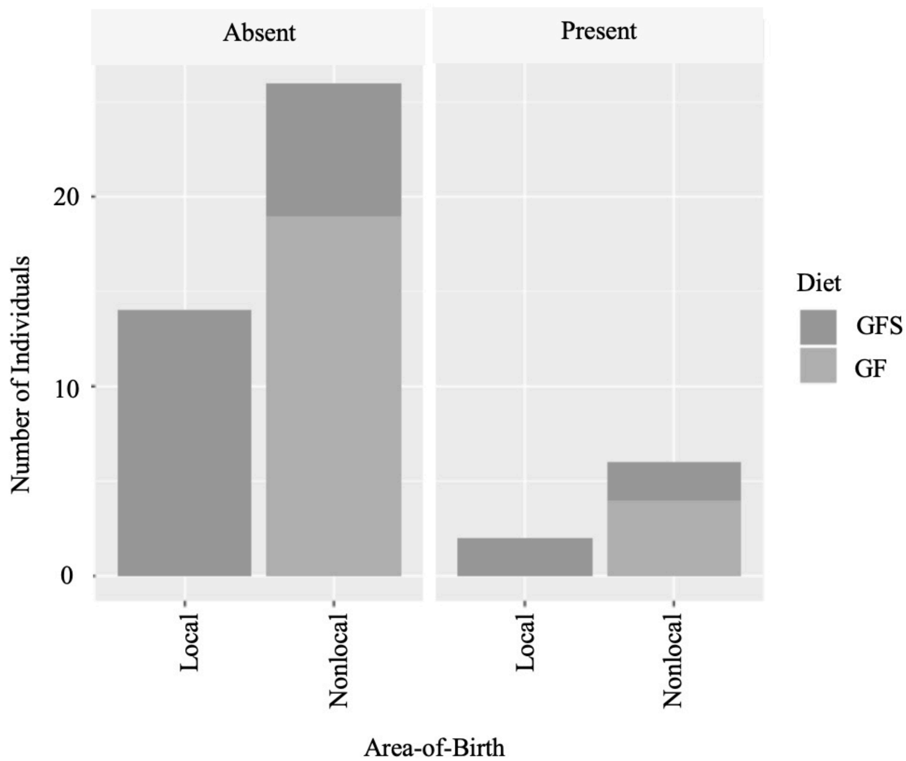


Figure 4.23 Number of individuals of each diet and area-of-birth category interred with and without hide working implements

Table 4.23 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and interment with hide working implements

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DT+BT | 1 | 0.00 | 1.0000 |
| BD+BT | 2 | 0.10 | 0.9529 |
| BD+DT | 2 | 0.39 | 0.8220 |
| BT+DT | 2 | 28.51 | 0.0000 |
| BD | 3 | 0.41 | 0.9384 |
| BT | 3 | 28.53 | 1.0000 |
| DT | 3 | 28.83 | 1.0000 |
| No Interaction | 4 | 28.84 | 1.0000 |

Legend: B= area-of-birth, D= diet, T= hide working

Model BD+BT says that the relationship between *area-of-birth and diet* is independent of interment with hide working implements and the relationship between *area-of- birth and hide working implements* is independent of diet. This model also says that the relationship between *diet and hide working implements* depends on area-of-birth. Model BD+DT says that the relationship between *area-of-birth and diet* is independent of hide working implements, and the relationship between *diet and hide working implements* is independent of area-of-birth. This model also says that the relationship between *area-of-birth and hide working implements* depends on diet. Figure 4.23 reflects illustrates these models.

### 4.10.2 Association between interment with hide working implements, diet, and cluster in K14

Figure 4.24 shows that there are no individuals interred with hide working implements in the Centre-East, while only GFS-diet followers (31%, 4/13) are interred with hide working implements in the West. There are no GF diet followers interred in the West. In the East, 38%

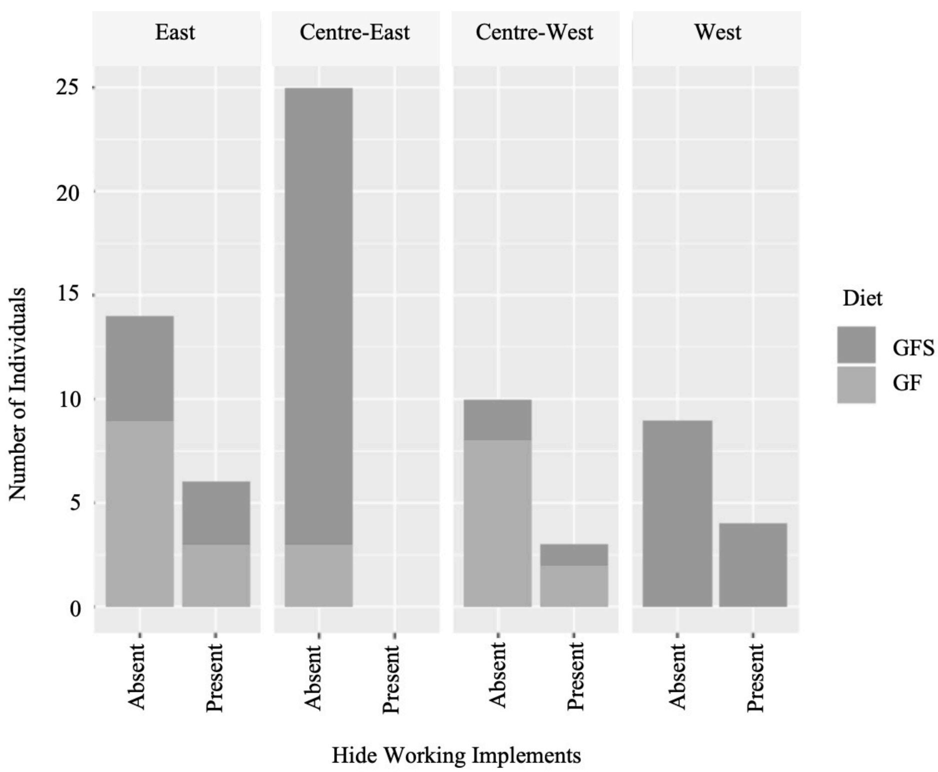


Figure 4.24 Number of individuals of each diet category interred with and without hide working implements in each cluster in K14

(3/8) of GFS-diet followers and 25% (3/12) of GF-diet followers have hide working implements. In the Centre-West, 33% (1/3) of GFS diet followers and 20% (2/10) of GF diet followers have these implements. Overall, 17% (8/46) of GFS diet followers and 20% (5/25) of GF diet followers have hide working implements.

Table 4.24 shows that there is one log-linear model that fits these data; TS+DS. This model says that the relationship between *hide working implements and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent off interment with hide working implements. This model also says that the relationship between *diet and hide working implements* depends on cluster in K14. Figure 4.24 illustrates this model.

Table 4.24 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, interment with hide working implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| TD+DS+TS | 3 | 0.00 | 0.9999 |
| TD+TS | 6 | 33.31 | 0.0000 |
| TD+DS | 6 | 13.57 | 0.0348 |
| TS+DS | 4 | 0.57 | 0.9662 |
| TD | 9 | 46.38 | 0.0000 |
| TS | 7 | 33.38 | 1.0000 |
| DS | 7 | 13.64 | 0.9421 |
| No Interaction | 10 | 46.45 | 1.0000 |

Legend: T= hide working, D= diet, S= cluster in K14

**4.10.3 Association between interment with hide working implements, area-of-birth, and cluster in K14**

Figure 4.25 shows that there are no individuals interred with hide working implements in the Centre-East. Only nonlocally-born individuals are interred with hide working implements present in the East (20%, 2/10) and Centre-West (18%, 2/11). There are no locally-born individuals interred in the East. In the West, 33% (2/6) of locally-born individuals and 67% (2/3) of nonlocally-born individuals are interred with hide working implements. Overall, 10% (2/21) of locally-born individuals and 18% (6/34) of nonlocally-born individuals are interred with hide working implements.

Table 4.25 shows that there is one log-linear model that fits these data; TS+BS. This model says that the relationship between *hide working implements and cluster in K14* is independent of area-of-birth, and the relationship between *area-of-birth and cluster in K14* is independent of hide working implements. This model also says that the relationship between *hide working implements and area-of-birth* depends on cluster in K14. Figure 4.25 illustrates this model.

Figure 4.25 Number of individuals of each area-of-birth category interred with and without hide working implements in each cluster in K14

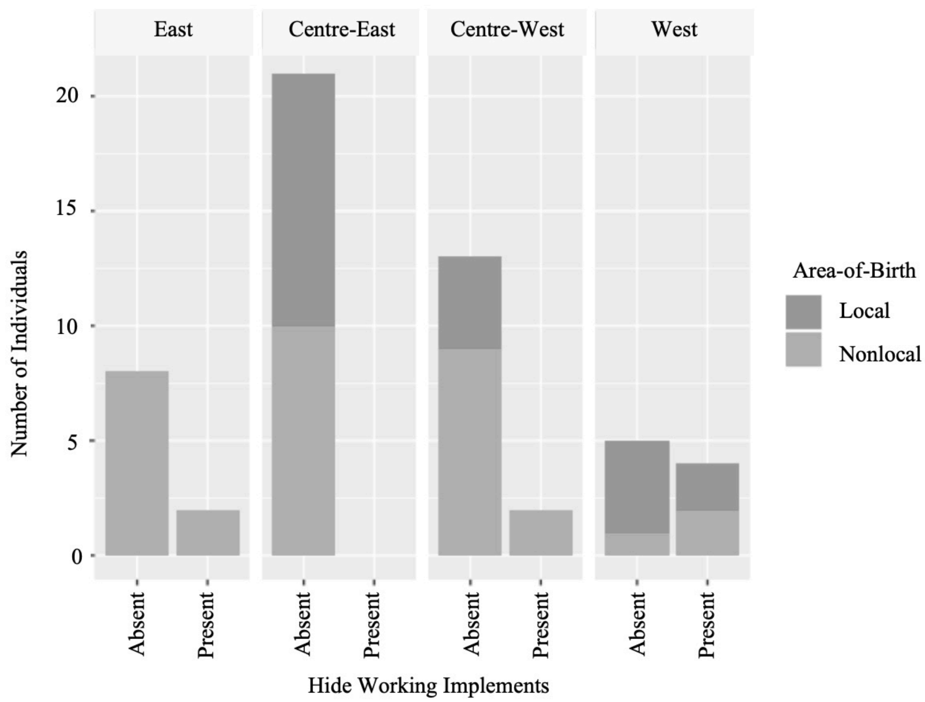


Table 4.25 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with hide working implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| TB+BS+TS | 3 | 0.35 | 0.9509 |
| TB+TS | 6 | 16.76 | 0.0102 |
| TB+BS | 6 | 13.00 | 0.0430 |
| TS+BS | 4 | 2.26 | 0.6886 |
| TB | 9 | 28.23 | 0.0009 |
| TS | 7 | 17.48 | 0.9855 |
| BS | 7 | 13.73 | 0.9437 |
| No Interaction | 10 | 28.95 | 0.9987 |

Legend: T= hide working, B= area-of-birth, S= cluster in K14

### 4.11 Interment with Hunting Implements

#### 4.11.1 Association between diet, area-of-birth, and interment with hunting implements

Figure 4.26 shows that, 39% (9/23) of GF-Nonlocals, 22% (2/9) of GFS-Nonlocals, and one GFS-Local (out of 16, 6%) are interred with hunting implements. Table 26 shows that there are two possible log-linear models that fit these data; BD+BH and BD+DH. The predicted and actual counts of these models say that both models are equally good fits (see Table A.26). Model BD+BH says that the relationship between *area-of-birth and diet* is independent of interment with hunting implements, and the relationship between *area-of-birth and hunting implements* is independent of diet.

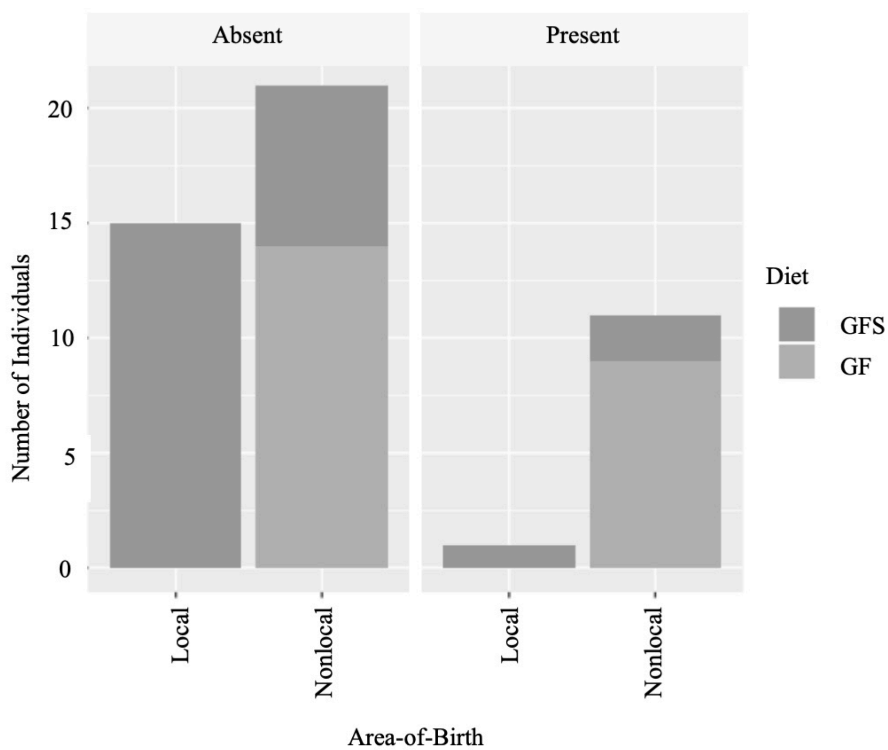


Figure 4.26 Number of individuals of each diet and area-of-birth category interred with and without hunting implements

This model also says that the relationship between *diet and hunting implements* depends on area-of-birth. Model BD+DH says that the relationship between *area-of-birth and diet* is independent of interment with hunting implements, and the relationship between *diet and hunting implements* is independent of area-of-birth. This model also says that the relationship between *area-of-birth and hunting implements* depends on diet. Figure 4.26 illustrates these models.

Table 4.26 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and interment with hunting implements

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DH+BH | 1 | 0.00 | 1.0000 |
| BD+BH | 2 | 0.86 | 0.6506 |
| BD+DH | 2 | 1.33 | 0.5142 |
| BH+DH | 2 | 24.45 | 0.0000 |
| BD | 3 | 6.18 | 0.1032 |
| BH | 3 | 29.29 | 1.0000 |
| DH | 3 | 29.76 | 1.0000 |
| No Interaction | 4 | 34.61 | 1.0000 |

Legend: B= area-of-birth, D= diet, H= hunting implements

### 4.11.2 Association between interment with hunting implements, diet, cluster in K14

Figure 4.27 shows that the only individuals interred with hunting implements in the Centre-West are GF diet followers (40%, 4/10). The only individuals interred with hunting implements in the Centre-East and West are GFS diet followers (18%, 4/22 and 8%, 1/13, respectively). There are no GF diet followers interred in the West. In the East, 38% (3/8) of GFS diet followers and 58% (7/12) of GF diet followers are interred with hunting implements. Overall, 17% (8/46) of GFS diet followers and 44% (11/25) of GF diet followers are interred with hunting implements present. Table 4.27 shows that there is one possible log-linear model

Table 4.27 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, interment with hunting implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| HD+DS+HS | 3 | 3.54 | 0.3162 |
| HD+HS | 6 | 31.68 | 0.0000 |
| HD+DS | 6 | 8.54 | 0.2008 |
| HS+DS | 4 | 4.55 | 0.3367 |
| HD | 9 | 41.35 | 0.0000 |
| HS | 7 | 37.36 | 1.0000 |
| DS | 7 | 14.22 | 1.0000 |
| No Interaction | 10 | 47.03 | 1.0000 |

Legend: H= hunting implements, D= diet, S= cluster in K14 that fit these data; HS+DS. This model says that the relationship between *hunting implements and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent of hunting implements. This model also says that the relationship between *diet and hunting implements* depends on cluster in K14. Figure 4.27 illustrates this model.

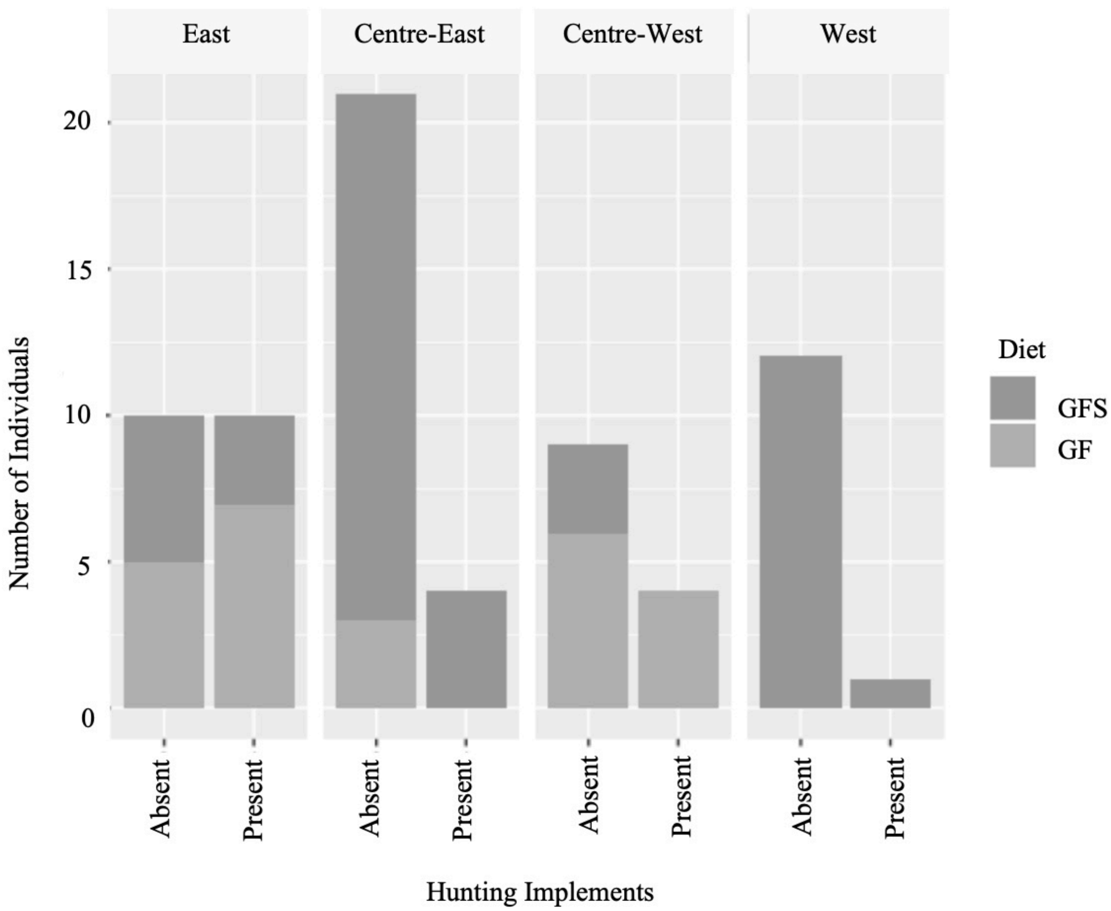


Figure 4.27 Number of individuals of each diet category interred with and without hunting implements in each cluster of K14

### 4.11.3 Association between interment with hunting implements, area-of-birth, and cluster in K14

Figure 4.28 shows that there are no individuals of either area-of-birth interred with hunting implements in the West. In the East and Centre-West, only nonlocally-born individuals have hunting implements (60%, 6/10 and 27%, 3/11 respectively). There are no locally-born individuals interred in the East. In the Centre-East, 9% (1/11) of locally-born and 20% (2/10) of nonlocally-born individuals are interred with hunting implements. Overall, 5% (1/21) of locally-born individuals and 35% (11/34) of nonlocally-born individuals are interred with hunting implements.

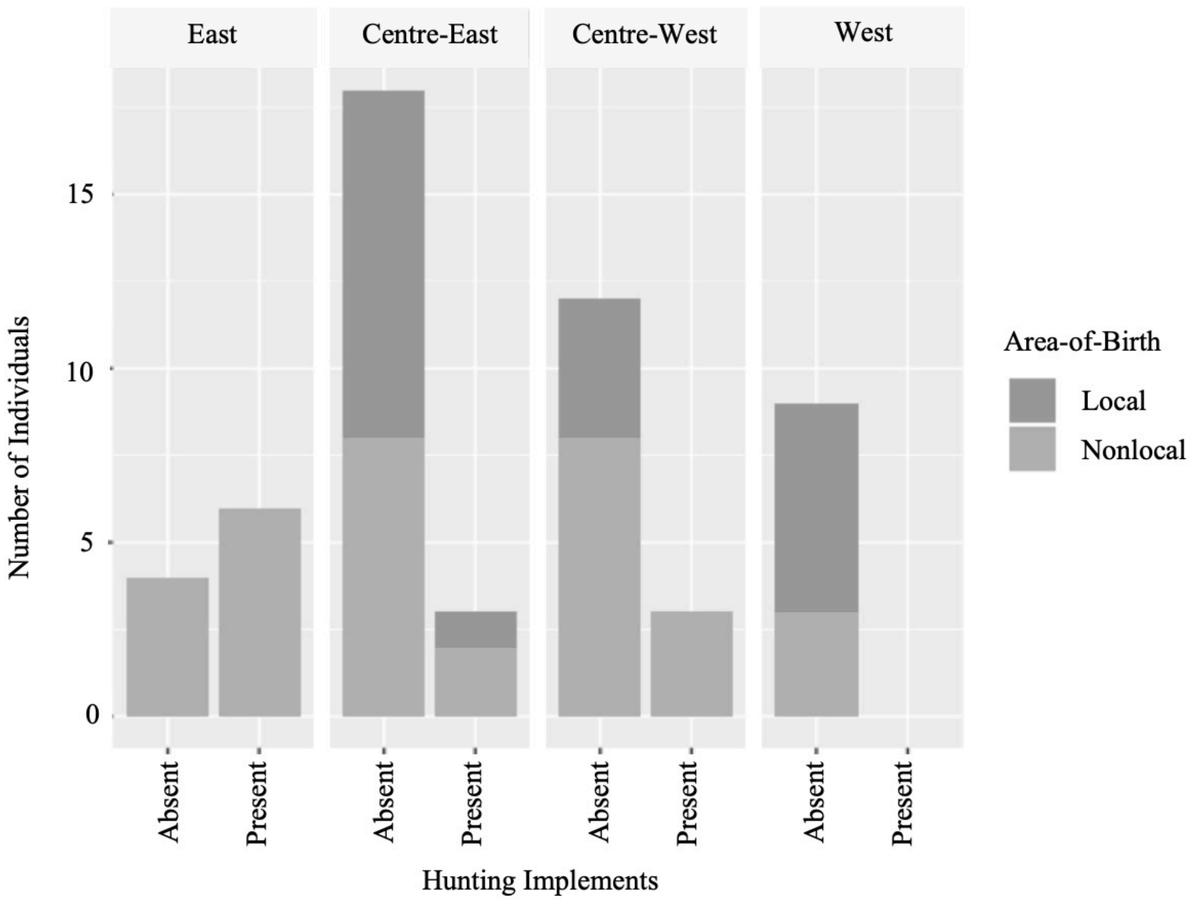


Figure 4.28 Number of individuals of each area-of-birth category interred with and without hunting implements in each cluster in K14

Table 28 shows that there is one log-linear model that fits these data; HS+BS. This model says that the relationship between *hunting implements and cluster in K14* is independent of area-of-birth, and the relationship between *area-of-birth and cluster in K14* is independent of interment with hunting implements. This model also says that the relationship between *hunting implements and area of birth* depends on cluster in K14. Figure 4.28 illustrates this model.

Table 4.28 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with hunting implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| HB+BS+HS | 3 | 0.79 | 0.8523 |
| HB+HS | 6 | 11.00 | 0.0883 |
| HB+BS | 6 | 7.79 | 0.2542 |
| HS+BS | 4 | 2.64 | 0.6205 |
| HB | 9 | 23.01 | 0.0062 |
| HS | 7 | 17.86 | 0.9874 |
| BS | 7 | 14.64 | 0.9592 |
| No Interaction | 10 | 29.87 | 0.9991 |

Legend: H= hunting implements, B= area-of-birth, S= cluster in K14

### 4.12 Interment with Meat Butchering implements

#### 4.12.1 Association between diet, area-of-birth, and interment with meat butchering implements

Figure 4.29 shows that 22% (5/23) of GF-Nonlocals, one (out of nine, 11%) GFS-

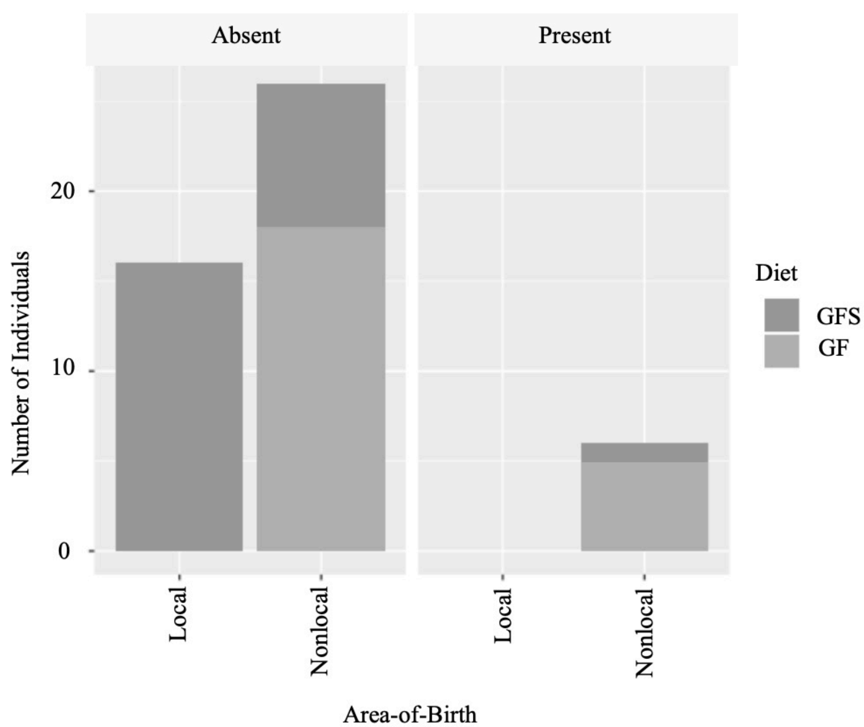


Figure 4.29 Number of individuals of each diet and area-of-birth category interred with and without meat butchering implements

Nonlocal, and no GFS-Locals are interred with meat butchering implements. Table 4.29 shows that there is one log-linear model that fits these data; BD+BP. This model says that the relationship between *area of birth and diet* is independent of interment with meat butchering implements, and the relationship between *area of birth and meat butchering implements* is independent of diet. This model also says that the relationship between *diet and meat butchering implements* depends on area-of-birth. Figure 4.29 illustrates this model.

Table 4.29 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and interment with meat butchering implements

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DP+BP | 1 | 0.00 | 1.0000 |
| BD+BP | 2 | 0.52 | 0.7707 |
| BD+DP | 2 | 2.12 | 0.3468 |
| BP+DP | 2 | 25.27 | 0.0000 |
| BD | 3 | 5.81 | 0.1214 |
| BP | 3 | 28.96 | 1.0000 |
| DP | 3 | 30.55 | 1.0000 |
| No Interaction | 4 | 34.24 | 1.0000 |

Legend: B= area-of-birth, D= diet, P= meat butchering implements

### 4.12.2 Association between interment with meat butchering implements, diet, and cluster in K14

Figure 4.30 shows that there are no individuals of either diet interred with meat butchering implements in the West, and only one individual each in the Centre-East and the Centre-West (both GFS diet followers). In the East, 25% (2/8) of GFS diet followers and 50% (6/12) of GF diet followers are interred with meat butchering implements. Overall, 9% (4/46) of GFS diet followers and 24% (6/25) of GF diet followers are interred with meat butchering implements.

Table 4.30 shows that there is one log-linear model that fits these data; PS+DS. This model says that the relationship between *meat butchering implements and cluster in K14* is independent of diet, and the relationship between *diet and cluster in K14* is independent of interment with meat butchering implements. This model also says that the relationship between *meat butchering implements and diet* depends on cluster in K14. Figure 4.30 illustrates this model.

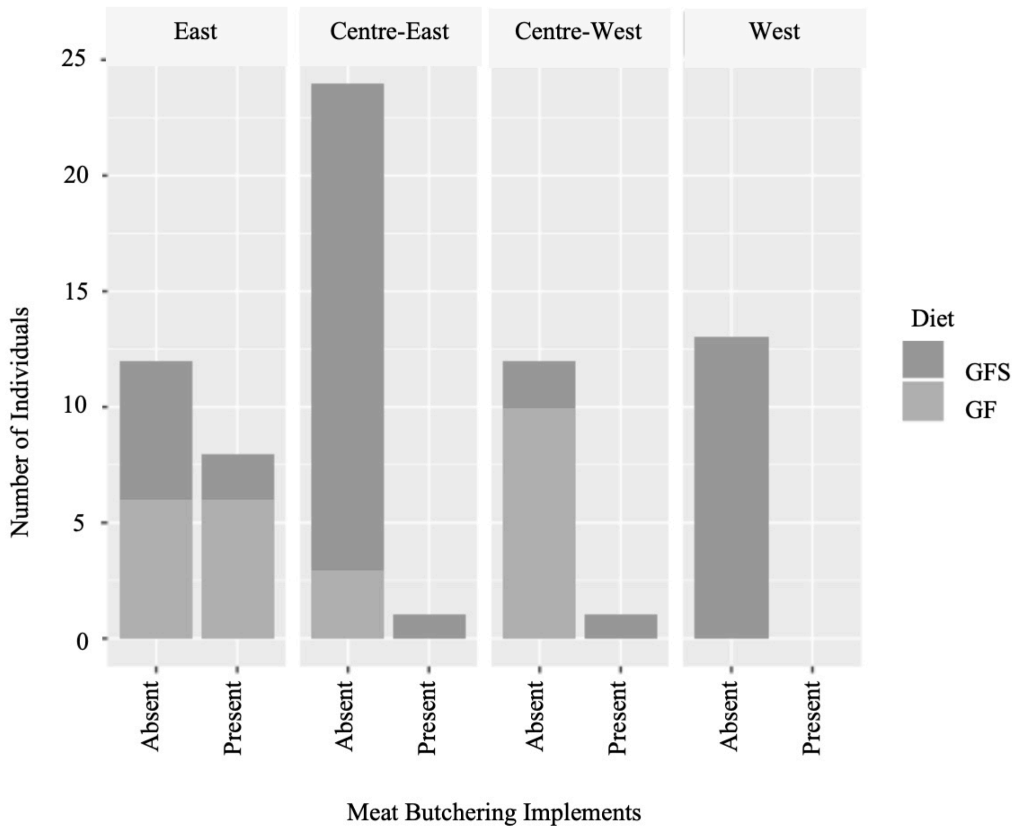


Figure 4.30 Number of individuals of each diet category interred with and without meat butchering implements in each cluster in K14

Table 4.30 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, interment with meat butchering implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| PD+DS+PS | 3 | 4.71 | 0.1941 |
| PD+PS | 6 | 34.60 | 0.0000 |
| PD+DS | 6 | 17.15 | 0.3105 |
| PS+DS | 4 | 4.78 | 0.3105 |
| PD | 9 | 49.96 | 0.0000 |
| PS | 7 | 37.59 | 1.0000 |
| DS | 7 | 20.13 | 0.9947 |
| No Interaction | 10 | 52.94 | 1.0000 |

Legend: P= meat butchering implements, D= diet, S= cluster in K14

### 4.12.3 Association between interment with meat butchering implements, area-of-birth, and cluster in K14

Figure 4.31 shows that there are no individuals interred with meat butchering implements in the Centre-West and West. Only nonlocally-born individuals in the East (50%, 5/10) and one nonlocally-born individual in the Centre-East (out of 10, 10%) are interred with these artifacts. There are no locally-born individuals interred in the East. Overall, there are no locally-born individuals and 18% (6/34) of nonlocally-born individuals interred with these implements. Table 4.31 shows that there is one log-linear model that fits these data; PS+BS. This model says that the relationship between *meat butchering implements and cluster in K14* is independent of area of birth, and the relationship between *area of birth and cluster in K14* is independent of interment with meat butchering implements. This model also says that the relationship between

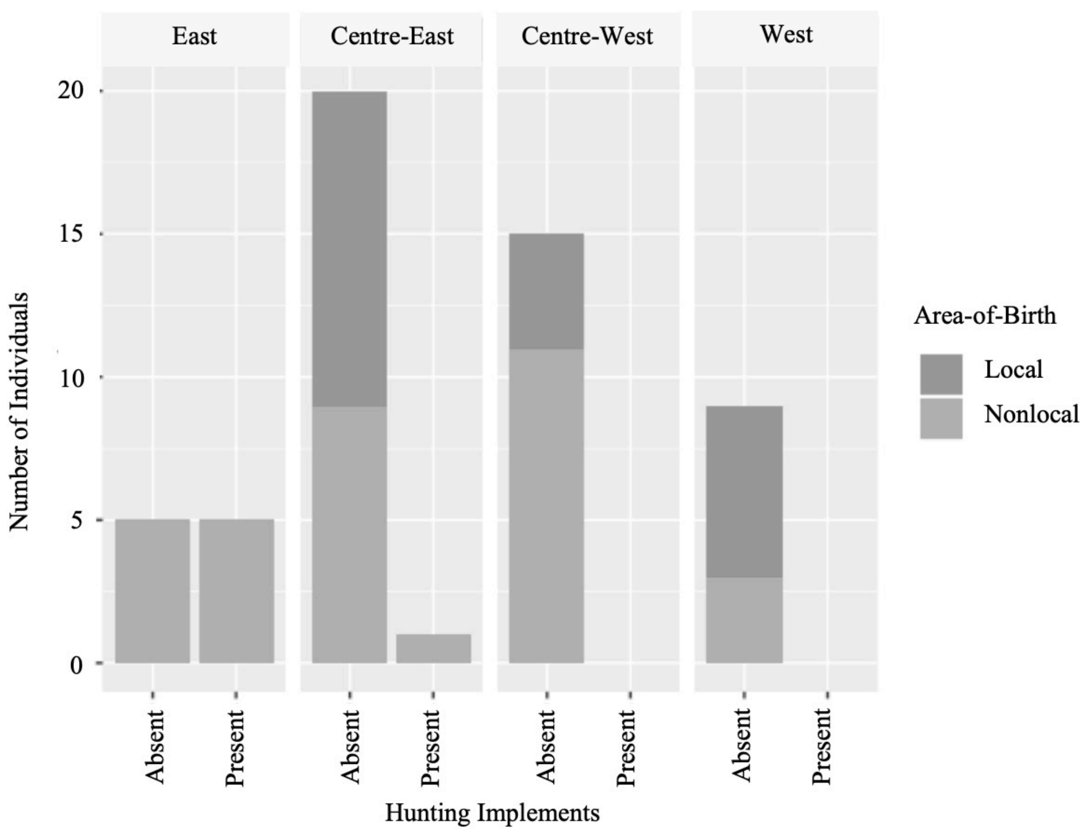


Figure 4.31 Number of individuals of each area-of-birth category interred with and without meat butchering implements in each cluster in K14

Table 4.31 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, interment with meat butchering implements, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| PB+BS+PS | 3 | 0.00 | 1.0000 |
| PB+PS | 6 | 10.54 | 0.1035 |
| PB+BS | 6 | 11.32 | 0.0789 |
| PS+BS | 4 | 1.54 | 0.8197 |
| PB | 9 | 26.55 | 0.0017 |
| PS | 7 | 16.76 | 0.9810 |
| BS | 7 | 17.54 | 0.9858 |
| No Interaction | 10 | 32.77 | 0.9997 |

Legend: P= meat butchering implements, B= area-of-birth, S= cluster in K14

*meat butchering implements and area of birth* depends on cluster in K14. Figure 4.31 illustrates this model.

## 4.13 Fire Use

### 4.13.1 Association between diet, area-of-birth, and fire use

Figure 4.32 shows that 22% (2/9) of GFS-Nonlocals and 26% (6/23) of GF-Nonlocals are

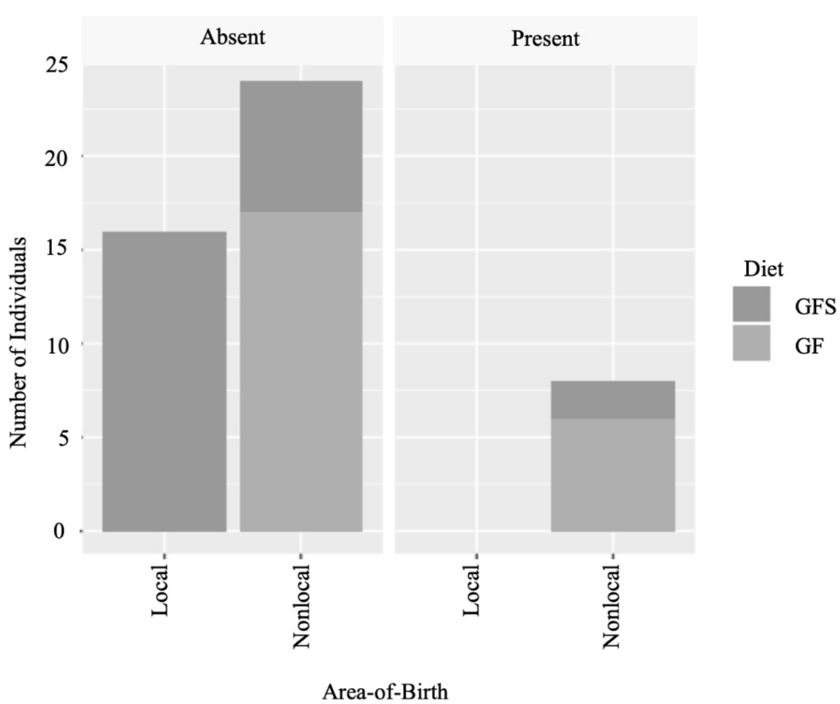


Figure 4.32 Number of individuals of each diet and area-of-birth category affected by fire

affected by fire. There are no fire affected GFS-Locals. Table 4.32 shows that there is one model that fits these data; BD+BF This model says that the relationship between *area-of-birth and diet* is independent of *fire use*, and the relationship between *area-of-birth and fire use* is independent of *diet.* This model also says that the relationship between *diet and fire use* depends on *area-of-birth*. Figure 4.32 illustrates this model.

Table 4.32 Degrees of freedom, deviance, and p-value for each possible log-linear model for variables diet, area-of-birth, and fire use

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DF+BF | 1 | 0.00 | 1.0000 |
| BD+BF | 2 | 0.05 | 0.9742 |
| BD+DF | 2 | 4.40 | 0.1106 |
| BF+DF | 2 | 25.57 | 0.0000 |
| BD | 3 | 7.32 | 0.9375 |
| BF | 3 | 28.49 | 1.0000 |
| DF | 3 | 32.84 | 1.0000 |
| No Interaction | 4 | 35.75 | 1.0000 |

Legend: B= area-of-birth, D= diet, F= fire use

### 4.13.2 Association between fire use, diet, and cluster in K14

Figure 4.33 shows that, in the Centre-East, 27% (6/22) of GFS diet followers and one (out of three, 33%) GF diet follower are affected by fire. Only one GF diet follower (out of 12, 8%) is affected by fire in the East while, in the Centre-West, 40% (4/10) of GF diet followers are. In the West, only GFS diet followers (15%, 2/13) are affected by fire. There are no GF diet followers interred in the West. Overall, 17% (8/46) of GFS diet followers and 24% (6/25) of GF diet followers affected by fire.

Table 4.33 shows that there are two log-linear models that fit these data; FS+DS and DS. The predicted and actual counts of these models (see Table A.33) indicate that FS+DS is a better fit. This model says that the relationship between *fire use and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of fire use, and the relationship between *fire use and diet* depends on cluster in K14. Figure 4.33 illustrates this model.

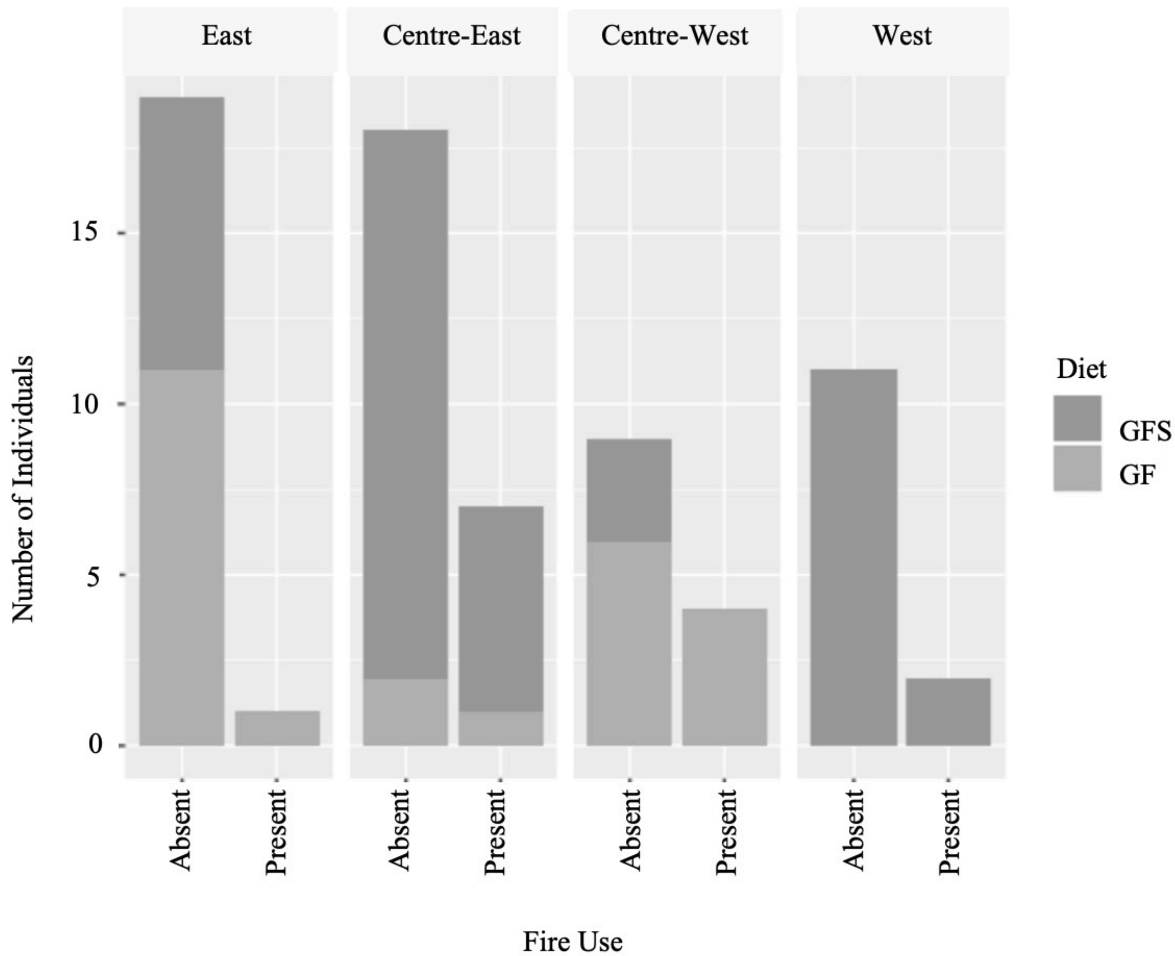


Figure 4.33 Number of individuals of each diet category affected by fire in each cluster in K14

Table 4.33 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, fire use, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| FD+DS+FS | 3 | 1.90 | 0.5930 |
| FD+FS | 6 | 36.06 | 0.0000 |
| FD+DS | 6 | 8.95 | 0.1762 |
| FS+DS | 4 | 3.69 | 0.4494 |
| FD | 9 | 41.76 | 0.0000 |
| FS | 7 | 36.50 | 1.0000 |
| DS | 7 | 9.39 | 0.7742 |
| No Interaction | 10 | 42.20 | 1.0000 |

Legend: F= fire use, D= diet, S= cluster in K14

### 4.13.3 Association between fire use, area-of-birth, and cluster in K14

Figure 4.34 shows that, in the East, only one nonlocally-born individual (out of 10, 10%) is affected by fire and, in the West, only one locally-born individual (out of six, 17%) is affected by fire. There are no locally-born individuals interred in the East. In the Centre-East, only one locally-born individual (out of 11, 9%) and less than half of nonlocally-born individuals (40%, 4/10) are affected by fire. In the Centre-West, most locally-born individuals are affected by fire (75%, 3/4), but less than half of nonlocally-born individuals are affected by fire (45%, 5/11). Overall, 24% (5/21) of locally-born individuals and 29% (10/34) of nonlocally-born individuals are affected by fire.

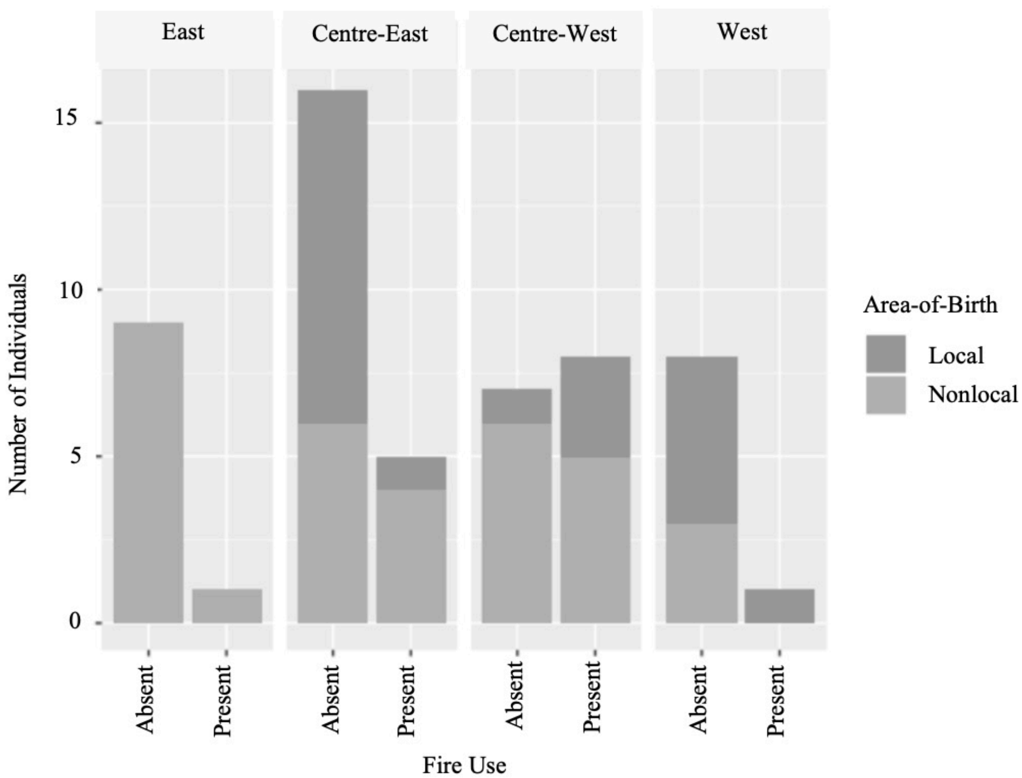


Figure 4.34 Number of individuals of each area-of-birth category affected by fire in each cluster in K14

Table 4.34 shows that there are two possible log-linear models that fit these data; FS+BS and BS. Analysis of the predicted and actual counts of these models suggest that FS+BS fits these data best (see Table A.34). FS+BS says that the relationship between *fire use and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of fire use, and the relationship between *fire use and area-of-birth* depends on cluster in K14. Figure 4.34 illustrates this model.

Table 4.34 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, fire use, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| FB+BS+FS | 3 | 4.74 | 0.1918 |
| FB+FS | 6 | 19.85 | 0.0029 |
| FB+BS | 6 | 12.52 | 0.0513 |
| FS+BS | 4 | 4.83 | 0.3048 |
| FB | 9 | 27.74 | 0.0011 |
| FS | 7 | 20.06 | 0.9946 |
| BS | 7 | 12.73 | 0.9210 |
| No Interaction | 10 | 27.95 | 0.9982 |

Legend: F= fire use, B= area-of-birth, S= cluster in K14

### 4.14 Head Treatment

#### 4.14.1 Association between diet, area-of-birth, and head treatment

Figure 4.35 shows that, of all 16 GFS-Locals, 94% (15) have their skulls articulated and one has their skull dislocated (but present). Out of eight GFS-Nonlocals, 75% (6/8) have their skulls articulated, one has their skull absent, and one has their skull dislocated but present. Of the23 GF-Nonlocals, 65% (15/23) have their skulls articulated, 30% (7/23) have their skulls absent, and one is represented by a skull only. Table 4.35 says that there is one log-linear model

Table 4.35 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and head treatment

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DC+BC | 3 | 0.00 | 1.0000 |
| BD+BC | 6 | 4.25 | 0.6432 |
| BD+DC | 6 | 2.65 | 0.8510 |
| BC+DC | 4 | 23.77 | 0.0001 |
| BD | 9 | 12.86 | 0.1692 |
| BC | 7 | 33.98 | 1.0000 |
| DC | 7 | 32.38 | 1.0000 |
| No Interaction | 10 | 42.59 | 1.0000 |

Legend: B= area-of-birth, D= diet, C= head treatment that fits these data; BD+DC. This model says that the relationship between *area-of-birth and diet* is independent of head treatment, *diet and head treatment* is independent of area-of-birth, and the relationship between *area-of-birth and head treatment* depends on diet. Figure 4.35 illustrates this model

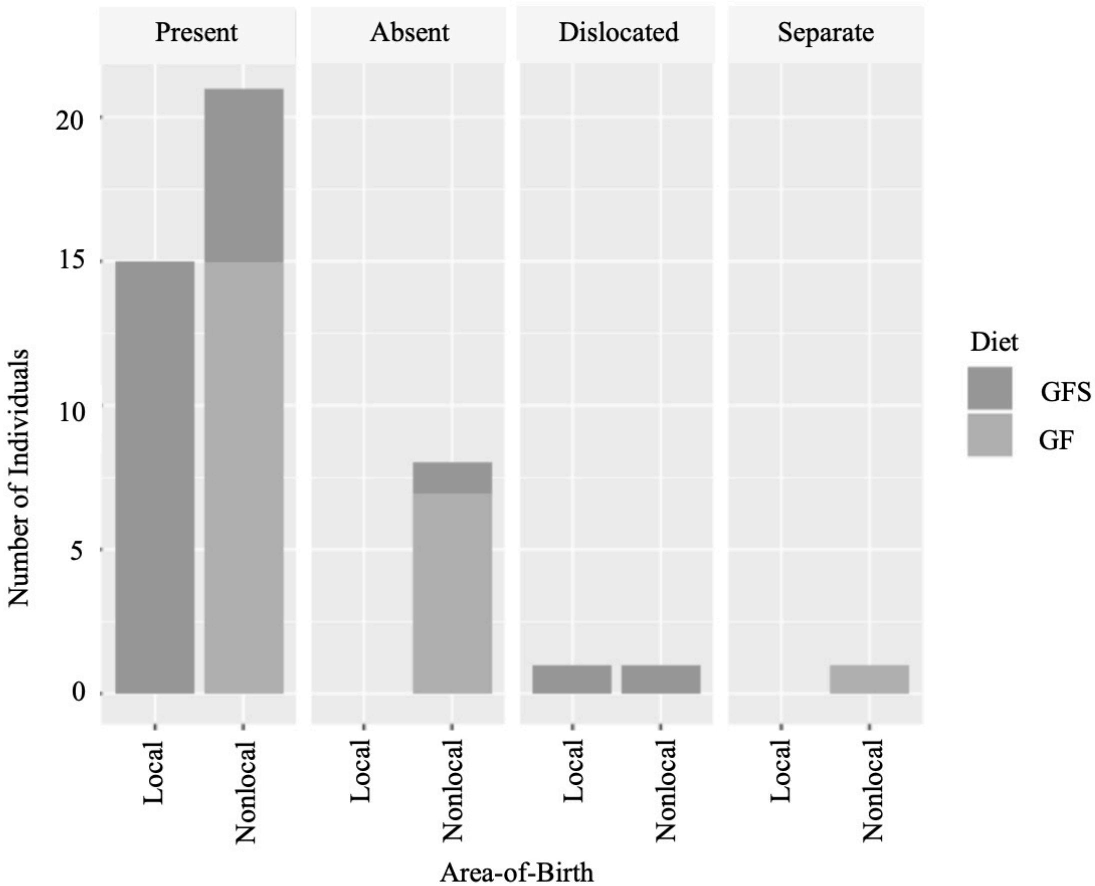


Figure 4.35 Number of individuals of each diet and area-of-birth category with their heads present (articulated), absent, dislocated, and separate

#### 4.14.2 Association between head treatment, diet, and cluster in K14

Figure 4.36 shows that, in the East, 75% (6/8) of GFS diet followers and 58% (7/12) of GF diet followers do not have their skulls present. In the Centre-East and West, only one (out of 22, 5%) and 17% (2/12), respectively, of GFS diet followers, do not have their skulls. There are no GF diet followers interred in the West. In both the East and Centre-East, only one individual, in each case a GF diet follower, is a separate skull interment only. Also, in the Centre-East, only 9% (2/22) of GFS diet followers are interred with their skulls dislocated but present. All individuals in the Centre-West are interred with their skulls articulated. Overall, 24% (11/46) of GFS diet followers and 36% (9/25) of GF diet followers have their skulls either absent, dislocated, or are represented by a skull only.

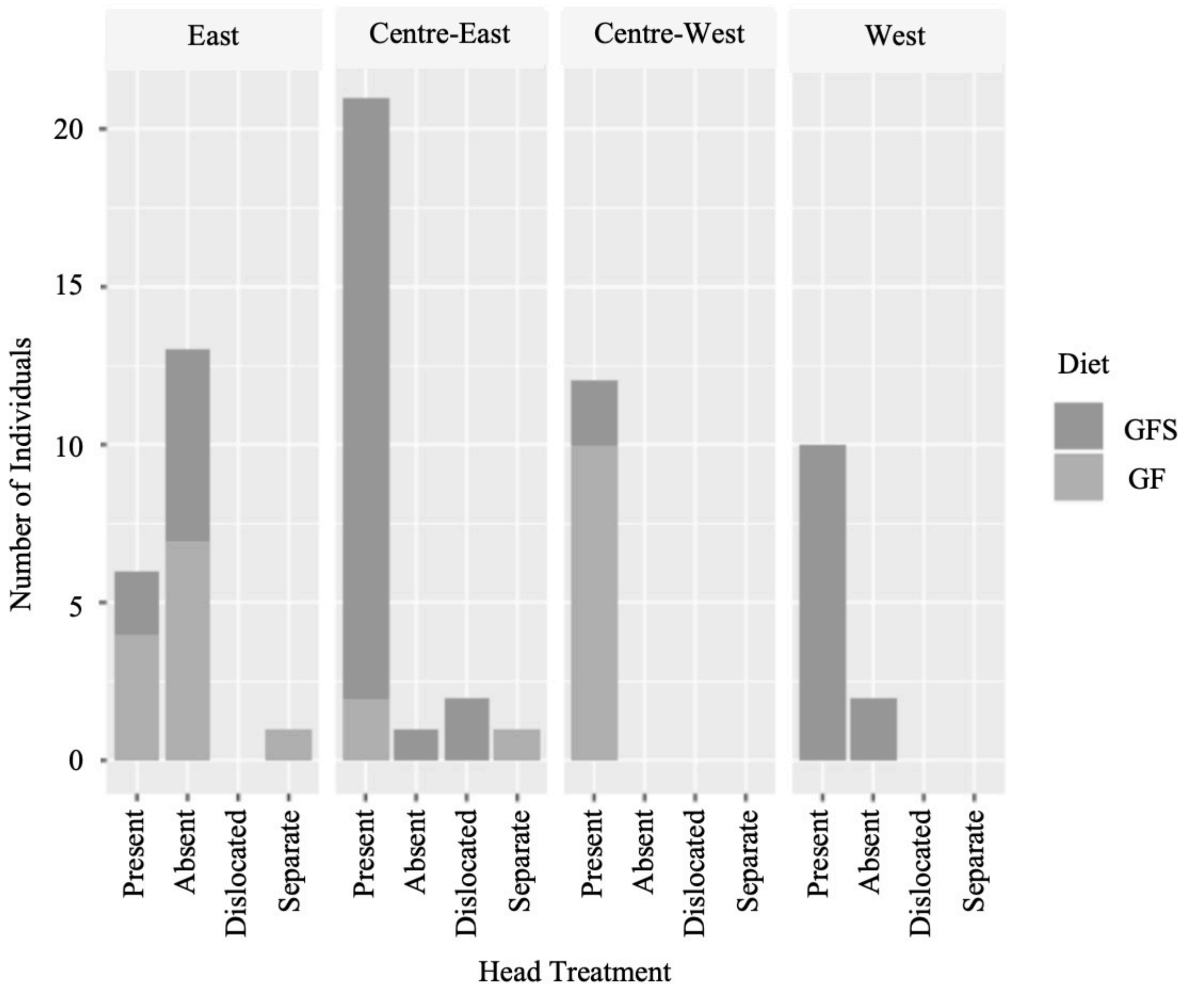


Figure 4.36 Number of individuals of each diet category with their heads articulated, absent, present but dislocated, and separate in each cluster of K14

Table 4.36 says that there is one log-linear model that fits these data; HS+DS. This model says that the relationship between *head treatment and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of head treatment, and the relationship between *head treatment and diet* depends on cluster in K14. Figure 4.36 illustrates this model.

Table 4.36 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, head treatment, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| HD+DS+HS | 9 | 0.11 | 1.0000 |
| HD+HS | 12 | 34.84 | 0.0006 |
| HD+DS | 18 | 35.84 | 0.0074 |
| HS+DS | 12 | 6.48 | 0.8903 |
| HD | 21 | 70.12 | 0.0000 |
| HS | 15 | 40.75 | 0.9997 |
| DS | 21 | 42.36 | 0.9962 |
| No Interaction | 24 | 76.64 | 1.0000 |

Legend: H= head treatment, D= diet, S= cluster in K14

### 4.14.3 Association between head treatment, area-of-birth, and cluster in K14

Figure 4.37 shows that, with one exception, all individuals (locally-born and nonlocally

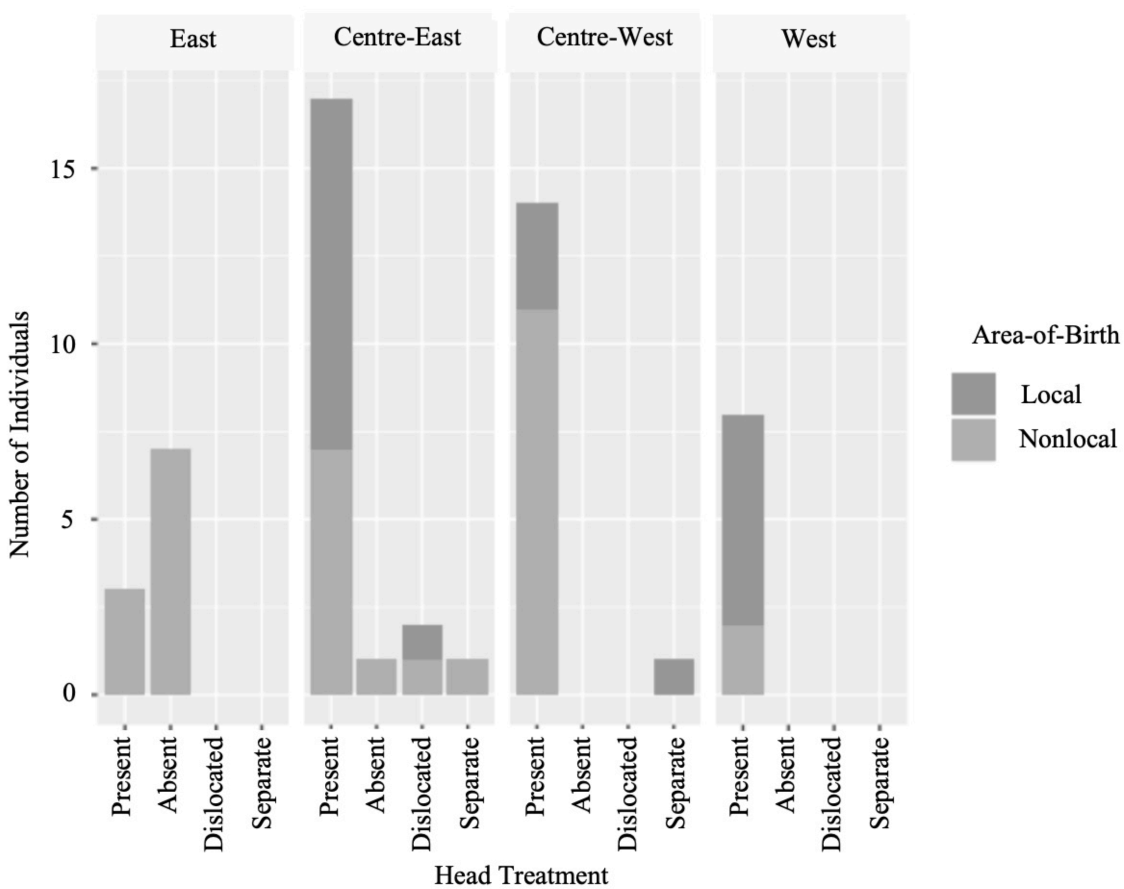


Figure 4.37 Number of locally and nonlocally-born individuals with their skulls articulated, absent, dislocated but present, or separate in each cluster in K14

-born) in the Centre-West and West are interred with their skulls articulated. The one exception is a locally-born individual in the Centre-West who is represented by a skull only. In the East, 70% (7/10) of nonlocally-born individuals are interred without their skulls, and the other 30% (3/10) are interred with their skulls articulated. There are no locally-born individuals interred in the East. In the Centre-East, one nonlocally-born individual (out of 10, 10%) is interred without their skull, and another (1/10, 10%) is interred as a separate skull only. Also, in the Centre-East, those with their skulls dislocated but present are represented by one locally-born (out of 11, 9%) and one nonlocally-born (out of 10, 10%) individual. Overall, 10% (2/21) of locally-born individuals and 29% (10/34) of nonlocally-born individuals have their skulls either absent, dislocated, or are represented by a skull only.

Table 4.37 shows that there is one possible log-linear model that fits these data; HS+BS. This model says that the relationship between *head treatment and cluster in K14* is independent of area-of-birth, the relationship between *area-of-birth and cluster in K14* is independent of head treatment, and the relationship between *head treatment and area-of-birth* depends on cluster in K14. Figure 4.37 illustrates this model.

Table 4.37 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, head treatment, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| HB+BS+HS | 9 | 4.47 | 0.8779 |
| HB+HS | 12 | 14.04 | 0.2985 |
| HB+BS | 18 | 27.02 | 0.0786 |
| HS+BS | 12 | 6.11 | 0.9106 |
| HB | 21 | 43.73 | 0.0025 |
| HS | 15 | 22.82 | 0.9119 |
| BS | 21 | 35.80 | 0.9770 |
| No Interaction | 24 | 52.51 | 0.9993 |

Legend: H= head treatment, B= area-of-birth, S= cluster in K14

## 4.15 Grave Disturbance

### 4.15.1 Association Between Diet, Area-of-Birth, and Grave Disturbance

Figure 4.38 shows that all GFS-Locals are in undisturbed graves. One GFS-Nonlocal is interred in a moderately disturbed grave (out of six, 17%), and the rest (83%, 5/6) are undisturbed. For GF-Nonlocals, 26% (5/19) are interred in extensively disturbed graves, 21% (4/19) are interred in moderately disturbed graves, and 53% (10/19) are undisturbed. Overall, 47% (9/19) of GF-Nonlocals are disturbed. There are less individuals in this analysis because those with 'inconclusive' grave disturbance are excluded.

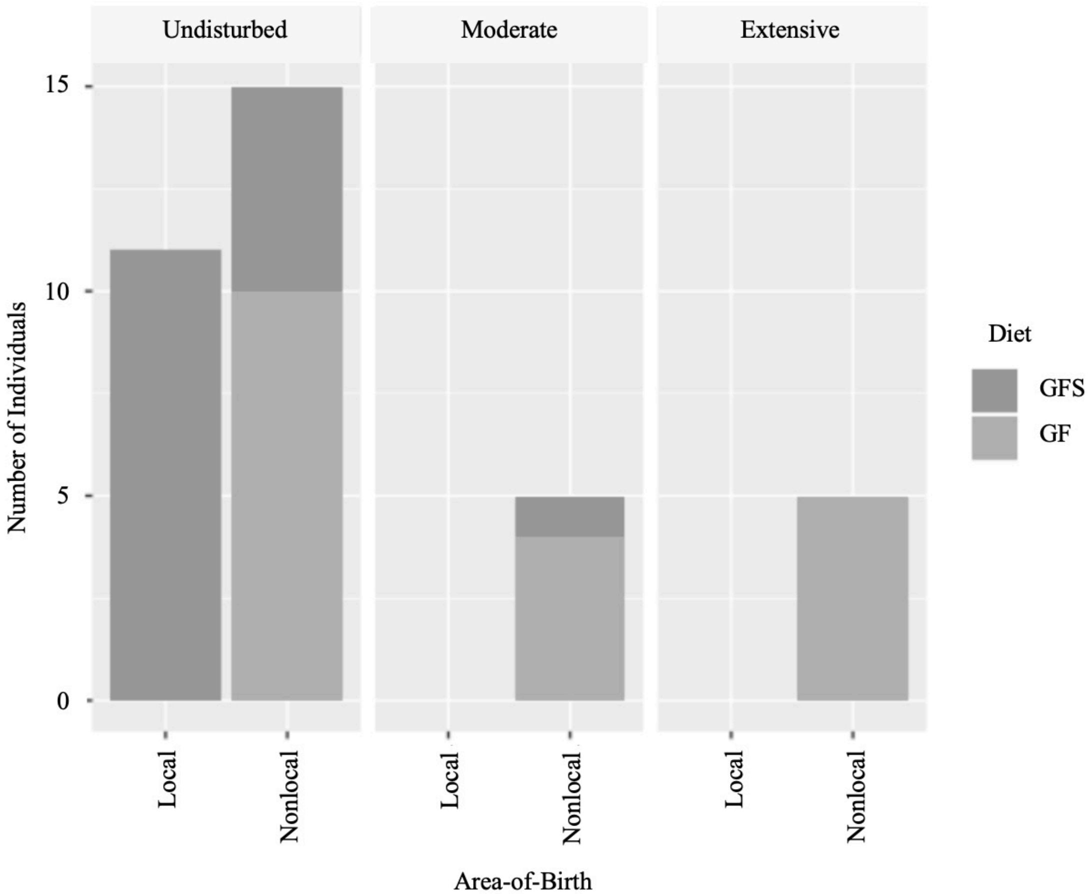


Figure 4.38 Number of individuals of each diet and area-of-birth category in undisturbed, moderately disturbed, and extensively disturbed graves

Table 4.38 shows us that there is one log-linear model that fits these data; BD+DG. This model says that the relationship between *area-of-birth and diet* is independent of grave disturbance, the relationship between *diet and grave disturbance* is independent of area-of-birth, and the relationship between *area-of-birth and grave disturbance* depends on diet. Figure 4.38 illustrates this model.

Table 4.38 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and grave disturbance

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DG+BG | 2 | 0.00 | 1.0000 |
| BD+BG | 4 | 3.45 | 0.4848 |
| BD+DG | 4 | 2.20 | 0.6991 |
| BG+DG | 3 | 15.55 | 0.0014 |
| BD | 6 | 12.34 | 0.0547 |
| BG | 5 | 25.70 | 0.9999 |
| DG | 5 | 24.44 | 0.9998 |
| No Interaction | 7 | 34.59 | 1.0000 |

Legend: B= area-of-birth, D= diet, G= grave disturbance

### 4.15.2 Association between grave disturbance, diet, and cluster in K14

Figure 4.39 shows that, for GFS diet followers in the East, 75% (6/8) are moderately

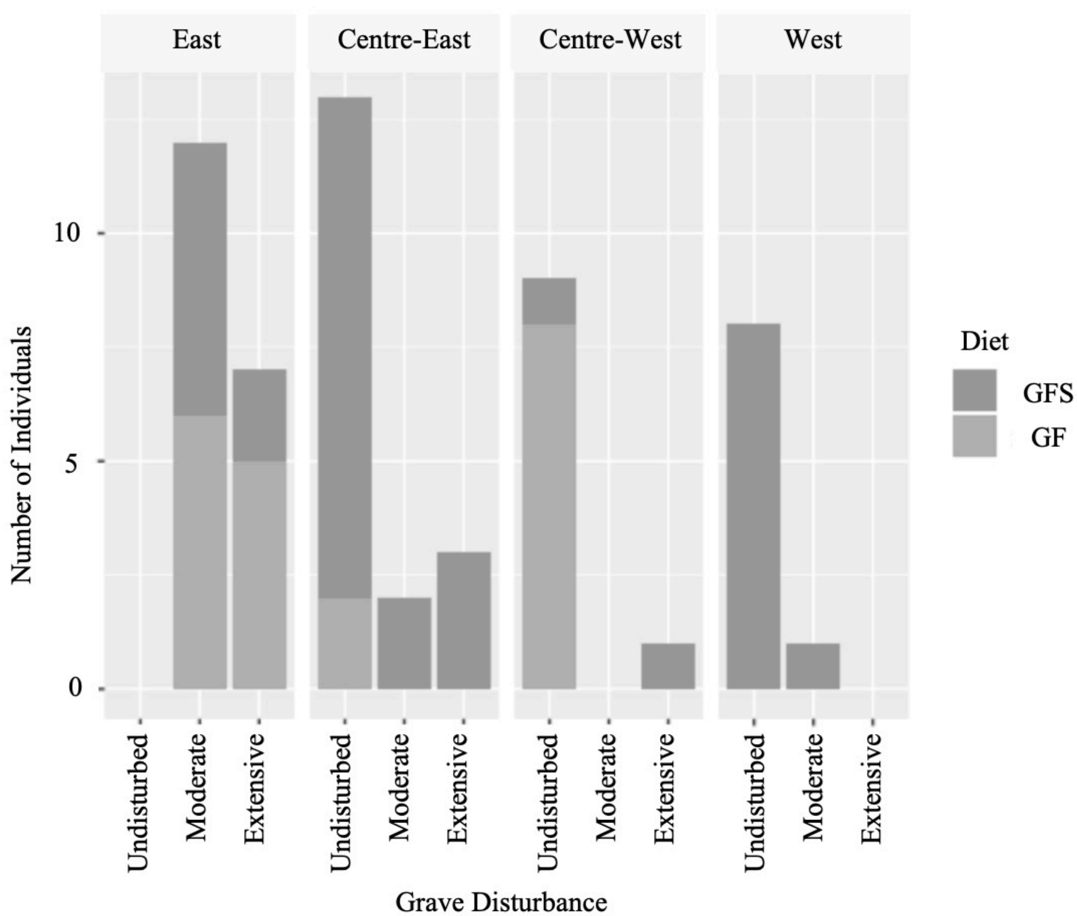


Figure 4.39 Number of individuals of each diet category in undisturbed, moderately disturbed, and extensively disturbed graves in each cluster in K14

disturbed and 25% (2/8) are extensively disturbed. For GF diet followers in the East, 55% (6/11) are moderately disturbed and 45% (5/11) are extensively disturbed. In the Centre-East, only the graves of GFS diet followers in this cluster are disturbed. Of these individuals, 13% (2/16) are moderately disturbed and 19% (3/16) are extensively disturbed. In the Centre-West, the grave of one GFS diet follower (out of two, 50%) is extensively disturbed. This is the only instance of grave disturbance among those with diet data in the Centre-West. In the West, only GFS diet followers are present. The grave of one individual (out of nine, 11%) is moderately disturbed, and the other eight (89%) are undisturbed. Overall, the graves of 43% (15/35) of GFS diet followers and 44% (11/25) of GF diet followers are disturbed.

Table 4.39 says that there is one log-linear model that fits these data; GS+DS. This model says that the relationship between *grave disturbance and cluster of K14* is independent of diet, the relationship between *diet and cluster of K14* is independent of grave disturbance, and the relationship between *grave disturbance and diet* depends on cluster of K14. Figure 4.39 illustrates this model.

Table 4.39 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, grave disturbance, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| GD+DS+GS | 6 | 0.00 | 1.0000 |
| GD+GS | 9 | 31.09 | 0.0003 |
| GD+DS | 12 | 52.40 | 0.0000 |
| GS+DS | 8 | 5.98 | 0.6498 |
| GD | 15 | 78.07 | 0.0000 |
| GS | 11 | 31.64 | 0.9991 |
| DS | 14 | 52.96 | 1.0000 |
| No Interaction | 17 | 78.63 | 1.0000 |

Legend: G= grave disturbance, D= diet, S= cluster in K14

### 4.15.3 Association between grave disturbance, area-of-birth, and cluster in K14

Figure 4.40 shows similar patterns as Figure 28 above; however, throughout K14, only the graves of nonlocally-born individuals are moderately or extensively disturbed. Out of the nine nonlocally-born individuals interred in the East, 44% (4/9) are in moderately disturbed graves and 56% (5/9) are in extensively disturbed graves. Out of the seven nonlocally-born

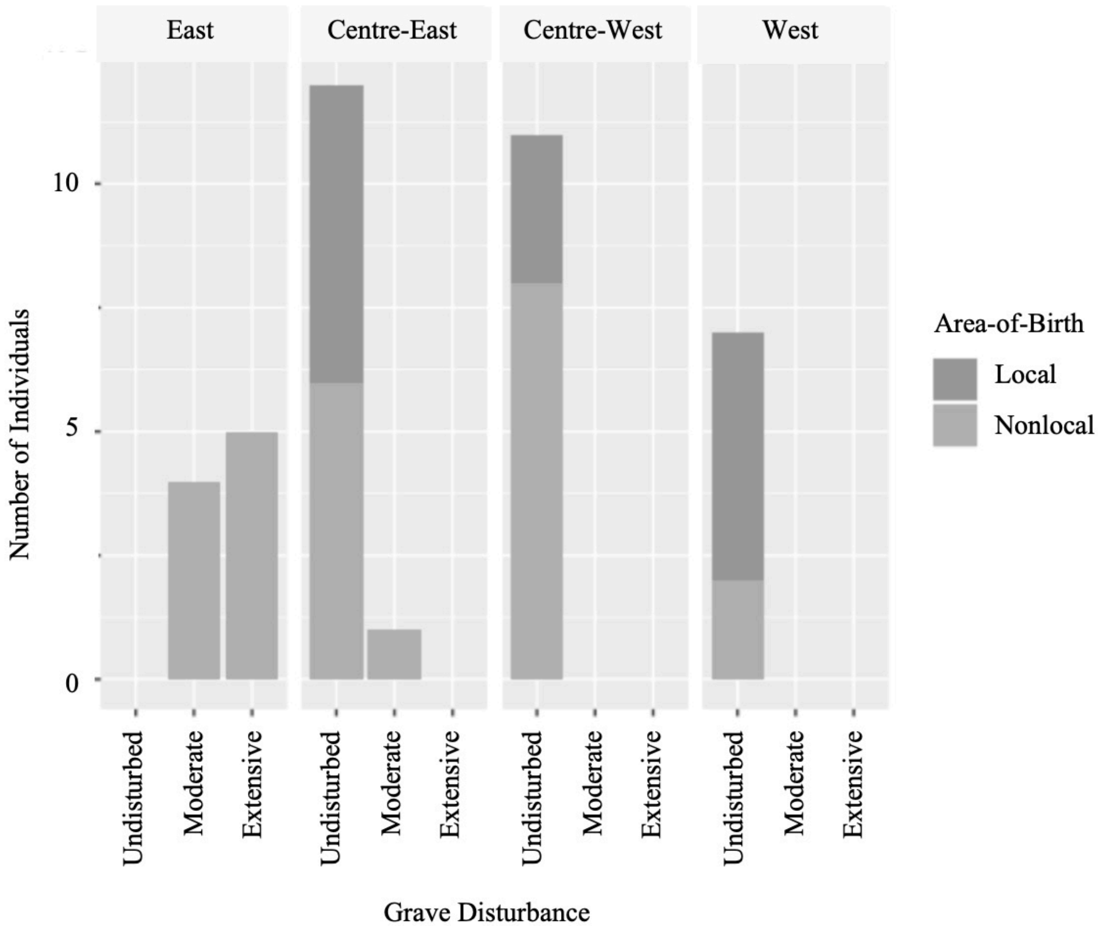


Figure 4.40 Number of individuals of each area-of-birth category in undisturbed, moderately disturbed, or extensively disturbed graves in each cluster in K14

individuals interred in the Centre-East, the grave of one is moderately disturbed grave, and 86% (6/7) are undisturbed. No individuals are disturbed in the Centre-West or West. Overall, the graves of no locally-born individuals and 29% (10/34) of nonlocally-born individuals are disturbed.

Table 4.40 shows that there are two models that fit these data; GB+GS and GS+BS. The predicted and actual counts for these models (see Table A.40) indicate that GB+GS is a better fit. This model says that the relationship between *grave disturbance and area-of-birth* is independent of cluster in K14, the relationship between *grave disturbance and cluster in K14* is independent of area-of-birth, and the relationship between *area-of-birth and cluster in K14* depends on grave disturbance. Figure 4.40 illustrates this model.

Table 4.40 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, grave disturbance, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| GB+BS+GS | 6 | 0.00 | 1.0000 |
| GB+GS | 9 | 3.55 | 0.9383 |
| GB+BS | 12 | 30.40 | 0.0024 |
| GS+BS | 8 | 1.31 | 0.9954 |
| GB | 15 | 42.99 | 0.0002 |
| GS | 11 | 13.89 | 0.7611 |
| BS | 14 | 40.74 | 0.9998 |
| No Interaction | 17 | 53.33 | 1.0000 |

Legend: G= grave disturbance, B= area-of-birth, S= cluster in K14

## 4.16 Grave pit lining

### 4.16.1 Association between diet, area-of-birth, and grave pit lining

Figure 4.41 shows that 13% (3/23) of GF-Nonlocals, 25% (4/16) of GFS-Locals, and no (out of nine) GFS-Nonlocals are interred in unlined graves. Table 4.41 shows that there is one log-linear model that fits these data, BD+BL. This model says that the relationship between

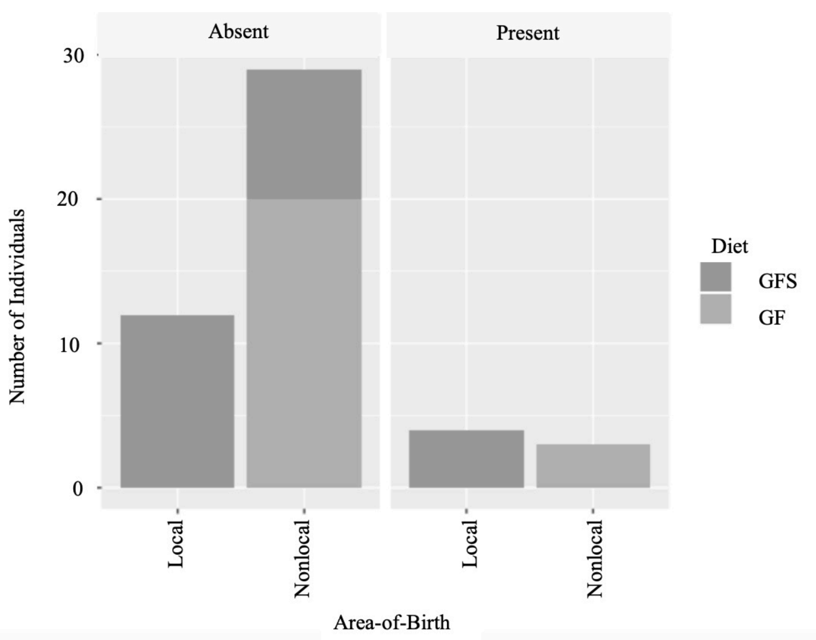


Figure 4.41 Number of individuals of each diet and area-of-birth category interred in lined and unlined graves

*area- of-birth and diet* is independent of grave pit lining, the relationship between *area-of-birth* *and grave pit lining* is independent of diet, and the relationship between *diet and grave pit lining* depends on area-of-birth. Figure 4.41 illustrates this model.

Table 4.41 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, area-of-birth, and grave pit lining

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| BD+DL+BL | 1 | 0.00 | 1.0000 |
| BD+BL | 2 | 2.10 | 0.3499 |
| BD+DL | 2 | 3.99 | 0.1361 |
| BL+DL | 2 | 30.45 | 0.0000 |
| BD | 3 | 4.07 | 0.2537 |
| BL | 3 | 30.53 | 1.0000 |
| DL | 3 | 32.42 | 1.0000 |
| No Interaction | 4 | 32.51 | 1.0000 |

Legend: B= area-of-birth, D= diet, L= grave pit lining

**4.16.2 Association between grave pit lining, diet, and cluster in K14**

Figure 4.42 shows that the graves of 75% (6/8) of GFS diet followers and 75% (9/12) of GF diet followers in the East are lined. All graves of individuals of both diets, except for one GFS diet follower in each the Centre-East (out of 22, 5%) and Centre-West (out of two, 50%), are lined. In the West, the graves of 46% (6/13) of GFS diet followers are lined. There are no GF diet followers interred in the West. Overall, the graves of 74% (34/46) of GFS diet followers and 88% (22/25) of GF diet followers are lined. Table 4.42 shows

Table 4.42 Degrees of freedom, deviance, and p-values for each log-linear model for variables diet, grave pit lining, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| LD+DS+LS | 3 | 3.58 | 0.3108 |
| LD+LS | 6 | 37.88 | 0.0000 |
| LD+DS | 6 | 17.05 | 0.0091 |
| LS+DS | 4 | 4.37 | 0.3579 |
| LD | 9 | 52.22 | 0.0000 |
| LS | 7 | 39.54 | 1.0000 |
| DS | 7 | 18.71 | 0.9909 |
| No Interaction | 10 | 53.88 | 1.0000 |

Legend: L= grave pit lining, D= diet, S= cluster in K14 that there is one possible log-linear model, LS+DS. This model says that the relationship between *grave pit lining and cluster in K14* is independent of diet, the relationship between *diet and cluster in K14* is independent of grave pit lining, and the relationship between *grave pit lining and diet* depends on cluster in K14. Figure 4.42 illustrates this model.

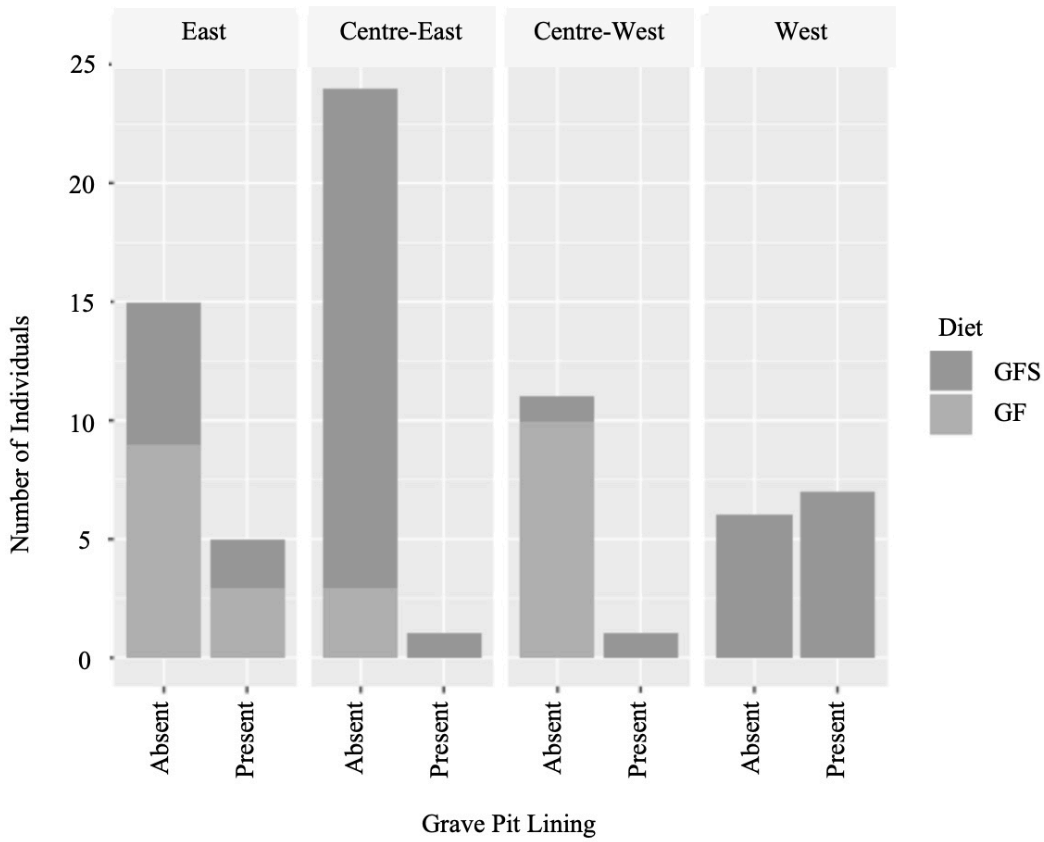


Figure 4.42 Number of individuals of each diet category interred in lined and unlined graves in each cluster in K14

### 4.16.3 Association between grave pit lining, area-of-birth, and cluster in K14

Figure 4.43 shows that all nonlocally-born individuals in all clusters are interred in lined graves, with the exception of three (out of 10, 30%) in the East. For locally-born individuals, 81% (9/11) in the Centre-East and 75% (3/4) in the Centre-West are interred in lined graves. In the West, half of all locally-born individuals are interred in lined graves (50%, 3/6). There are no locally-born individuals in the East. Overall, 71% (15/21) of locally-born individuals and 91% (31/34) of nonlocally-born individuals are interred in lined graves.

Table 4.43 shows that there is one log-linear model that fits these data, LB+BS. This model says that the relationship between *grave pit lining and area-of-birth* is independent of cluster in K14, the relationship between *area-of-birth and cluster in K14* is independent of grave pit lining, and the relationship between *grave pit lining and cluster in K14* depends on area-of-birth. Figure 4.43 illustrates this model.

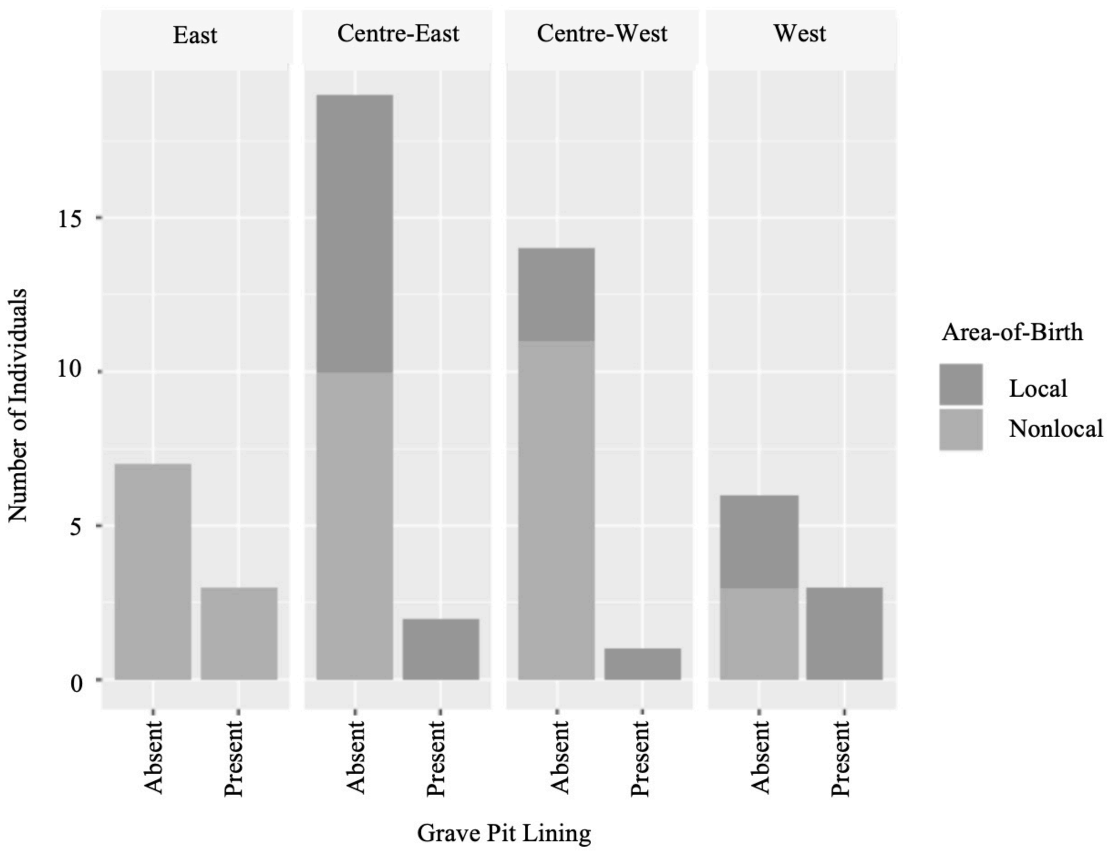


Figure 4.43 Number of individuals of each area-of-birth category interred in lined and unlined graves in each cluster in K14

Table 4.43 Degrees of freedom, deviance, and p-values for each log-linear model for variables area-of-birth, grave pit lining, and cluster in K14

| | Df | Deviance | p-value |
|---|---|---|---|
| Saturated | 0 | 0.00 | 0.0000 |
| LB+BS+LS | 3 | 0.00 | 1.0000 |
| LB+LS | 6 | 20.39 | 0.0024 |
| LB+BS | 6 | 9.96 | 0.1265 |
| LS+BS | 4 | 8.77 | 0.0672 |
| LB | 9 | 25.18 | 0.0028 |
| LS | 7 | 23.99 | 0.9989 |
| BS | 7 | 13.56 | 0.9404 |
| No Interaction | 10 | 28.78 | 0.9986 |

Legend: L= grave pit lining, B= area-of-birth, S= cluster in K14

### 4.17 Chapter Summary

Using log-linear models, the following statistical relationships were observed (Table 4.44). While the relationship between diet and area-of-birth does not depend on any other variable tested (seen in the inclusion of BD or DB in all log-linear models that included these two variables), diet and area-birth related to different mortuary variables separately. For example, diet is related to area-of-birth (Section 4.11), red deer canine pendants (Section 4.4.1), wood working implements (Section 4.8.1), head treatment (Section 4.13.1), and grave disturbance (Section 4.14.1). This is evidenced by the lack of relationship between area-of-birth (B) and the mortuary variables in the log linear model itself (BR, BW, BC, BG, respectively). Instead, there are relationships between diet (D) and area-of-birth (B), and diet (D) and the mortuary variable. The relationships between area-of-birth and these mortuary variables changes for each diet (GFS or GF).

Area-of-birth is related to diet (Section 4.1.1), ornaments (Section 4.3.1), lithic arrowheads (Section 4.7.1), meat butchering (Section 4.11.1), fire use (Section 4.12.1), and grave pit lining (Section 4.15.1). This is evidenced by the lack of relationship between diet (D) and these mortuary variables in the model itself (DO, DA, DP, DF, DL, respectively). Instead, there are relationships between area-of-birth (B) and diet (D), and area-of-birth (B) and the mortuary variables. The relationship between diet and these variables depends on area-of-birth in this instance. Interestingly, interment with implements (Section 4.2.1), kaolinite cylindrical beads (Section 4.5.1), nephrite (Section 4.6.1), hide working implements (Section 4.9.1), and hunting implements (Section 4.10.1) are not strongly related to either diet or area-of-birth. This is evidenced by the fact that there are two log-linear models which fit these data equally well, and as mentioned in Section 3.8, the existence of multiple models of equally good fits indicates either a lack of clear relationship or the existence of more than one relationship between these data.

Many of the relationships summarized above changed depending on cluster in K14. This is because in these models, there is no relationship between either diet (D) or area-of-birth (B) and the mortuary variable in the model itself. Instead, there are relationships between the variable and cluster (S), and cluster (S) and diet (D), and the variable and cluster (S), and area-of-birth (B) and cluster (S). The relationship between diet, area-of-birth, and the mortuary variables depends on cluster in K14. Therefore, since cluster in K14 (S) is in all these models, it has a stronger relationship to these variables than either diet or area-of-birth does. Interestingly, grave disturbance is equally related to area-of-birth and cluster in K14 because the model that fit these data include the relationship between area-of-birth (B) and grave disturbance (G), as well as the relationship between cluster in K14 (S) and grave disturbance (G) (see Section 4.14.3).

Table 4.44 Mortuary Variables Associated with diet, area-of-birth, both diet and area-of-birth, and cluster in K14

| | Mortuary Variable |
|---|---|
| Diet | Area-of-birth, red deer canine pendants, wood working implements, head treatment, grave disturbance |
| Area-of-birth | Diet, ornaments, lithic arrowheads, meat butchering implements, fire use, grave pit lining |
| Diet and Area-of-birth | Implements, kaolinite cylindrical beads, nephrite, hide working implements, hunting implements |
| Cluster in K14 | Diet, area-of-birth, implements, ornaments, red deer canine pendants, kaolinite cylindrical beads, nephrite, lithic arrowheads, wood working implements, hide working implements, hunting implements, meat butchering implements, fire use, head treatment, grave disturbance, and grave pit lining |

To summarize, this chapter highlights three main results. First, diet and area-of-birth are always related to one another, but never to the same mortuary treatment variables. Second, cluster in K14 changed many of the relationships observed when just diet and area-of-birth were analyzed, except for the relationship between diet and area-of-birth. Third, there are multiple group and individual identities simultaneously expressed through mortuary treatment at K14. The next chapter discusses how these results further our understanding of mortuary treatment at K14.

# CHAPTER 5: DISCUSSION

## 5.1 Introduction

Using log-linear models, I found that there are multiple factors that influenced mortuary treatment at K14 that are represented simultaneously. In addition to individual diet and area-of-birth influences, as evidenced by their separate relationships with mortuary variables, there also appear to be group influences that are evidenced by the four main spatial clusters in K14. And all of these distinct identities are embedded into a larger Glazkovo cultural identity through their joint interment in a Glazkovo cemetery. This chapter presents evidence from the previous chapter of these identities and their overlapping nature and discusses what this can mean for understanding K14 and the people interred there.

Before discussing the results, there are several caveats to the data that must be kept in mind. First, not all K14 individuals are included due to preservation issues precluding biogeochemical analysis. This also means that what is found to be associated with a combined diet and area-of-birth group may not be when those with just diet or just area-of-birth data are considered since the differences in group size may lead to different patterns. Second, a substantial number of individuals do not have age-at-death or sex data. It is possible that many of the observed variabilities in mortuary treatment that were unable to be explained by diet, area-of-birth, or cluster in K14, might be understood if these missing data were available. Third, the disturbances in the East lead to numerous artifacts found in the upper levels of those graves that were excluded from this analysis due to their lack of clear and direct association with the interred individual. It is unclear if and when these artifacts were added and/or left behind after the disturbance event.

It must also be noted that these cluster divisions in K14 are based on patterns observed through archaeological data (i.e., mortuary treatment), biological data, and biogeochemical data, and may not reflect the intentions behind the interment of these individuals, or social groups. In other words, the meaning behind the reactions to death on behalf of the surviving EBA individuals may not be accurately reflected within the archaeological record. However, this should not prevent academic inquiry into any possible explanations to these cluster divisions. Finally, future detailed chronological analysis of K14 using the updated radiocarbon dates will likely provide further information on the formation of the four sectors of the cemetery. With these limitations in mind, many new observations about mortuary treatment at K14 were made.

**5.2 Discussion**

The first of the numerous factors represented through mortuary treatment at K14 are those related to diet and to area-of-birth. This research found that diet and area-of-birth are always related to one another, independent of a third variable, even when cluster in K14 is considered. This is interesting since mortuary treatment and cluster in K14 almost certainly represent social groups (McKenzie 2010a), so the fact that diet and area-of-birth are always related to one another regardless of cluster indicates that the relationship between these two variables does not change regardless of other social groups or identities.

However, as shown in the previous chapter, diet and area-of-birth are not identically related to the same mortuary variables, despite their close and unchanging relationship. Therefore, diet and area-of-birth have different mortuary influences from one another, and perhaps in addition to discussing GFS-Local, GFS-Nonlocal, and GF-Nonlocal 'groups', it may also be necessary to discuss how the two diets and two areas-of-birth also influence mortuary treatment. For example, when diet and area-of-birth are tested against a third mortuary variable, the relationships between diet and each of five different variables (cluster in K14, red deer canine pendants, wood working implements, head treatment, and grave disturbance) is independent of area-of-birth. When diet and cluster in K14 are considered (separately from area-of-birth), the relationship between these variables (i.e. red deer canine pendants, wood working implements, head treatment, and grave disturbance), and cluster in K14 is independent of diet, and the relationship between these variables and diet depends on cluster in K14. This means that when the cemetery is considered as a whole, interment with red deer canine pendants, wood working implements, head treatment, and grave disturbance is influenced by diet. However, when cluster in K14 is included, these mortuary variables are influenced by cluster in K14, as the relationship between diet and these variables (mentioned above) changes depending on cluster in K14. In other words, these variables are influenced by both diet and cluster in ways that are difficult to tease apart. This also means that the relationship between diet and these variables is not as strong as the relationship between these variables (mentioned above) and cluster in K14 (because otherwise they would have shown up in these models), but there is still a relationship.

GF diet followers throughout K14 as a whole are most frequently interred with red deer canine pendants and wood working implements (in comparison to GFS diet followers) which could indicate a relationship between these artifacts and those individuals that followed the GF diet. These data also suggest that GF diet followers were more likely to be subject to additional (fire use) and secondary (head treatment) mortuary treatment than those following the GFS diet. Furthermore, their more frequent interment with wood working implements may reflect their workload during life. Interestingly, grave disturbance is almost equally frequent for individuals of both diets. However, as Section 5.3 shows, these relationships change depending on cluster in K14, which indicates that there are influential factors about both diets being simultaneously expressed with other group influences that only partially overlap each other.

A similar conclusion can be drawn from the relationships with area-of-birth. Area-of-birth, when tested with diet and a third mortuary variable, is related to ornaments, lithic arrowheads, meat butchering implements, fire use, and grave pit lining, independent of diet. When area-of-birth and cluster in K14 are considered (separately from diet), the relationship between these mortuary variables and area-of-birth is dependent on cluster in K14, and the relationship between these mortuary variables and cluster in K14 is independent of area-of-birth. This means that the relationship between area-of-birth and these mortuary variables are not as strong as the relationship between these variables and cluster in K14 (because otherwise they would have shown up in the models), but there is still a relationship. Therefore, it is likely meaningful that these mortuary variables are most frequently observed with nonlocally-born individuals, with the exception of ornaments which are most frequently observed with locally-born individuals. This indicates that there likely are locally-born based mortuary influences that would lead to their more frequent interment with ornaments, and nonlocally-born identities that would lead to additional (fire use and stone lined grave pits) mortuary treatment. Also, their more frequent interment with meat butchering implements may reflect their workload during life.

Grave disturbance is one variable that does not fit into these patterns. When tested with diet and area-of-birth, it was related to diet, and the relationship between disturbance and area-of-birth changed depending on diet (Section 4.15.1). However, when tested with diet and cluster in K14, it was related to cluster in K14 and the relationship with diet changed depending on cluster in K14 (Section 4.15.2). When tested with area-of-birth and cluster in K14, grave disturbance was related to both area-of-birth and cluster in K14 (Section 4.15.3). Interestingly, this model (GB+GS, Section 4.15.3) also said that the relationship between area-of-birth and cluster in K14 depended on grave disturbance (since the variables BS are not in this model and are therefore dependent on variable G). As mentioned earlier, grave disturbance is almost equally frequent among individuals of both diets; however, only the graves of nonlocally-born individuals (regardless of diet) are disturbed. This could mean that grave disturbance represents a nonlocal secondary mortuary treatment or ritual (see Robertson [2006] for discussion of grave disturbance at K14) that is not affected by diet in any way. Robertson (2006) also concluded that only the graves of adults (20+) were disturbed. This suggests that within this nonlocal secondary mortuary ritual, are additional 'rules' and social distinctions.

Furthermore, the log linear model analysis suggests that the relationship between area-of-birth and cluster in K14 depends on grave disturbance. In all other models with area-of-birth and cluster in K14, the relationship between these two variables is independent of the third variable (except for diet). This is the clearest correlation between mortuary treatment and area-of-birth observed at K14 so far, and may be reflective of a nonlocal identity that exists and has social impact within the larger social groups present at K14 (i.e., those groups represented by cluster in K14, by diet, by interment in a Glazkovo cemetery, etc.). These identities are discussed in further detail later.

**5.3 Cluster in K14**

The second influential factor present is represented by cluster in K14. It is clear that spatial organization of K14 is a significant factor in both mortuary treatment and where to inter individuals of different diets and areas-of-birth, as evidenced by the fact that cluster in K14 is always related to diet or area-of-birth, and a third mortuary variable. The two exceptions to this are in Section 4.1.1 where diet is related to cluster in K14 independent of area-of-birth, and in Section 4.14.3 where area-of-birth is related to grave disturbance independent of cluster in K14. Even though the relationship between area-of-birth and cluster in K14 depends on diet, in all other tests between area-of-birth, cluster in K14, and a third mortuary variable (not diet), the relationship between area-of-birth and cluster in K14 is independent of the third variable (barring the relationship with grave disturbance). This means that when cluster in K14 is included in the analysis, area-of-birth has specific mortuary patterns separate from diet, and vice versa.

As mentioned earlier, when cluster in K14 was added as a third variable, the relationships between diet or area-of-birth and all other mortuary variables change. This observation indicates that in addition to diet and area-of-birth, there are other social identities that are represented by mortuary treatment at K14. A clear example of this is how mortuary treatments of individuals of the same diets and areas-of-birth differed for each cluster in K14, particularly when the two Centre clusters are observed.

Table 5.1 Proportions of Individuals of Each Diet with Mortuary Variables that Illustrate Centre-East and Centre-West Differences at K14

| | Centre-East | | Centre-West | |
|---|---|---|---|---|
| | GFS | GF | GFS | GF |
| Diet | 50%, 23/46 | 12%, 3/25 | 6%, 3/47 | 40%, 10/25 |
| Ornaments | 91%, 20/22 | 33%, 1/3 | 33%, 1/3 | 90%, 9/10 |
| RDCP | 18%, 4/22 | 33%, 1/3 | 0%, 0/3 | 30%, 3/10 |
| Beads | 91%, 20/22 | 67%, 2/3 | 33%, 1/3 | 90%, 9/10 |
| Nephrite | 9%, 2/22 | 0%, 0/3 | 0%, 0/3 | 30%, 3/10 |
| Wood Working | 1/22 | 0%, 0/3 | 0%, 0/3 | 10%, 1/10 |
| Hide Working | 0%, 0/22 | 0%, 0/3 | 33%, 1/3 | 20%, 2/10 |
| Hunting | 18%, 4/22 | 0%, 0/3 | 0%, 0/3 | 40%, 4/10 |
| Fire Use | 27%, 6/22 | 33%, 1/3 | 0%, 0/3 | 40%, 4/10 |
| Head Treatment | 14%, 3/22 | 33%, 1/3 | 0%, 0/3 | 0%, 0/10 |

In most cases, the difference between the two Centre clusters is observed with only one geochemical group. For example, when only diet is considered, the frequency of kaolinite cylindrical beads and mortuary use of fire differ between GFS diet followers, whereas all other variables differ for both diets depending on cluster (Table 5.1). Meaning, there is a clear difference between not only the two diet groups (GFS and GF), but also between individuals of the same diet group (GFS) and some mortuary variables, but not all of them. A similar observation is made with area-of-birth.

When only area-of-birth is considered, the frequency of implements, lithic arrowheads, red deer canine pendants, and the mortuary use of fire differ for those locally-born, and the

Table 5.2 Proportions of Individuals of Each Area-of-Birth with Mortuary Variables that Illustrate Centre-East and Centre-West Differences at K14

| | Centre-East | | Centre-West | |
|---|---|---|---|---|
| | Locally-born | Nonlocally-born | Locally-born | Nonlocally-born |
| Area-of-birth | 52%, 11/21 | 29%, 10/34 | 19%, 4/21 | 32%, 11/34 |
| Implements | 27%, 3/11 | 40%, 4/10 | 0%, | 27%, 3/11 |
| Ornaments | 100%, 11/11 | 80%, 8/10 | 75%, 3/4 | 91%, 10/11 |
| RDCP | 18%, 2/11 | 20%, 2/10 | 0%, | 27%, 3/11 |
| Beads | 100%, 11/11 | 20%, 2/10 | 75%, 3/4 | 91%, 10/11 |
| Lithic Arrowheads | 9%, 1/11 | 20%, 2/10 | 0%, 0/4 | 27%, 3/11 |
| Wood Working | 9%, 1/11 | 0%, 0/10 | 0%, 0/4 | 9%, 1/11 |
| Hide Working | 0%, 0/11 | 0%, 0/10 | 0%, 0/4 | 18%, 2/11 |
| Hunting | 9%, 1/11 | 20%, 2/10 | 0%, 0/4 | 27%, 3/11 |
| Meat Butchering | 0%, 0/11 | 10%, 1/10 | 0%, 0/4 | 0%, 0/11 |
| Fire Use | 9%, 1/11 | 40%, 4/10 | 75%, 3/4 | 45%, 5/11 |
| Head Treatment | 9%, 1/11 | 30%, 3/10 | 25%, 1/4 | 0%, 0/11 |
| Grave Disturbance | 0%, 0/11 | 10%, 1/10 | 0%, 0/4 | 0%, 0/11 |

presence of kaolinite cylindrical beads, hide working and butchering implements, head treatment, and grave disturbance differ between those nonlocally-born (Table 5.2). Mortuary variables that display no differences between these two clusters and diet are grave pit lining, grave disturbance, and interment with meat butchering implements

The mortuary variable that displays no difference between these two clusters and area-of birth is interment with nephrite and is therefore excluded from the tables. The observations from these tables suggests that additional, more individual, or smaller group-based identities exist within the social identities that led to interment in the Centre clusters (see McKenzie 2010a). Cluster in K14 therefore likely represents one type of group identity, within which are numerous other group identities based on diet, area-of-birth, and likely other variables unable to be tested here such as age at death, sex, and family groupings (see Shepard 2016).

Furthermore, the numerous individual and group influences that patterned mortuary treatment into all spatial clusters in K14 (McKenzie 2010a; Weber and Goriunova 2013) do not always align with diet and area-of-birth identities. If they did, spatial organization of the different diets and areas-of-birth would match the spatial organization of the mortuary treatment in the cemetery, and there would be clearer spatial boundaries of mortuary treatment between individuals of either diets or areas-of-birth. The fact that diet and area-of-birth are independently related to different mortuary variables, and the relationships between all variables (except for diet and area-of-birth, and area-of-birth and grave disturbance) change based on cluster in K14, suggests a mix of overlapping social identities that are simultaneously expressed. These social identities do not appear to be equally expressed, however, but may have been involved in a hierarchy of decision making. Meaning, while diet and area-of-birth are important determinants in understanding mortuary treatment variability at K14; they did not always follow whatever social identities led to spatial organization at K14. Since cluster in K14 is related to almost every single variable tested here, it seems to have been more important, based on the social identities behind it, than either diet or area-of-birth. Diet and area-of-birth then would be expressed by mortuary treatment within the 'rules' of that cluster in at K14.

## 5.4 Additional Mortuary Influences at K14

Previous research at K14 has shown that this cemetery represents a wider community, as evidenced by the presence of both sexes and a wide range of ages, than other more restrictive cemeteries (e.g., Kurma XI) (McKenzie 2010a; Lieverse et al. 2007a). The spatial groupings correspond with mortuary treatment that represents different social groups, with mortuary treatment changing after certain ages-at-death (McKenzie 2010a; McKenzie et al. 2008). The smaller rows likely represent familial groupings (Shepard 2016). The data from K14 suggests that during the EBA, these individuals were part of a network political economy, (Shepard 2012, 2016), and were involved in long distance exchange networks, particularly for prestige items like nephrite (Shepard 2016). Individuals interred at K14 followed two general diets based on seal and local or nonlocal aquatic sources (Katzenberg et al. 2010; Weber et al. 2011). Individuals also were quite diverse in their histories of movement, with some individuals traveling extensively throughout their lives and others being born and living their whole lives within the

Little Sea (Scharlotta and Weber 2012; Scharlotta et al. 2013). Analysis of skeletal biology suggests that this community was fairly egalitarian with little differentiation in workload (Lieverse et al. 2013).

I would add that the Glazkovo EBA society was comprised of diverse groups of individuals whose life histories of diet, area-of-birth, and social status defined them in ways that can be identified through their mortuary treatment. However, these groups were all still part of a wider Glazkovo culture, as evidenced by their joint interment in a single cemetery. It is possible that since these individuals were living within a network political economy (Shepard 2016) and 'belonged' to different social groups, that mortuary treatment was an attempt by the living to maintain larger Glazkovo group cohesion. A network political economy is defined as one that is focused on individuals or small elite groups developing long distance exchange networks (Blanton et al. 1996). Research elsewhere (Kerber 1986; Rakita 2001) suggests that the rituals of cemetery use serve as a way for the social group using it to promote social structure or cohesion in several ways. Rakita (2001) argues that mortuary rituals require and encourage cooperation among the members of the social group and in doing so, can "establish multiple, crosscutting ties of allegiance among sub-groups of the community" and that participating in ritual "facilitates the socialization of individuals into community held beliefs" (Rakita 2001:98). In part, this also reinforces social differentiation among the living, and therefore strengthens the structure and order of the living society (Kerber 1986; Rakita 2001). McKenzie (2010a) and Weber and Goriunova (2013) suggested that the spatial organization represents sub-community groups, and Weber and Goriunova (2013) indicated some correlation with diet.

At K14, this type of group cohesion is evidenced by the fact that despite the smaller group-related mortuary treatment variables present at K14, the cemetery fits into Glazkovo mortuary classifications based on types of artifacts found, orientation of burials, use of fire, and body position (McKenzie 2006; Okladnikov 1959), and the community using it has been interpreted as a Glazkovo community (Weber and Goriunova 2013). The Glazkovo culture is seen throughout Cis-Baikal, so maintaining membership with this larger regional culture would have helped maintain networks throughout the region. This idea of maintaining networks fits with Shepards' (2016) suggestion that maintaining these networks is part of a network political economy present through the EBA, and observable through mortuary treatment at K14. However, it does not explain the group-based influences observed at K14.

The data presented in this thesis suggests that there are further distinct community groups present in this community that are only clearly observed when diet and area-of-birth are included in analyses. Previously, EBA Glazkovo culture had been described as one with moderate social differentiation (Weber and Bettinger 2010). Social differentiation is not explicitly defined by Weber and Bettinger (2010), but it is in other discussions (e.g., Weber et al., 2013), where they follow definitions by Burch and Ellana (1994) and Price and Brown (1985). Here, social differentiation reflects the degree and specialization of internally differentiated components of the social system. Following this, a culture with a high degree of social differentiation should be recognizable in high levels of variability in mortuary treatment. Therefore, Weber's and Bettinger's (2010) descriptions of the EBA Glazkovo culture as having moderate social differentiation may not be true, as analyses in this thesis appear to show multiple simultaneous social identities differentiated through mortuary treatment, diet, area-of-birth, and cluster in K14 in addition to the age-related mortuary treatment McKenzie (2010a) noted. It may be more accurate to describe EBA Glazkovo culture as one with considerable social differentiation based on how multiple individual and group influenced mortuary treatment variation.

These group influences also suggest elements of a corporate political strategy, where, unlike the network political strategy, the focus is on the social group (Blanton et al. 1996; Feinman 1995; Peregrine 2008) and power is structured and enacted through social 'codes' (Blanton et al. 1996). It is important to note that while one strategy (i.e., exclusionary/network or corporate) may be more prevalent than the other, both strategies coexist, (Blanton et al. 1996; Feinman 2001). Peregrine (2008) notes that these two strategies exist on a continuum, and while some societies may lean more towards one than another, aspects of both are present in any given society. Re-evaluating these network strategies in light of the data presented by this thesis may shed further insight on the political economies present during the EBA in the Little Sea, and possibly the Cis-Baikal in general.

### 5.5 Chapter Summary

Overall, further evidence for multiple and simultaneous mortuary influences represented through mortuary treatment at K14 was identified. This is not surprising, as McKenzie (2010a), Shepard (2016), and Weber and Goriunova (2013) all identified mortuary patterns and interpreted them as social groups existing within the Glazkovo group using K14. What is new is the extent to which diet and area-of-birth are related to mortuary treatment, how they are related to different mortuary variables, and how those relationships change when cluster in K14 is included in the analysis. The next chapter lays out a few next steps in interpreting these data, and in future research on K14 and the Little Sea.

# CHAPTER 6: CONCLUSION

## 6.1 Summary of Results and Discussion

In this thesis, I set out to identify mortuary treatment correlates to diet and area-of-birth using log linear models. Mortuary treatment at K14 was found to independently relate to diet and area-of-birth, suggesting that diet and area-of-birth can individually influence mortuary treatment in some ways. For example, the relationship between diet and red deer canine pendants, wood working implements, head treatment, and grave disturbance is independent of area-of-birth. The relationship between area-of-birth and lithic arrowheads, meat butchering implements, fire use, and grave pit lining is independent of diet. When cluster in K14 was included in the analysis, almost all mortuary treatment variables were related to cluster, independent of diet or area-of-birth. The one exception was grave disturbance. Interestingly, grave disturbance was related to diet independently of area-of-birth unless cluster in K14 was included. When cluster in K14 was included in the analysis, diet was no longer independently related to grave disturbance but area-of-birth (specifically nonlocal birth) was. This suggests that, while grave disturbance is related to both diet and cluster in K14, it is related to area-of-birth regardless of cluster in K14. Grave disturbance could represent a nonlocal mortuary ritual that transcends the social identities represented by cluster in K14.

Furthermore, there is a clear division of the Centre Cluster into two sub-clusters (as previously identified by Weber and Goriunova [2013]) when diet, area-of-birth, and almost all mortuary variables are analyzed. For example, kaolinite cylindrical beads are common to the Centre Cluster; however, when diet and area-of-birth are analyzed, they are more frequently interred with the GFS diet (compared to GF diet) in the Centre-East, and are more frequently interred with the GF diet (compared to the GFS diet)in the Centre-West. Overall, I suggest that these results indicate multiple, simultaneous individual and group identities expressed at K14 through mortuary treatment. These identities are based on diet, area-of-birth, and other social identities that are reflected by the different clusters at K14 and identified by McKenzie 2010a.

## 6.2 Future Research

It is clear that, while this research was able to explain some of the mortuary variability present at K14, there are still many unanswered questions. What effect do sex and age-at-death have on mortuary treatment for the different diet and area-of-birth groups? McKenzie (2010a) identified changes in mortuary treatment around certain ages-at-death. Are these changes similar for individuals of those ages of both diets and areas-of-birth? Are there mortuary treatment patterns related to the more specific life histories of movement as identified by Scharlotta and Weber (2013), and Scharlotta and colleagues (2013)? The more specific mobility patterns mentioned in Chapter 2 show that area-of-birth does not always lead to similar lifetimes of movement. The Glazkovo culture is considered a network political economy that relies on maintaining ties with long distance prestige objects and higher status people, so it is likely that the overall lifetime of movement and travel led to social statuses and/or identities that may be reflected in mortuary treatment at K14.

Future research conducted using the *bioarchaeology of individual life histories* approach in the upper Lena microregion would also help understand mortuary variability in the Little Sea, as the upper Lena is a probable origin place for many of the nonlocally-born individuals interred at K14 (Scharlotta and Weber 2012; Scharlotta et al. 2013). Furthermore, research into mortuary treatment correlates to diet and area-of-birth in other Little Sea Glazkovo cemeteries will indicate whether the diet and area-of-birth patterns noted at K14 are reflected throughout the other social groups that the other cemeteries represent (McKenzie 2010a).

### 6.3 Concluding Remarks

Overall, in this thesis I have demonstrated the value of including individuals' diets and areas-of-birth into an analysis of mortuary treatment. This approach, termed the *bioarchaeology of individual life histories* approach, yielded numerous insights on mortuary treatment variability at K14. This research has also introduced a new analytical method, log linear models, to these data that has proven to be an effective way to identify not only the relationships among mortuary variables, but also to capture some of the complexity of these relationships. Future research in a similar manner should no doubt add to this complex and increasingly interesting story.

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## APPENDIX: Predicted and Actual Count Tables

Table A.1 Predicted and Actual Counts of log-linear models for diet (D), area-of-birth(B), and cluster in K14 (S)

| | D | B | S | true count | Saturated | DB+BS+DS | DB+DS | DB+BS | DS+BS | DB | DS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3.33 | 0 | 0 | 1.74 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.33 | 0 | 1.6 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 2.81 | 0 | 1.87 | 0 | 5.21 | 3.47 |
| 4 | 2 | 2 | 1 | 10 | 10 | 10 | 10 | 7.19 | 10 | 4.79 | 6.67 | 4.79 | 3.19 |
| 5 | 1 | 1 | 2 | 10 | 10 | 10 | 10.24 | 10 | 8.42 | 6.33 | 5.33 | 5.21 | 3.3 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 1.58 | 0 | 1 | 4.79 | 3.03 |
| 7 | 1 | 2 | 2 | 6 | 6 | 6 | 5.76 | 2.53 | 7.58 | 3.56 | 10.67 | 4.69 | 6.6 |
| 8 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 6.47 | 1.42 | 9.1 | 2 | 4.31 | 6.07 |
| 9 | 1 | 1 | 3 | 1 | 1 | 1 | 0.64 | 1 | 0.09 | 3.67 | 0.33 | 0.52 | 1.91 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0.91 | 0 | 3.33 | 0.48 | 1.76 |
| 11 | 1 | 2 | 3 | 0 | 0 | 0 | 0.36 | 2.81 | 0.91 | 2.06 | 0.67 | 5.21 | 3.82 |
| 12 | 2 | 2 | 3 | 10 | 10 | 10 | 10 | 7.19 | 9.09 | 5.27 | 6.67 | 4.79 | 3.51 |
| 13 | 1 | 1 | 4 | 5 | 5 | 5 | 5.12 | 5 | 5 | 2.67 | 2.67 | 2.6 | 1.39 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.4 | 1.28 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 2.88 | 0.84 | 3 | 1.5 | 5.33 | 1.56 | 2.78 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 2.16 | 0 | 3.83 | 0 | 1.44 | 2.56 |

Table A.2. Predicted and Actual Counts of log-linear models for interment with implements (I), diet (D), and area-of-birth (B)

| | B | D | I | true count | Saturated | BD+BI+DI | BD+BI | BD+DI | BI+DI | BD | BI | DI | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 11 | 11 | 11 | 11 | 10.24 | 6.29 | 9.33 | 5.73 | 5.33 | 4.86 |
| 2 | 2 | 1 | 1 | 5 | 5 | 5 | 4.78 | 5.76 | 9.71 | 5.25 | 8.85 | 10.67 | 9.72 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 4.71 | 0 | 5.27 | 4 | 4.47 |
| 4 | 2 | 2 | 1 | 12 | 12 | 12 | 12.22 | 12 | 7.29 | 13.42 | 8.15 | 8 | 8.94 |
| 5 | 1 | 1 | 2 | 5 | 5 | 5 | 5 | 5.76 | 2.25 | 6.67 | 2.6 | 3 | 3.47 |
| 6 | 2 | 1 | 2 | 4 | 4 | 4 | 4.22 | 3.24 | 6.75 | 3.75 | 7.81 | 6 | 6.94 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 2.75 | 0 | 2.4 | 3.67 | 3.19 |
| 8 | 2 | 2 | 2 | 11 | 11 | 11 | 10.78 | 11 | 8.25 | 9.58 | 7.19 | 7.33 | 6.39 |

Table A.3 Predicted and Actual Counts of log-linear models for interment with implements (I), diet (D), and cluster in K14 (S)

| | I | D | S | true count | Saturated | ID+IS+DS | ID+IS | ID+DS | IS+DS | ID | IS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0.93 | 2.63 | 4.35 | 1.6 | 7.04 | 2.59 | 4.28 | 6.94 |
| 2 | 2 | 1 | 1 | 8 | 8 | 7.07 | 10.18 | 3.65 | 6.4 | 5.92 | 10.37 | 3.72 | 6.02 |
| 3 | 1 | 2 | 1 | 4 | 4 | 3.07 | 1.37 | 6.24 | 2.4 | 3.66 | 1.41 | 6.42 | 3.77 |
| 4 | 2 | 2 | 1 | 8 | 8 | 8.93 | 5.82 | 5.76 | 9.6 | 3.38 | 5.63 | 5.58 | 3.27 |
| 5 | 1 | 1 | 2 | 15 | 15 | 14.5 | 11.18 | 11.96 | 14.96 | 8.8 | 11.01 | 11.77 | 8.67 |
| 6 | 2 | 1 | 2 | 7 | 7 | 7.5 | 5.09 | 10.04 | 7.04 | 7.39 | 5.18 | 10.23 | 7.53 |
| 7 | 1 | 2 | 2 | 2 | 2 | 2.5 | 5.82 | 1.56 | 2.04 | 4.58 | 5.99 | 1.61 | 4.71 |
| 8 | 2 | 2 | 2 | 1 | 1 | 0.5 | 2.91 | 1.44 | 0.96 | 4.23 | 2.82 | 1.39 | 4.09 |
| 9 | 1 | 1 | 3 | 2 | 2 | 1.57 | 5.92 | 1.63 | 2.08 | 4.58 | 5.83 | 1.61 | 4.51 |
| 10 | 2 | 1 | 3 | 1 | 1 | 1.43 | 2.55 | 1.37 | 0.92 | 3.85 | 2.59 | 1.39 | 3.91 |
| 11 | 1 | 2 | 3 | 7 | 7 | 7.43 | 3.08 | 5.2 | 6.92 | 2.38 | 3.17 | 5.35 | 2.45 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.57 | 1.45 | 4.8 | 3.08 | 2.2 | 1.41 | 4.65 | 2.13 |
| 13 | 1 | 1 | 4 | 8 | 8 | 8 | 5.26 | 7.07 | 8 | 4.58 | 5.18 | 6.96 | 4.51 |
| 14 | 2 | 1 | 4 | 5 | 5 | 5 | 3.18 | 5.93 | 5 | 3.85 | 3.24 | 6.04 | 3.91 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 2.74 | 0 | 0 | 2.38 | 2.82 | 0 | 2.45 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1.82 | 0 | 0 | 2.2 | 1.76 | 0 | 2.13 |

Table A.4. Predicted and Actual Counts of log-linear models for interment with implements (I), area-of-birth (B), and cluster in K14 (S)

| | I | B | S | true count | Saturated | IB+IS+BS | IB+IS | IB+BS | IS+BS | IB | IS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1.37 | 0 | 0 | 2.91 | 1.15 | 0 | 2.43 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 1.75 | 0 | 0 | 0.91 | 2.67 | 0 | 1.39 |
| 3 | 1 | 2 | 1 | 3 | 3 | 3 | 1.63 | 5.59 | 3 | 3.45 | 1.85 | 6.36 | 3.93 |
| 4 | 2 | 2 | 1 | 7 | 7 | 7 | 5.25 | 4.41 | 7 | 2.73 | 4.33 | 3.64 | 2.25 |
| 5 | 1 | 1 | 2 | 8 | 8 | 8.17 | 6.4 | 8.38 | 7.33 | 6.11 | 5.35 | 7 | 5.1 |
| 6 | 2 | 1 | 2 | 3 | 3 | 2.83 | 1.75 | 2.62 | 3.67 | 1.91 | 2.67 | 4 | 2.92 |
| 7 | 1 | 2 | 2 | 6 | 6 | 5.83 | 7.6 | 5.59 | 6.67 | 7.25 | 8.65 | 6.36 | 8.26 |
| 8 | 2 | 2 | 2 | 4 | 4 | 4.17 | 5.25 | 4.41 | 3.33 | 5.73 | 4.33 | 3.64 | 4.72 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.5 | 5.49 | 3.05 | 3.2 | 4.36 | 4.58 | 2.55 | 3.64 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.5 | 0.75 | 0.95 | 0.8 | 1.36 | 1.15 | 1.45 | 2.08 |
| 11 | 1 | 2 | 3 | 8 | 8 | 8.5 | 6.51 | 6.15 | 8.8 | 5.18 | 7.42 | 7 | 5.9 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.5 | 2.25 | 4.85 | 2.2 | 4.09 | 1.85 | 4 | 3.37 |
| 13 | 1 | 1 | 4 | 4 | 4 | 4.33 | 2.74 | 4.57 | 4 | 2.62 | 2.29 | 3.82 | 2.19 |
| 14 | 2 | 1 | 4 | 2 | 2 | 1.67 | 0.75 | 1.43 | 2 | 0.82 | 1.15 | 2.18 | 1.25 |
| 15 | 1 | 2 | 4 | 2 | 2 | 1.67 | 3.26 | 1.68 | 2 | 3.11 | 3.71 | 1.91 | 3.54 |
| 16 | 2 | 2 | 4 | 1 | 1 | 1.33 | 2.25 | 1.32 | 1 | 2.45 | 1.85 | 1.09 | 2.02 |

Table A.5. Predicted and Actual Counts of log-linear models for diet (D), area-of-birth (B), and interment with ornaments (O)

| | B | D | O | true count | Saturated | BD+BO+DO | BD+BO | BD+DO | BO+DO | BD | BO | DO | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3.2 | 1 | 3.33 | 1.04 | 1.67 | 1.74 |
| 2 | 2 | 1 | 1 | 3 | 3 | 3 | 2.25 | 1.8 | 4 | 1.87 | 4.17 | 3.33 | 3.47 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0.96 | 1.67 | 1.6 |
| 4 | 2 | 2 | 1 | 5 | 5 | 5 | 5.75 | 5 | 4 | 4.79 | 3.83 | 3.33 | 3.19 |
| 5 | 1 | 1 | 2 | 14 | 14 | 14 | 14 | 12.8 | 7.37 | 12.67 | 7.29 | 6.67 | 6.6 |
| 6 | 2 | 1 | 2 | 6 | 6 | 6 | 6.75 | 7.2 | 12.63 | 7.12 | 12.5 | 13.33 | 13.19 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 6.63 | 0 | 6.71 | 6 | 6.07 |
| 8 | 2 | 2 | 2 | 18 | 18 | 18 | 17.25 | 18 | 11.37 | 18.21 | 11.5 | 12 | 12.14 |

Table A.6 Predicted and Actual Counts of log-linear models for interment with ornaments (O), diet (D), and cluster in K14 (S)

| | O | D | S | true count | Saturated | OD+OS+DS | OD+OS | OD+DS | OS+DS | OD | OS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 3 | 3 | 3.49 | 5.33 | 2.43 | 3.2 | 3.94 | 5.18 | 2.37 | 3.83 |
| 2 | 2 | 1 | 1 | 5 | 5 | 4.51 | 7.68 | 5.57 | 4.8 | 9.01 | 7.77 | 5.63 | 9.13 |
| 3 | 1 | 2 | 1 | 5 | 5 | 4.51 | 2.67 | 3.36 | 4.8 | 1.97 | 2.82 | 3.55 | 2.08 |
| 4 | 2 | 2 | 1 | 7 | 7 | 7.49 | 4.32 | 8.64 | 7.2 | 5.07 | 4.23 | 8.45 | 4.96 |
| 5 | 1 | 1 | 2 | 2 | 2 | 2.71 | 2 | 6.7 | 2.64 | 4.93 | 1.94 | 6.51 | 4.79 |
| 6 | 2 | 1 | 2 | 20 | 20 | 19.29 | 14.08 | 15.3 | 19.36 | 11.27 | 14.25 | 15.49 | 11.41 |
| 7 | 1 | 2 | 2 | 1 | 1 | 0.29 | 1 | 0.84 | 0.36 | 2.46 | 1.06 | 0.89 | 2.6 |
| 8 | 2 | 2 | 2 | 2 | 2 | 2.71 | 7.92 | 2.16 | 2.64 | 6.34 | 7.75 | 2.11 | 6.2 |
| 9 | 1 | 1 | 3 | 2 | 2 | 0.8 | 2 | 0.91 | 0.69 | 2.56 | 1.94 | 0.89 | 2.49 |
| 10 | 2 | 1 | 3 | 1 | 1 | 2.2 | 6.4 | 2.09 | 2.31 | 5.86 | 6.48 | 2.11 | 5.93 |
| 11 | 1 | 2 | 3 | 1 | 1 | 2.2 | 1 | 2.8 | 2.31 | 1.28 | 1.06 | 2.96 | 1.35 |
| 12 | 2 | 2 | 3 | 9 | 9 | 7.8 | 3.6 | 7.2 | 7.69 | 3.3 | 3.52 | 7.04 | 3.22 |
| 13 | 1 | 1 | 4 | 7 | 7 | 7 | 4.67 | 3.96 | 7 | 2.56 | 4.54 | 3.85 | 2.49 |
| 14 | 2 | 1 | 4 | 6 | 6 | 6 | 3.84 | 9.04 | 6 | 5.86 | 3.89 | 9.15 | 5.93 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 2.33 | 0 | 0 | 1.28 | 2.46 | 0 | 1.35 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 2.16 | 0 | 0 | 3.3 | 2.11 | 0 | 3.22 |

Table A.7 Predicted and Actual counts of log-linear models for interment with ornaments (O), area-of-birth (B), and cluster in K14 (S)

| | O | B | S | true count | Saturated | OB+OS+BS | OB+OS | OB+BS | OS+BS | OB | OS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0.73 | 1.15 | 0 | 0.83 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2.77 | 0 | 0 | 3.09 | 2.67 | 0 | 2.99 |
| 3 | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 2.35 | 3 | 1.45 | 1.85 | 2.18 | 1.35 |
| 4 | 2 | 2 | 1 | 7 | 7 | 7 | 4.23 | 7.65 | 7 | 4.73 | 4.33 | 7.82 | 4.83 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0.71 | 0.67 | 2.1 | 1.05 | 1.53 | 0.76 | 2.4 | 1.75 |
| 6 | 2 | 1 | 2 | 11 | 11 | 10.29 | 7.51 | 8.9 | 9.95 | 6.49 | 7.25 | 8.6 | 6.27 |
| 7 | 1 | 2 | 2 | 2 | 2 | 1.29 | 1.33 | 2.35 | 0.95 | 3.05 | 1.24 | 2.18 | 2.83 |
| 8 | 2 | 2 | 2 | 8 | 8 | 8.71 | 11.49 | 7.65 | 9.05 | 9.93 | 11.75 | 7.82 | 10.15 |
| 9 | 1 | 1 | 3 | 1 | 1 | 0.31 | 0.67 | 0.76 | 0.53 | 1.09 | 0.76 | 0.87 | 1.25 |
| 10 | 2 | 1 | 3 | 3 | 3 | 3.69 | 5.14 | 3.24 | 3.47 | 4.64 | 4.96 | 3.13 | 4.48 |
| 11 | 1 | 2 | 3 | 1 | 1 | 1.69 | 1.33 | 2.59 | 1.47 | 2.18 | 1.24 | 2.4 | 2.02 |
| 12 | 2 | 2 | 3 | 10 | 10 | 9.31 | 7.86 | 8.41 | 9.53 | 7.09 | 8.04 | 8.6 | 7.25 |
| 13 | 1 | 1 | 4 | 3 | 3 | 2.97 | 1.67 | 1.14 | 3.33 | 0.65 | 1.91 | 1.31 | 0.75 |
| 14 | 2 | 1 | 4 | 3 | 3 | 3.03 | 1.58 | 4.86 | 2.67 | 2.78 | 1.53 | 4.69 | 2.69 |
| 15 | 1 | 2 | 4 | 2 | 2 | 2.03 | 3.33 | 0.71 | 1.67 | 1.31 | 3.09 | 0.65 | 1.21 |
| 16 | 2 | 2 | 4 | 1 | 1 | 0.97 | 2.42 | 2.29 | 1.33 | 4.25 | 2.47 | 2.35 | 4.35 |

Table A.8 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B) and red deer canine pendants (R)

| | B | D | R | true count | Saturated | BD+BR+DR | BD+BR | BD+DR | BR+DR | BD | BR | DR | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 13 | 13 | 13 | 13 | 13.44 | 7.58 | 12 | 6.77 | 7 | 6.25 |
| 2 | 2 | 1 | 1 | 8 | 8 | 8 | 6.47 | 7.56 | 13.42 | 6.75 | 11.98 | 14 | 12.5 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5.42 | 0 | 6.23 | 5 | 5.75 |
| 4 | 2 | 2 | 1 | 15 | 15 | 15 | 16.53 | 15 | 9.58 | 17.25 | 11.02 | 10 | 11.5 |
| 5 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 2.56 | 1 | 4 | 1.56 | 1.33 | 2.08 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1 | 2.53 | 1.44 | 3 | 2.25 | 4.69 | 2.67 | 4.17 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1.44 | 2.67 | 1.92 |
| 8 | 2 | 2 | 2 | 8 | 8 | 8 | 6.47 | 8 | 6 | 5.75 | 4.31 | 5.33 | 3.83 |

Table A.9 Predicted and Actual counts of log-linear models for interment with red deer canine pendants (R), diet (D), cluster in K14 (S)

| | R | D | S | true count | Saturated | RD+RS+DS | RD+RS | RD+DS | RS+DS | RD | RS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 6 | 6 | 6.39 | 9.67 | 6.61 | 5.6 | 10.7 | 9.07 | 6.2 | 10.04 |
| 2 | 2 | 1 | 1 | 2 | 2 | 1.61 | 3 | 1.39 | 2.4 | 2.25 | 3.89 | 1.8 | 2.92 |
| 3 | 1 | 2 | 1 | 8 | 8 | 7.61 | 4.33 | 8.16 | 8.4 | 4.79 | 4.93 | 9.3 | 5.46 |
| 4 | 2 | 2 | 1 | 4 | 4 | 4.39 | 3 | 3.84 | 3.6 | 2.25 | 2.11 | 2.7 | 1.59 |
| 5 | 1 | 1 | 2 | 18 | 18 | 18.01 | 13.82 | 18.17 | 17.6 | 13.38 | 12.96 | 17.04 | 12.55 |
| 6 | 2 | 1 | 2 | 4 | 4 | 3.99 | 2.5 | 3.83 | 4.4 | 2.82 | 3.24 | 4.96 | 3.65 |
| 7 | 1 | 2 | 2 | 2 | 2 | 1.99 | 6.18 | 2.04 | 2.4 | 5.99 | 7.04 | 2.32 | 6.82 |
| 8 | 2 | 2 | 2 | 1 | 1 | 1.01 | 2.5 | 0.96 | 0.6 | 2.82 | 1.76 | 0.68 | 1.98 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.6 | 6.91 | 2.48 | 2.31 | 6.96 | 6.48 | 2.32 | 6.52 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.4 | 1.5 | 0.52 | 0.69 | 1.46 | 1.94 | 0.68 | 1.9 |
| 11 | 1 | 2 | 3 | 7 | 7 | 7.4 | 3.09 | 6.8 | 7.69 | 3.11 | 3.52 | 7.75 | 3.55 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.6 | 1.5 | 3.2 | 2.31 | 1.46 | 1.06 | 2.25 | 1.03 |
| 13 | 1 | 1 | 4 | 11 | 11 | 11 | 7.6 | 10.74 | 11 | 6.96 | 7.13 | 10.07 | 6.52 |
| 14 | 2 | 1 | 4 | 2 | 2 | 2 | 1 | 2.26 | 2 | 1.46 | 1.3 | 2.93 | 1.9 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.4 | 0 | 0 | 3.11 | 3.87 | 0 | 3.55 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 1.46 | 0.7 | 0 | 1.03 |

Table A.10 Predicted and Actual counts of log-linear models for interment with red deer canine pendants (R), area-of-birth (B), and cluster in K14 (S)

| | R | B | S | true count | Saturated | RB+RS+BS | RB+RS | RB+BS | RS+BS | RB | RS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2.51 | 0 | 0 | 3.27 | 2.29 | 0 | 2.99 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0.55 | 1.53 | 0 | 0.83 |
| 3 | 1 | 2 | 1 | 6 | 6 | 6 | 3.49 | 7.35 | 6 | 4.55 | 3.71 | 7.82 | 4.83 |
| 4 | 2 | 2 | 1 | 4 | 4 | 4 | 3 | 2.65 | 4 | 1.64 | 2.47 | 2.18 | 1.35 |
| 5 | 1 | 1 | 2 | 9 | 9 | 9.22 | 7.12 | 9.43 | 8.9 | 6.87 | 6.49 | 8.6 | 6.27 |
| 6 | 2 | 1 | 2 | 2 | 2 | 1.78 | 1 | 1.57 | 2.1 | 1.15 | 1.53 | 2.4 | 1.75 |
| 7 | 1 | 2 | 2 | 8 | 8 | 7.78 | 9.88 | 7.35 | 8.1 | 9.55 | 10.51 | 7.82 | 10.15 |
| 8 | 2 | 2 | 2 | 2 | 2 | 2.22 | 3 | 2.65 | 1.9 | 3.44 | 2.47 | 2.18 | 2.83 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.37 | 5.02 | 3.43 | 3.2 | 4.91 | 4.58 | 3.13 | 4.48 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.63 | 0.75 | 0.57 | 0.8 | 0.82 | 1.15 | 0.87 | 1.25 |
| 11 | 1 | 2 | 3 | 8 | 8 | 8.63 | 6.98 | 8.09 | 8.8 | 6.82 | 7.42 | 8.6 | 7.25 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.37 | 2.25 | 2.91 | 2.2 | 2.45 | 1.85 | 2.4 | 2.02 |
| 13 | 1 | 1 | 4 | 5 | 5 | 5.41 | 3.35 | 5.14 | 5.33 | 2.95 | 3.05 | 4.69 | 2.69 |
| 14 | 2 | 1 | 4 | 1 | 1 | 0.59 | 0.25 | 0.86 | 0.67 | 0.49 | 0.38 | 1.31 | 0.75 |
| 15 | 1 | 2 | 4 | 3 | 3 | 2.59 | 4.65 | 2.21 | 2.67 | 4.09 | 4.95 | 2.35 | 4.35 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0.41 | 0.75 | 0.79 | 0.33 | 1.47 | 0.62 | 0.65 | 1.21 |

Table A.11 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and interment with cylindrical beads (K)

| | B | D | K | true count | Saturated | BD+BK+DK | BD+BK | BD+DK | BK+DK | BD | BK | DK | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 5 | 5 | 5 | 5 | 5.76 | 2.14 | 7 | 2.6 | 3 | 3.65 |
| 2 | 2 | 1 | 1 | 4 | 4 | 4 | 4.5 | 3.24 | 6.86 | 3.94 | 8.33 | 6 | 7.29 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 2.86 | 0 | 2.4 | 4 | 3.35 |
| 4 | 2 | 2 | 1 | 12 | 12 | 12 | 11.5 | 12 | 9.14 | 10.06 | 7.67 | 8 | 6.71 |
| 5 | 1 | 1 | 2 | 11 | 11 | 11 | 11 | 10.24 | 6.52 | 9 | 5.73 | 5.33 | 4.69 |
| 6 | 2 | 1 | 2 | 5 | 5 | 5 | 4.5 | 5.76 | 9.48 | 5.06 | 8.33 | 10.67 | 9.37 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 4.48 | 0 | 5.27 | 3.67 | 4.31 |
| 8 | 2 | 2 | 2 | 11 | 11 | 11 | 11.5 | 11 | 6.52 | 12.94 | 7.67 | 7.33 | 8.63 |

Table A.12 Predicted and Actual counts of log-linear models for interment with kaolinite cylindrical beads (K), diet (D), and cluster in K14 (S)

| | K | D | S | true count | Saturated | KD+KS+DS | KD+KS | KD+DS | KS+DS | KD | KS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 7 | 7 | 7.62 | 11.81 | 4 | 7.6 | 6.48 | 12.31 | 4.17 | 6.75 |
| 2 | 2 | 1 | 1 | 1 | 1 | 0.38 | 0.68 | 4 | 0.4 | 6.48 | 0.65 | 3.83 | 6.21 |
| 3 | 1 | 2 | 1 | 12 | 12 | 11.38 | 7.19 | 6.72 | 11.4 | 3.94 | 6.69 | 6.25 | 3.67 |
| 4 | 2 | 2 | 1 | 0 | 0 | 0.62 | 0.32 | 5.28 | 0.6 | 3.1 | 0.35 | 5.75 | 3.37 |
| 5 | 1 | 1 | 2 | 2 | 2 | 2.66 | 1.86 | 11 | 2.64 | 8.1 | 1.94 | 11.46 | 8.44 |
| 6 | 2 | 1 | 2 | 20 | 20 | 19.34 | 14.88 | 11 | 19.36 | 8.1 | 14.25 | 10.54 | 7.76 |
| 7 | 1 | 2 | 2 | 1 | 1 | 0.34 | 1.14 | 1.68 | 0.36 | 4.93 | 1.06 | 1.56 | 4.59 |
| 8 | 2 | 2 | 2 | 2 | 2 | 2.66 | 7.12 | 1.32 | 2.64 | 3.87 | 7.75 | 1.44 | 4.22 |
| 9 | 1 | 1 | 3 | 2 | 2 | 0.72 | 1.86 | 1.5 | 0.69 | 4.21 | 1.94 | 1.56 | 4.39 |
| 10 | 2 | 1 | 3 | 1 | 1 | 2.28 | 6.76 | 1.5 | 2.31 | 4.21 | 6.48 | 1.44 | 4.03 |
| 11 | 1 | 2 | 3 | 1 | 1 | 2.28 | 1.14 | 5.6 | 2.31 | 2.56 | 1.06 | 5.21 | 2.39 |
| 12 | 2 | 2 | 3 | 9 | 9 | 7.72 | 3.24 | 4.4 | 7.69 | 2.01 | 3.52 | 4.79 | 2.19 |
| 13 | 1 | 1 | 4 | 12 | 12 | 12 | 7.46 | 6.5 | 12 | 4.21 | 7.77 | 6.77 | 4.39 |
| 14 | 2 | 1 | 4 | 1 | 1 | 1 | 0.68 | 6.5 | 1 | 4.21 | 0.65 | 6.23 | 4.03 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 4.54 | 0 | 0 | 2.56 | 4.23 | 0 | 2.39 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0.32 | 0 | 0 | 2.01 | 0.35 | 0 | 2.19 |

Table A.13 Predicted and Actual counts of log-linear models for interment with kaolinite cylindrical beads (K), area-of-birth (B), and cluster in K14 (S)

| | K | B | S | true count | Saturated | KB+KS+BS | KB+KS | KB+BS | KS+BS | KB | KS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 3.04 | 0 | 0 | 1.27 | 3.82 | 0 | 1.6 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2.55 | 0 | 0 | 2.22 |
| 3 | 1 | 2 | 1 | 10 | 10 | 10 | 6.96 | 4.71 | 10 | 2.91 | 6.18 | 4.18 | 2.59 |
| 4 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 5.29 | 0 | 3.27 | 0 | 5.82 | 3.6 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0.7 | 0.61 | 3.67 | 1.05 | 2.67 | 0.76 | 4.6 | 3.35 |
| 6 | 2 | 1 | 2 | 11 | 11 | 10.3 | 8.31 | 7.33 | 9.95 | 5.35 | 7.25 | 6.4 | 4.67 |
| 7 | 1 | 2 | 2 | 2 | 2 | 1.3 | 1.39 | 4.71 | 0.95 | 6.11 | 1.24 | 4.18 | 5.43 |
| 8 | 2 | 2 | 2 | 8 | 8 | 8.7 | 10.69 | 5.29 | 9.05 | 6.87 | 11.75 | 5.82 | 7.55 |
| 9 | 1 | 1 | 3 | 1 | 1 | 0.3 | 0.61 | 1.33 | 0.53 | 1.91 | 0.76 | 1.67 | 2.4 |
| 10 | 2 | 1 | 3 | 3 | 3 | 3.7 | 5.69 | 2.67 | 3.47 | 3.82 | 4.96 | 2.33 | 3.33 |
| 11 | 1 | 2 | 3 | 1 | 1 | 1.7 | 1.39 | 5.18 | 1.47 | 4.36 | 1.24 | 4.6 | 3.88 |
| 12 | 2 | 2 | 3 | 10 | 10 | 9.3 | 7.31 | 5.82 | 9.53 | 4.91 | 8.04 | 6.4 | 5.4 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 2.74 | 2 | 6 | 1.15 | 3.44 | 2.51 | 1.44 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 2.29 | 0 | 3.49 | 2 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 6.26 | 1.41 | 3 | 2.62 | 5.56 | 1.25 | 2.33 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 1.59 | 0 | 2.95 | 0 | 1.75 | 3.24 |

Table A.14 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and interment with nephrite artifacts (N)

| | B | D | N | true count | Saturated | BD+BN+DN | BD+BN | BD+DN | BN+DN | BD | BN | DN | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 13 | 13 | 13 | 13 | 13.44 | 7 | 13 | 6.77 | 7 | 6.77 |
| 2 | 2 | 1 | 1 | 8 | 8 | 8 | 7.31 | 7.56 | 14 | 7.31 | 13.54 | 14 | 13.54 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6.23 | 6 | 6.23 |
| 4 | 2 | 2 | 1 | 18 | 18 | 18 | 18.69 | 18 | 12 | 18.69 | 12.46 | 12 | 12.46 |
| 5 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 2.56 | 1.33 | 3 | 1.56 | 1.33 | 1.56 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1 | 1.69 | 1.44 | 2.67 | 1.69 | 3.12 | 2.67 | 3.12 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1.67 | 0 | 1.44 | 1.67 | 1.44 |
| 8 | 2 | 2 | 2 | 5 | 5 | 5 | 4.31 | 5 | 3.33 | 4.31 | 2.88 | 3.33 | 2.88 |

Table A.15 Predicted and Actual counts of log-linear models for interment with nephrite artifacts (N), diet (D), and cluster in K14 (S)

| | A | B | C | true count | Saturated | AB+AC+BC | AB+AC | AB+BC | AC+BC | AB | AC | BC | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 4 | 4 | 4.26 | 8.51 | 6.26 | 5.2 | 10.14 | 8.42 | 6.2 | 10.04 |
| 2 | 2 | 1 | 1 | 4 | 4 | 3.74 | 4.37 | 1.74 | 2.8 | 2.82 | 4.54 | 1.8 | 2.92 |
| 3 | 1 | 2 | 1 | 9 | 9 | 8.74 | 4.49 | 9.12 | 7.8 | 5.35 | 4.58 | 9.3 | 5.46 |
| 4 | 2 | 2 | 1 | 3 | 3 | 3.26 | 2.63 | 2.88 | 4.2 | 1.69 | 2.46 | 2.7 | 1.59 |
| 5 | 1 | 1 | 2 | 20 | 20 | 20.11 | 15.05 | 17.22 | 20.24 | 12.68 | 14.9 | 17.04 | 12.55 |
| 6 | 2 | 1 | 2 | 2 | 2 | 1.89 | 1.25 | 4.78 | 1.76 | 3.52 | 1.3 | 4.96 | 3.65 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.89 | 7.95 | 2.28 | 2.76 | 6.69 | 8.1 | 2.32 | 6.82 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.11 | 0.75 | 0.72 | 0.24 | 2.11 | 0.7 | 0.68 | 1.98 |
| 9 | 1 | 1 | 3 | 2 | 2 | 1.63 | 5.89 | 2.35 | 2.08 | 6.59 | 5.83 | 2.32 | 6.52 |
| 10 | 2 | 1 | 3 | 1 | 1 | 1.37 | 2.5 | 0.65 | 0.92 | 1.83 | 2.59 | 0.68 | 1.9 |
| 11 | 1 | 2 | 3 | 7 | 7 | 7.37 | 3.11 | 7.6 | 6.92 | 3.48 | 3.17 | 7.75 | 3.55 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.63 | 1.5 | 2.4 | 3.08 | 1.1 | 1.41 | 2.25 | 1.03 |
| 13 | 1 | 1 | 4 | 10 | 10 | 10 | 6.55 | 10.17 | 10 | 6.59 | 6.48 | 10.07 | 6.52 |
| 14 | 2 | 1 | 4 | 3 | 3 | 3 | 1.88 | 2.83 | 3 | 1.83 | 1.94 | 2.93 | 1.9 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.45 | 0 | 0 | 3.48 | 3.52 | 0 | 3.55 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1.13 | 0 | 0 | 1.1 | 1.06 | 0 | 1.03 |

Table A.16 Predicted and Actual counts of log-linear models for interment with nephrite artifacts (N), area-of-birth (B), and cluster in K14 (S)

| | N | B | S | true count | Saturated | NB+NS+BS | NB+NS | NB+BS | NS+BS | NB | NS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 3.13 | 0 | 0 | 3.27 | 3.05 | 0 | 3.19 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.67 | 0 | 0 | 0.55 | 0.76 | 0 | 0.62 |
| 3 | 1 | 2 | 1 | 8 | 8 | 8 | 4.87 | 8.24 | 8 | 5.09 | 4.95 | 8.36 | 5.17 |
| 4 | 2 | 2 | 1 | 2 | 2 | 2 | 1.33 | 1.76 | 2 | 1.09 | 1.24 | 1.64 | 1.01 |
| 5 | 1 | 1 | 2 | 10 | 10 | 9.87 | 7.43 | 9.43 | 9.95 | 6.87 | 7.25 | 9.2 | 6.71 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1.13 | 0.67 | 1.57 | 1.05 | 1.15 | 0.76 | 1.8 | 1.31 |
| 7 | 1 | 2 | 2 | 9 | 9 | 9.13 | 11.57 | 8.24 | 9.05 | 10.69 | 11.75 | 8.36 | 10.86 |
| 8 | 2 | 2 | 2 | 1 | 1 | 0.87 | 1.33 | 1.76 | 0.95 | 2.29 | 1.24 | 1.64 | 2.12 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.83 | 4.3 | 3.43 | 2.93 | 4.91 | 4.2 | 3.35 | 4.79 |
| 10 | 2 | 1 | 3 | 1 | 1 | 1.17 | 1.33 | 0.57 | 1.07 | 0.82 | 1.53 | 0.65 | 0.94 |
| 11 | 1 | 2 | 3 | 8 | 8 | 8.17 | 6.7 | 9.06 | 8.07 | 7.64 | 6.8 | 9.2 | 7.76 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.83 | 2.67 | 1.94 | 2.93 | 1.64 | 2.47 | 1.8 | 1.52 |
| 13 | 1 | 1 | 4 | 5 | 5 | 5.3 | 3.13 | 5.14 | 5.33 | 2.95 | 3.05 | 5.02 | 2.87 |
| 14 | 2 | 1 | 4 | 1 | 1 | 0.7 | 0.33 | 0.86 | 0.67 | 0.49 | 0.38 | 0.98 | 0.56 |
| 15 | 1 | 2 | 4 | 3 | 3 | 2.7 | 4.87 | 2.47 | 2.67 | 4.58 | 4.95 | 2.51 | 4.65 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0.3 | 0.67 | 0.53 | 0.33 | 0.98 | 0.62 | 0.49 | 0.91 |

Table A.17 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and interment with lithic arrowheads (A)

| | B | D | A | true count | Saturated | BD+BA+DA | BD+BA | BD+DA | BA+DA | BD | BA | DA | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 15 | 15 | 15 | 15 | 14.08 | 8.68 | 12.67 | 7.81 | 7.33 | 6.6 |
| 2 | 2 | 1 | 1 | 7 | 7 | 7 | 6.47 | 7.92 | 13.32 | 7.13 | 11.98 | 14.67 | 13.19 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.32 | 0 | 7.19 | 5.33 | 6.07 |
| 4 | 2 | 2 | 1 | 16 | 16 | 16 | 16.53 | 16 | 9.68 | 18.21 | 11.02 | 10.67 | 12.14 |
| 5 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1.92 | 0.3 | 3.33 | 0.52 | 1 | 1.74 |
| 6 | 2 | 1 | 2 | 2 | 2 | 2 | 2.53 | 1.08 | 2.7 | 1.88 | 4.69 | 2 | 3.47 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0.7 | 0 | 0.48 | 2.33 | 1.6 |
| 8 | 2 | 2 | 2 | 7 | 7 | 7 | 6.47 | 7 | 6.3 | 4.79 | 4.31 | 4.67 | 3.19 |

Table A.18 Predicted and Actual counts of log-linear models for interment with lithic arrowheads (A), diet (D), cluster in K14 (S)

| | A | D | S | true count | Saturated | AD+AS+DS | AD+AS | AD+DS | AS+DS | AD | AS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 5 | 5 | 5.05 | 8.29 | 6.61 | 4.8 | 10.7 | 7.77 | 6.2 | 10.04 |
| 2 | 2 | 1 | 1 | 3 | 3 | 2.95 | 4 | 1.39 | 3.2 | 2.25 | 5.18 | 1.8 | 2.92 |
| 3 | 1 | 2 | 1 | 7 | 7 | 6.95 | 3.71 | 8.16 | 7.2 | 4.79 | 4.23 | 9.3 | 5.46 |
| 4 | 2 | 2 | 1 | 5 | 5 | 5.05 | 4 | 3.84 | 4.8 | 2.25 | 2.82 | 2.7 | 1.59 |
| 5 | 1 | 1 | 2 | 18 | 18 | 18.56 | 14.51 | 18.17 | 18.48 | 13.38 | 13.61 | 17.04 | 12.55 |
| 6 | 2 | 1 | 2 | 4 | 4 | 3.44 | 2 | 3.83 | 3.52 | 2.82 | 2.59 | 4.96 | 3.65 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.44 | 6.49 | 2.04 | 2.52 | 5.99 | 7.39 | 2.32 | 6.82 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.56 | 2 | 0.96 | 0.48 | 2.82 | 1.41 | 0.68 | 1.98 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.39 | 6.91 | 2.48 | 2.31 | 6.96 | 6.48 | 2.32 | 6.52 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.61 | 1.5 | 0.52 | 0.69 | 1.46 | 1.94 | 0.68 | 1.9 |
| 11 | 1 | 2 | 3 | 7 | 7 | 7.61 | 3.09 | 6.8 | 7.69 | 3.11 | 3.52 | 7.75 | 3.55 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.39 | 1.5 | 3.2 | 2.31 | 1.46 | 1.06 | 2.25 | 1.03 |
| 13 | 1 | 1 | 4 | 12 | 12 | 12 | 8.29 | 10.74 | 12 | 6.96 | 7.77 | 10.07 | 6.52 |
| 14 | 2 | 1 | 4 | 1 | 1 | 1 | 0.5 | 2.26 | 1 | 1.46 | 0.65 | 2.93 | 1.9 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.71 | 0 | 0 | 3.11 | 4.23 | 0 | 3.55 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0.5 | 0 | 0 | 1.46 | 0.35 | 0 | 1.03 |

Table A.19 Predicted and actual counts for log-linear models for interment with lithic arrowheads (A), area-of-birth (B), and cluster in K14 (S)

| | A | B | S | true count | Saturated | AB+AS+BS | AB+AS | AB+BS | AS+BS | AB | AS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2.67 | 0 | 0 | 3.64 | 2.29 | 0 | 3.12 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0.18 | 1.53 | 0 | 0.69 |
| 3 | 1 | 2 | 1 | 6 | 6 | 6 | 3.33 | 7.35 | 6 | 4.55 | 3.71 | 8.18 | 5.06 |
| 4 | 2 | 2 | 1 | 4 | 4 | 4 | 3.6 | 2.65 | 4 | 1.64 | 2.47 | 1.82 | 1.12 |
| 5 | 1 | 1 | 2 | 10 | 10 | 10.29 | 8 | 10.48 | 9.43 | 7.64 | 6.87 | 9 | 6.56 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.71 | 0.3 | 0.52 | 1.57 | 0.38 | 1.15 | 2 | 1.46 |
| 7 | 1 | 2 | 2 | 8 | 8 | 7.71 | 10 | 7.35 | 8.57 | 9.55 | 11.13 | 8.18 | 10.62 |
| 8 | 2 | 2 | 2 | 2 | 2 | 2.29 | 2.7 | 2.65 | 1.43 | 3.44 | 1.85 | 1.82 | 2.36 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.71 | 5.33 | 3.81 | 3.2 | 5.45 | 4.58 | 3.27 | 4.69 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.29 | 0.3 | 0.19 | 0.8 | 0.27 | 1.15 | 0.73 | 1.04 |
| 11 | 1 | 2 | 3 | 8 | 8 | 8.29 | 6.67 | 8.09 | 8.8 | 6.82 | 7.42 | 9 | 7.59 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.71 | 2.7 | 2.91 | 2.2 | 2.45 | 1.85 | 2 | 1.69 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 4 | 5.71 | 6 | 3.27 | 3.44 | 4.91 | 2.81 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0.29 | 0 | 0.16 | 0 | 1.09 | 0.62 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 5 | 2.21 | 3 | 4.09 | 5.56 | 2.45 | 4.55 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.79 | 0 | 1.47 | 0 | 0.55 | 1.01 |

Table A.20 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and interment with wood working implements (W)

| | B | D | W | true count | Saturated | BD+DW+BW | BD+BW | BD+DW | BW+DW | BD | BW | DW | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 15 | 15 | 15 | 15 | 15.36 | 8.57 | 14 | 7.81 | 8 | 7.29 |
| 2 | 2 | 1 | 1 | 9 | 9 | 9 | 7.59 | 8.64 | 15.43 | 7.88 | 14.06 | 16 | 14.58 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.43 | 0 | 7.19 | 6 | 6.71 |
| 4 | 2 | 2 | 1 | 18 | 18 | 18 | 19.41 | 18 | 11.57 | 20.12 | 12.94 | 12 | 13.42 |
| 5 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 0.64 | 0.17 | 2 | 0.52 | 0.33 | 1.04 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 1.41 | 0.36 | 0.83 | 1.13 | 2.6 | 0.67 | 2.08 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0.83 | 0 | 0.48 | 1.67 | 0.96 |
| 8 | 2 | 2 | 2 | 5 | 5 | 5 | 3.59 | 5 | 4.17 | 2.88 | 2.4 | 3.33 | 1.92 |

Table A.21 Predicted and Actual counts of log-linear models for interment with wood working implements (W), diet (D), and cluster in K14 (S)

| | W | D | S | true count | Saturated | WD+WS+DS | WD+WS | WD+DS | WS+DS | WD | WS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 4 | 4 | 4.16 | 7.46 | 6.96 | 4.4 | 11.27 | 7.13 | 6.65 | 10.77 |
| 2 | 2 | 1 | 1 | 4 | 4 | 3.84 | 4.5 | 1.04 | 3.6 | 1.69 | 5.83 | 1.35 | 2.19 |
| 3 | 1 | 2 | 1 | 7 | 7 | 6.84 | 3.54 | 9.12 | 6.6 | 5.35 | 3.87 | 9.97 | 5.85 |
| 4 | 2 | 2 | 1 | 5 | 5 | 5.16 | 4.5 | 2.88 | 5.4 | 1.69 | 3.17 | 2.03 | 1.19 |
| 5 | 1 | 1 | 2 | 21 | 21 | 21.1 | 16.27 | 19.13 | 21.12 | 14.08 | 15.55 | 18.28 | 13.46 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.9 | 0.5 | 2.87 | 0.88 | 2.11 | 0.65 | 3.72 | 2.74 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.9 | 7.73 | 2.28 | 2.88 | 6.69 | 8.45 | 2.49 | 7.32 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.1 | 0.5 | 0.72 | 0.12 | 2.11 | 0.35 | 0.51 | 1.49 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.74 | 8.14 | 2.61 | 2.77 | 7.32 | 7.77 | 2.49 | 7 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.26 | 0.5 | 0.39 | 0.23 | 1.1 | 0.65 | 0.51 | 1.42 |
| 11 | 1 | 2 | 3 | 9 | 9 | 9.26 | 3.86 | 7.6 | 9.23 | 3.48 | 4.23 | 8.31 | 3.8 |
| 12 | 2 | 2 | 3 | 1 | 1 | 0.74 | 0.5 | 2.4 | 0.77 | 1.1 | 0.35 | 1.69 | 0.77 |
| 13 | 1 | 1 | 4 | 12 | 12 | 12 | 8.14 | 11.3 | 12 | 7.32 | 7.77 | 10.8 | 7 |
| 14 | 2 | 1 | 4 | 1 | 1 | 1 | 0.5 | 1.7 | 1 | 1.1 | 0.65 | 2.2 | 1.42 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.86 | 0 | 0 | 3.48 | 4.23 | 0 | 3.8 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0.5 | 0 | 0 | 1.1 | 0.35 | 0 | 0.77 |

Table A.22 Predicted and Actual counts of log-linear models for interment with wood working implements (W), area-of-birth (B), and cluster in K14 (S)

| | W | B | S | true count | Saturated | WB+WS+BS | WB+WS | WB+BS | WS+BS | WB | WS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2.45 | 0 | 0 | 3.64 | 2.29 | 0 | 3.4 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.67 | 0 | 0 | 0.18 | 1.53 | 0 | 0.42 |
| 3 | 1 | 2 | 1 | 6 | 6 | 6 | 3.55 | 8.53 | 6 | 5.27 | 3.71 | 8.91 | 5.51 |
| 4 | 2 | 2 | 1 | 4 | 4 | 4 | 3.33 | 1.47 | 4 | 0.91 | 2.47 | 1.09 | 0.67 |
| 5 | 1 | 1 | 2 | 10 | 10 | 10.36 | 8.16 | 10.48 | 10.48 | 7.64 | 7.64 | 9.8 | 7.14 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.64 | 0.17 | 0.52 | 0.52 | 0.38 | 0.38 | 1.2 | 0.87 |
| 7 | 1 | 2 | 2 | 10 | 10 | 9.64 | 11.84 | 8.53 | 9.52 | 11.07 | 12.36 | 8.91 | 11.57 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.36 | 0.83 | 1.47 | 0.48 | 1.91 | 0.62 | 1.09 | 1.42 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.64 | 5.71 | 3.81 | 3.73 | 5.45 | 5.35 | 3.56 | 5.1 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.36 | 0.17 | 0.19 | 0.27 | 0.27 | 0.38 | 0.44 | 0.62 |
| 11 | 1 | 2 | 3 | 10 | 10 | 10.36 | 8.29 | 9.38 | 10.27 | 7.91 | 8.65 | 9.8 | 8.26 |
| 12 | 2 | 2 | 3 | 1 | 1 | 0.64 | 0.83 | 1.62 | 0.73 | 1.36 | 0.62 | 1.2 | 1.01 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 3.67 | 5.71 | 6 | 3.27 | 3.44 | 5.35 | 3.06 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0.29 | 0 | 0.16 | 0 | 0.65 | 0.37 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 5.33 | 2.56 | 3 | 4.75 | 5.56 | 2.67 | 4.96 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.44 | 0 | 0.82 | 0 | 0.33 | 0.61 |

Table A.23 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and interment with hide working implements (T)

| | B | D | T | true count | Saturated | BD+BT+DT | BD+BT | BD+DT | BT+DT | BD | BT | DT | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 14 | 14 | 14 | 14 | 13.44 | 7.35 | 13.33 | 7.29 | 7 | 6.94 |
| 2 | 2 | 1 | 1 | 7 | 7 | 7 | 7.31 | 7.56 | 13.65 | 7.5 | 13.54 | 14 | 13.89 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.65 | 0 | 6.71 | 6.33 | 6.39 |
| 4 | 2 | 2 | 1 | 19 | 19 | 19 | 18.69 | 19 | 12.35 | 19.17 | 12.46 | 12.67 | 12.78 |
| 5 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2.56 | 1 | 2.67 | 1.04 | 1.33 | 1.39 |
| 6 | 2 | 1 | 2 | 2 | 2 | 2 | 1.69 | 1.44 | 3 | 1.5 | 3.12 | 2.67 | 2.78 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0.96 | 1.33 | 1.28 |
| 8 | 2 | 2 | 2 | 4 | 4 | 4 | 4.31 | 4 | 3 | 3.83 | 2.88 | 2.67 | 2.56 |

Table A.24 Predicted and Actual counts of log-linear models for diet (D), interment with hide working implements (T), and cluster in K14 (S)

| | T | D | S | true count | Saturated | TD+TS+DS | TD+TS | TD+DS | TS+DS | TD | TS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 5 | 5 | 4.97 | 9.17 | 6.61 | 5.6 | 10.7 | 9.07 | 6.54 | 10.59 |
| 2 | 2 | 1 | 1 | 3 | 3 | 3.03 | 3.69 | 1.39 | 2.4 | 2.25 | 3.89 | 1.46 | 2.37 |
| 3 | 1 | 2 | 1 | 9 | 9 | 9.03 | 4.83 | 9.6 | 8.4 | 5.63 | 4.93 | 9.8 | 5.75 |
| 4 | 2 | 2 | 1 | 3 | 3 | 2.97 | 2.31 | 2.4 | 3.6 | 1.41 | 2.11 | 2.2 | 1.29 |
| 5 | 1 | 1 | 2 | 22 | 22 | 22 | 16.38 | 18.17 | 22 | 13.38 | 16.2 | 17.97 | 13.23 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 3.83 | 0 | 2.82 | 0 | 4.03 | 2.97 |
| 7 | 1 | 2 | 2 | 3 | 3 | 3 | 8.62 | 2.4 | 3 | 7.04 | 8.8 | 2.45 | 7.19 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0.6 | 0 | 1.76 | 0 | 0.55 | 1.61 |
| 9 | 1 | 1 | 3 | 2 | 2 | 2.03 | 6.55 | 2.48 | 2.31 | 6.96 | 6.48 | 2.45 | 6.88 |
| 10 | 2 | 1 | 3 | 1 | 1 | 0.97 | 1.85 | 0.52 | 0.69 | 1.46 | 1.94 | 0.55 | 1.54 |
| 11 | 1 | 2 | 3 | 8 | 8 | 7.97 | 3.45 | 8 | 7.69 | 3.66 | 3.52 | 8.17 | 3.74 |
| 12 | 2 | 2 | 3 | 2 | 2 | 2.03 | 1.15 | 2 | 2.31 | 0.92 | 1.06 | 1.83 | 0.84 |
| 13 | 1 | 1 | 4 | 9 | 9 | 9 | 5.9 | 10.74 | 9 | 6.96 | 5.83 | 10.62 | 6.88 |
| 14 | 2 | 1 | 4 | 4 | 4 | 4 | 2.46 | 2.26 | 4 | 1.46 | 2.59 | 2.38 | 1.54 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.1 | 0 | 0 | 3.66 | 3.17 | 0 | 3.74 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1.54 | 0 | 0 | 0.92 | 1.41 | 0 | 0.84 |

Table A.25 Predicted and Actual counts of log-linear models for interment with hide working implements (T), area-of-birth (B), and cluster in K14 (S)

| | T | B | S | true count | Saturated | TB+TS+BS | TB+TS | TB+BS | TS+BS | TB | TS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 3.23 | 0 | 0 | 3.45 | 3.05 | 0 | 3.26 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0.36 | 0.76 | 0 | 0.56 |
| 3 | 1 | 2 | 1 | 8 | 8 | 8 | 4.77 | 8.24 | 8 | 5.09 | 4.95 | 8.55 | 5.28 |
| 4 | 2 | 2 | 1 | 2 | 2 | 2 | 1.5 | 1.76 | 2 | 1.09 | 1.24 | 1.45 | 0.9 |
| 5 | 1 | 1 | 2 | 11 | 11 | 11 | 8.49 | 9.95 | 11 | 7.25 | 8.02 | 9.4 | 6.85 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 1.05 | 0 | 0.76 | 0 | 1.6 | 1.17 |
| 7 | 1 | 2 | 2 | 10 | 10 | 10 | 12.51 | 8.24 | 10 | 10.69 | 12.98 | 8.55 | 11.09 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 1.76 | 0 | 2.29 | 0 | 1.45 | 1.89 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.86 | 5.26 | 3.62 | 3.47 | 5.18 | 4.96 | 3.42 | 4.89 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.14 | 0.5 | 0.38 | 0.53 | 0.55 | 0.76 | 0.58 | 0.83 |
| 11 | 1 | 2 | 3 | 9 | 9 | 9.14 | 7.74 | 9.06 | 9.53 | 7.64 | 8.04 | 9.4 | 7.92 |
| 12 | 2 | 2 | 3 | 2 | 2 | 1.86 | 1.5 | 1.94 | 1.47 | 1.64 | 1.24 | 1.6 | 1.35 |
| 13 | 1 | 1 | 4 | 4 | 4 | 4.14 | 2.02 | 5.43 | 3.33 | 3.11 | 1.91 | 5.13 | 2.94 |
| 14 | 2 | 1 | 4 | 2 | 2 | 1.86 | 1 | 0.57 | 2.67 | 0.33 | 1.53 | 0.87 | 0.5 |
| 15 | 1 | 2 | 4 | 1 | 1 | 0.86 | 2.98 | 2.47 | 1.67 | 4.58 | 3.09 | 2.56 | 4.75 |
| 16 | 2 | 2 | 4 | 2 | 2 | 2.14 | 3 | 0.53 | 1.33 | 0.98 | 2.47 | 0.44 | 0.81 |

Table A.26 Predicted and Actual counts of log-linear models for interment with hunting implements (H), diet (D), and area-of-birth (B)

| | B | D | H | true count | Saturated | BD+BH+DH | BD+BH | BD+DH | BH+DH | BD | BH | DH | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 15 | 15 | 15 | 15 | 14.08 | 9.17 | 12 | 7.81 | 7.33 | 6.25 |
| 2 | 2 | 1 | 1 | 7 | 7 | 7 | 5.91 | 7.92 | 12.83 | 6.75 | 10.94 | 14.67 | 12.5 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5.83 | 0 | 7.19 | 4.67 | 5.75 |
| 4 | 2 | 2 | 1 | 14 | 14 | 14 | 15.09 | 14 | 8.17 | 17.25 | 10.06 | 9.33 | 11.5 |
| 5 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1.92 | 0.25 | 4 | 0.52 | 1 | 2.08 |
| 6 | 2 | 1 | 2 | 2 | 2 | 2 | 3.09 | 1.08 | 2.75 | 2.25 | 5.73 | 2 | 4.17 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0.75 | 0 | 0.48 | 3 | 1.92 |
| 8 | 2 | 2 | 2 | 9 | 9 | 9 | 7.91 | 9 | 8.25 | 5.75 | 5.27 | 6 | 3.83 |

Table A.27 Predicted and Actual counts of log-linear models for interment with hunting implements (H), diet (D), cluster in K14 (S)

| | H | D | S | true count | Saturated | HD+HS+DS | HD+HS | HD+DS | HS+DS | HD | HS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 5 | 5 | 4.83 | 7.31 | 6.61 | 4 | 10.7 | 6.48 | 5.86 | 9.49 |
| 2 | 2 | 1 | 1 | 3 | 3 | 3.17 | 4.21 | 1.39 | 4 | 2.25 | 6.48 | 2.14 | 3.47 |
| 3 | 1 | 2 | 1 | 5 | 5 | 5.17 | 2.69 | 6.72 | 6 | 3.94 | 3.52 | 8.79 | 5.16 |
| 4 | 2 | 2 | 1 | 7 | 7 | 6.83 | 5.79 | 5.28 | 6 | 3.1 | 3.52 | 3.21 | 1.88 |
| 5 | 1 | 1 | 2 | 18 | 18 | 18.77 | 15.35 | 18.17 | 18.48 | 13.38 | 13.61 | 16.11 | 11.86 |
| 6 | 2 | 1 | 2 | 4 | 4 | 3.23 | 1.68 | 3.83 | 3.52 | 2.82 | 2.59 | 5.89 | 4.33 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.23 | 5.65 | 1.68 | 2.52 | 4.93 | 7.39 | 2.2 | 6.45 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.77 | 2.32 | 1.32 | 0.48 | 3.87 | 1.41 | 0.8 | 2.36 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.39 | 6.58 | 2.48 | 2.08 | 6.96 | 5.83 | 2.2 | 6.17 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.61 | 1.68 | 0.52 | 0.92 | 1.46 | 2.59 | 0.8 | 2.25 |
| 11 | 1 | 2 | 3 | 6 | 6 | 6.61 | 2.42 | 5.6 | 6.92 | 2.56 | 3.17 | 7.32 | 3.35 |
| 12 | 2 | 2 | 3 | 4 | 4 | 3.39 | 2.32 | 4.4 | 3.08 | 2.01 | 1.41 | 2.68 | 1.22 |
| 13 | 1 | 1 | 4 | 12 | 12 | 12 | 8.77 | 10.74 | 12 | 6.96 | 7.77 | 9.52 | 6.17 |
| 14 | 2 | 1 | 4 | 1 | 1 | 1 | 0.42 | 2.26 | 1 | 1.46 | 0.65 | 3.48 | 2.25 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.23 | 0 | 0 | 2.56 | 4.23 | 0 | 3.35 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0.58 | 0 | 0 | 2.01 | 0.35 | 0 | 1.22 |

Table A.28 Predicted and Actual counts of log-linear models for interment with hunting implements (H), area-of-birth (B), cluster in K14 (S)

| | H | B | S | true count | Saturated | HB+HS+BS | HB+HS | HB+BS | HS+BS | HB | HS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1.86 | 0 | 0 | 3.64 | 1.53 | 0 | 2.99 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0.18 | 2.29 | 0 | 0.83 |
| 3 | 1 | 2 | 1 | 4 | 4 | 4 | 2.14 | 6.76 | 4 | 4.18 | 2.47 | 7.82 | 4.83 |
| 4 | 2 | 2 | 1 | 6 | 6 | 6 | 5.5 | 3.24 | 6 | 2 | 3.71 | 2.18 | 1.35 |
| 5 | 1 | 1 | 2 | 10 | 10 | 10.29 | 8.37 | 10.48 | 9.43 | 7.64 | 6.87 | 8.6 | 6.27 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.71 | 0.25 | 0.52 | 1.57 | 0.38 | 1.15 | 2.4 | 1.75 |
| 7 | 1 | 2 | 2 | 8 | 8 | 7.71 | 9.63 | 6.76 | 8.57 | 8.78 | 11.13 | 7.82 | 10.15 |
| 8 | 2 | 2 | 2 | 2 | 2 | 2.29 | 2.75 | 3.24 | 1.43 | 4.2 | 1.85 | 2.18 | 2.83 |
| 9 | 1 | 1 | 3 | 4 | 4 | 3.71 | 5.58 | 3.81 | 3.2 | 5.45 | 4.58 | 3.13 | 4.48 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.29 | 0.25 | 0.19 | 0.8 | 0.27 | 1.15 | 0.87 | 1.25 |
| 11 | 1 | 2 | 3 | 8 | 8 | 8.29 | 6.42 | 7.44 | 8.8 | 6.27 | 7.42 | 8.6 | 7.25 |
| 12 | 2 | 2 | 3 | 3 | 3 | 2.71 | 2.75 | 3.56 | 2.2 | 3 | 1.85 | 2.4 | 2.02 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 4.19 | 5.71 | 6 | 3.27 | 3.44 | 4.69 | 2.69 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0.29 | 0 | 0.16 | 0 | 1.31 | 0.75 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 4.81 | 2.03 | 3 | 3.76 | 5.56 | 2.35 | 4.35 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.97 | 0 | 1.8 | 0 | 0.65 | 1.21 |

Table A.29 Predicted and Actual counts of log-linear models for interment with meat butchering implements (P), diet (D), and area-of-birth (B)

| | B | D | P | true count | Saturated | BD+BP+DP | BD+BP | BD+DP | BP+DP | BD | BP | DP | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 16 | 16 | 16 | 16 | 15.36 | 9.14 | 14 | 8.33 | 8 | 7.29 |
| 2 | 2 | 1 | 1 | 8 | 8 | 8 | 7.31 | 8.64 | 14.86 | 7.87 | 13.54 | 16 | 14.58 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.86 | 0 | 7.67 | 6 | 6.71 |
| 4 | 2 | 2 | 1 | 18 | 18 | 18 | 18.69 | 18 | 11.14 | 20.13 | 12.46 | 12 | 13.42 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0.64 | 0 | 2 | 0 | 0.33 | 1.04 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1 | 1.69 | 0.36 | 1 | 1.12 | 3.12 | 0.67 | 2.08 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.67 | 0.96 |
| 8 | 2 | 2 | 2 | 5 | 5 | 5 | 4.31 | 5 | 5 | 2.88 | 2.88 | 3.33 | 1.92 |

Table A.30 Predicted and Actual counts of log-linear models for interment with meat butchering implements (P), diet (D), and cluster in K14 (S)

| | P | D | S | true count | Saturated | PD+PS+DS | PD+PS | PD+DS | PS+DS | PD | PS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 6 | 6 | 5.05 | 8.26 | 7.3 | 4.8 | 11.83 | 7.77 | 6.87 | 11.13 |
| 2 | 2 | 1 | 1 | 2 | 2 | 2.95 | 3.2 | 0.7 | 3.2 | 1.13 | 5.18 | 1.13 | 1.83 |
| 3 | 1 | 2 | 1 | 6 | 6 | 6.95 | 3.74 | 9.12 | 7.2 | 5.35 | 4.23 | 10.31 | 6.05 |
| 4 | 2 | 2 | 1 | 6 | 6 | 5.05 | 4.8 | 2.88 | 4.8 | 1.69 | 2.82 | 1.69 | 0.99 |
| 5 | 1 | 1 | 2 | 21 | 21 | 21.14 | 16.52 | 20.09 | 21.12 | 14.79 | 15.55 | 18.9 | 13.92 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.86 | 0.4 | 1.91 | 0.88 | 1.41 | 0.65 | 3.1 | 2.28 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.86 | 7.48 | 2.28 | 2.88 | 6.69 | 8.45 | 2.58 | 7.56 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.14 | 0.6 | 0.72 | 0.12 | 2.11 | 0.35 | 0.42 | 1.24 |
| 9 | 1 | 1 | 3 | 2 | 2 | 2.8 | 8.26 | 2.74 | 2.77 | 7.69 | 7.77 | 2.58 | 7.24 |
| 10 | 2 | 1 | 3 | 1 | 1 | 0.2 | 0.4 | 0.26 | 0.23 | 0.73 | 0.65 | 0.42 | 1.19 |
| 11 | 1 | 2 | 3 | 10 | 10 | 9.2 | 3.74 | 7.6 | 9.23 | 3.48 | 4.23 | 8.59 | 3.93 |
| 12 | 2 | 2 | 3 | 0 | 0 | 0.8 | 0.6 | 2.4 | 0.77 | 1.1 | 0.35 | 1.41 | 0.64 |
| 13 | 1 | 1 | 4 | 13 | 13 | 13 | 8.95 | 11.87 | 13 | 7.69 | 8.42 | 11.17 | 7.24 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 1.13 | 0 | 0.73 | 0 | 1.83 | 1.19 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 4.05 | 0 | 0 | 3.48 | 4.58 | 0 | 3.93 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 0 | 0 | 0.64 |

Table A.31 Predicted and Actual counts of log-linear models for interment with meat butchering implements (P), area-of-birth (B), and cluster in K14 (S)

| | P | B | S | true count | Saturated | PB+PS+BS | PB+PS | PB+BS | PS+BS | PB | PS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2.14 | 0 | 0 | 3.82 | 1.91 | 0 | 3.4 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.91 | 0 | 0.42 |
| 3 | 1 | 2 | 1 | 5 | 5 | 5 | 2.86 | 8.24 | 5 | 5.09 | 3.09 | 8.91 | 5.51 |
| 4 | 2 | 2 | 1 | 5 | 5 | 5 | 5 | 1.76 | 5 | 1.09 | 3.09 | 1.09 | 0.67 |
| 5 | 1 | 1 | 2 | 11 | 11 | 11 | 8.57 | 11 | 10.48 | 8.02 | 7.64 | 9.8 | 7.14 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0.52 | 0 | 0.38 | 1.2 | 0.87 |
| 7 | 1 | 2 | 2 | 9 | 9 | 9 | 11.43 | 8.24 | 9.52 | 10.69 | 12.36 | 8.91 | 11.57 |
| 8 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1.76 | 0.48 | 2.29 | 0.62 | 1.09 | 1.42 |
| 9 | 1 | 1 | 3 | 4 | 4 | 4 | 6.43 | 4 | 4 | 5.73 | 5.73 | 3.56 | 5.1 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.44 | 0.62 |
| 11 | 1 | 2 | 3 | 11 | 11 | 11 | 8.57 | 9.06 | 11 | 7.64 | 9.27 | 9.8 | 8.26 |
| 12 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 1.94 | 0 | 1.64 | 0 | 1.2 | 1.01 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 3.86 | 6 | 6 | 3.44 | 3.44 | 5.35 | 3.06 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.65 | 0.37 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 5.14 | 2.47 | 3 | 4.58 | 5.56 | 2.67 | 4.96 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.53 | 0 | 0.98 | 0 | 0.33 | 0.61 |

Table A.32 Predicted and Actual counts of log-linear models for fire use (F), diet (D), and area-of-birth (B)

| | F | B | D | true count | Saturated | FB+FD+BD | FB+FD | FB+BD | FD+BD | FB | FD | BD | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 16 | 16 | 16 | 16 | 14.72 | 9.2 | 13.33 | 8.33 | 7.67 | 6.94 |
| 2 | 2 | 1 | 1 | 7 | 7 | 7 | 6.75 | 8.28 | 13.8 | 7.5 | 12.5 | 15.33 | 13.89 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.8 | 0 | 7.67 | 5.67 | 6.39 |
| 4 | 2 | 2 | 1 | 17 | 17 | 17 | 17.25 | 17 | 10.2 | 19.17 | 11.5 | 11.33 | 12.78 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 1.28 | 0 | 2.67 | 0 | 0.67 | 1.39 |
| 6 | 2 | 1 | 2 | 2 | 2 | 2 | 2.25 | 0.72 | 2 | 1.5 | 4.17 | 1.33 | 2.78 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.28 |
| 8 | 2 | 2 | 2 | 6 | 6 | 6 | 5.75 | 6 | 6 | 3.83 | 3.83 | 4 | 2.56 |

Table A.33 Predicted and Actual counts of log-linear models for fire use (F), diet (D), and cluster in K14 (S)

| | F | D | S | true count | Saturated | FD+FS+DS | FD+FS | FD+DS | FS+DS | FD | FS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 8 | 8 | 7.83 | 12.67 | 6.61 | 7.6 | 10.7 | 12.31 | 6.42 | 10.4 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0.17 | 0.57 | 1.39 | 0.4 | 2.25 | 0.65 | 1.58 | 2.56 |
| 3 | 1 | 2 | 1 | 11 | 11 | 11.17 | 6.33 | 9.12 | 11.4 | 5.35 | 6.69 | 9.63 | 5.65 |
| 4 | 2 | 2 | 1 | 1 | 1 | 0.83 | 0.43 | 2.88 | 0.6 | 1.69 | 0.35 | 2.37 | 1.39 |
| 5 | 1 | 1 | 2 | 16 | 16 | 16.59 | 12 | 18.17 | 15.84 | 13.38 | 11.66 | 17.66 | 13 |
| 6 | 2 | 1 | 2 | 6 | 6 | 5.41 | 4 | 3.83 | 6.16 | 2.82 | 4.54 | 4.34 | 3.19 |
| 7 | 1 | 2 | 2 | 2 | 2 | 1.41 | 6 | 2.28 | 2.16 | 6.69 | 6.34 | 2.41 | 7.07 |
| 8 | 2 | 2 | 2 | 1 | 1 | 1.59 | 3 | 0.72 | 0.84 | 2.11 | 2.46 | 0.59 | 1.74 |
| 9 | 1 | 1 | 3 | 3 | 3 | 2.58 | 6 | 2.48 | 2.08 | 6.96 | 5.83 | 2.41 | 6.76 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0.42 | 2.29 | 0.52 | 0.92 | 1.46 | 2.59 | 0.59 | 1.66 |
| 11 | 1 | 2 | 3 | 6 | 6 | 6.42 | 3 | 7.6 | 6.92 | 3.48 | 3.17 | 8.03 | 3.67 |
| 12 | 2 | 2 | 3 | 4 | 4 | 3.58 | 1.71 | 2.4 | 3.08 | 1.1 | 1.41 | 1.97 | 0.9 |
| 13 | 1 | 1 | 4 | 11 | 11 | 11 | 7.33 | 10.74 | 11 | 6.96 | 7.13 | 10.44 | 6.76 |
| 14 | 2 | 1 | 4 | 2 | 2 | 2 | 1.14 | 2.26 | 2 | 1.46 | 1.3 | 2.56 | 1.66 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 3.67 | 0 | 0 | 3.48 | 3.87 | 0 | 3.67 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 0.86 | 0 | 0 | 1.1 | 0.7 | 0 | 0.9 |

Table A.34 Predicted and Actual counts of log-linear models for fire use (F), area-of-birth (B), and cluster in K14 (S)

| | F | B | S | true count | Saturated | FB+FS+BS | FB+FS | FB+BS | FS+BS | FB | FS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 3.6 | 0 | 0 | 2.91 | 3.44 | 0 | 2.78 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0.33 | 0 | 0 | 0.91 | 0.38 | 0 | 1.04 |
| 3 | 1 | 2 | 1 | 9 | 9 | 9 | 5.4 | 7.06 | 9 | 4.36 | 5.56 | 7.27 | 4.5 |
| 4 | 2 | 2 | 1 | 1 | 1 | 1 | 0.67 | 2.94 | 1 | 1.82 | 0.62 | 2.73 | 1.69 |
| 5 | 1 | 1 | 2 | 10 | 10 | 8.59 | 6.4 | 8.38 | 8.38 | 6.11 | 6.11 | 8 | 5.83 |
| 6 | 2 | 1 | 2 | 1 | 1 | 2.41 | 1.67 | 2.62 | 2.62 | 1.91 | 1.91 | 3 | 2.19 |
| 7 | 1 | 2 | 2 | 6 | 6 | 7.41 | 9.6 | 7.06 | 7.62 | 9.16 | 9.89 | 7.27 | 9.44 |
| 8 | 2 | 2 | 2 | 4 | 4 | 2.59 | 3.33 | 2.94 | 2.38 | 3.82 | 3.09 | 2.73 | 3.54 |
| 9 | 1 | 1 | 3 | 1 | 1 | 2.03 | 2.8 | 3.05 | 1.87 | 4.36 | 2.67 | 2.91 | 4.17 |
| 10 | 2 | 1 | 3 | 3 | 3 | 1.97 | 2.67 | 0.95 | 2.13 | 1.36 | 3.05 | 1.09 | 1.56 |
| 11 | 1 | 2 | 3 | 6 | 6 | 4.97 | 4.2 | 7.76 | 5.13 | 6.55 | 4.33 | 8 | 6.74 |
| 12 | 2 | 2 | 3 | 5 | 5 | 6.03 | 5.33 | 3.24 | 5.87 | 2.73 | 4.95 | 3 | 2.53 |
| 13 | 1 | 1 | 4 | 5 | 5 | 5.38 | 3.2 | 4.57 | 5.33 | 2.62 | 3.05 | 4.36 | 2.5 |
| 14 | 2 | 1 | 4 | 1 | 1 | 0.62 | 0.33 | 1.43 | 0.67 | 0.82 | 0.38 | 1.64 | 0.94 |
| 15 | 1 | 2 | 4 | 3 | 3 | 2.62 | 4.8 | 2.12 | 2.67 | 3.93 | 4.95 | 2.18 | 4.05 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0.38 | 0.67 | 0.88 | 0.33 | 1.64 | 0.62 | 0.82 | 1.52 |

Table A.35 Predicted and Actual counts of log-linear models for head treatment (C), diet (D), and area-of-birth (B)

| | B | D | C | true count | Saturated | BD+BC+DC | BD+BC | BD+DC | BC+DC | BD | BC | DC | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 15 | 15 | 15 | 15 | 14 | 8.75 | 12.26 | 7.66 | 7.15 | 6.26 |
| 2 | 2 | 1 | 1 | 6 | 6 | 6 | 5.42 | 7 | 12.25 | 6.13 | 10.72 | 13.85 | 12.12 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6.25 | 0 | 7.34 | 5.11 | 6 |
| 4 | 2 | 2 | 1 | 15 | 15 | 15 | 15.58 | 15 | 8.75 | 17.62 | 10.28 | 9.89 | 11.62 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0.67 | 0 | 2.72 | 0 | 0.34 | 1.39 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1 | 2.06 | 0.33 | 1 | 1.36 | 4.09 | 0.66 | 2.69 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.38 | 1.33 |
| 8 | 2 | 2 | 2 | 7 | 7 | 7 | 5.94 | 7 | 7 | 3.91 | 3.91 | 4.62 | 2.58 |
| 9 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1.33 | 1 | 0.68 | 0.51 | 0.68 | 0.35 |
| 10 | 2 | 1 | 3 | 1 | 1 | 1 | 0.26 | 0.67 | 1 | 0.34 | 0.51 | 1.32 | 0.67 |
| 11 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.49 | 0 | 0.33 |
| 12 | 2 | 2 | 3 | 0 | 0 | 0 | 0.74 | 0 | 0 | 0.98 | 0.49 | 0 | 0.65 |
| 13 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0.34 | 0 | 0 | 0.17 |
| 14 | 2 | 1 | 4 | 0 | 0 | 0 | 0.26 | 0 | 0 | 0.17 | 0.51 | 0 | 0.34 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.34 | 0.17 |
| 16 | 2 | 2 | 4 | 1 | 1 | 1 | 0.74 | 1 | 1 | 0.49 | 0.49 | 0.66 | 0.32 |

Table A.36 Predicted and Actual counts of log-linear models for head treatment (C), diet (D), and cluster in K14 (S)

| | C | D | S | true count | Saturated | CD+CS+DS | CD+CS | CD+DS | CS+DS | CD | CS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 2 | 2 | 1.95 | 4.04 | 6 | 2.4 | 9.57 | 3.83 | 5.68 | 9.06 |
| 2 | 2 | 1 | 1 | 6 | 6 | 6.05 | 7.31 | 1.64 | 5.2 | 2.61 | 8.29 | 1.86 | 2.96 |
| 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0.36 | 0 | 0.58 | 0 | 0.23 | 0.37 |
| 4 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0.64 | 0.23 | 0.37 |
| 5 | 1 | 2 | 1 | 4 | 4 | 4.05 | 1.96 | 7.68 | 3.6 | 4.64 | 2.17 | 8.52 | 5.15 |
| 6 | 2 | 2 | 1 | 7 | 7 | 6.95 | 5.69 | 3.36 | 7.8 | 2.03 | 4.71 | 2.78 | 1.68 |
| 7 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.35 | 0.21 |
| 8 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 0.96 | 0.6 | 0.58 | 0.36 | 0.35 | 0.21 |
| 9 | 1 | 1 | 2 | 19 | 19 | 19.05 | 14.14 | 16.5 | 18.48 | 11.96 | 13.39 | 15.62 | 11.32 |
| 10 | 2 | 1 | 2 | 1 | 1 | 0.95 | 0.56 | 4.5 | 0.88 | 3.26 | 0.64 | 5.1 | 3.7 |
| 11 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1.76 | 0.72 | 1.28 | 0.64 | 0.46 |
| 12 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0.88 | 0 | 0.64 | 0.64 | 0.46 |
| 13 | 1 | 2 | 2 | 2 | 2 | 1.95 | 6.86 | 1.92 | 2.52 | 5.8 | 7.61 | 2.13 | 6.43 |
| 14 | 2 | 2 | 2 | 0 | 0 | 0.05 | 0.44 | 0.84 | 0.12 | 2.54 | 0.36 | 0.7 | 2.1 |
| 15 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0.24 | 0 | 0.72 | 0.09 | 0.26 |
| 16 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 0.24 | 0.12 | 0.72 | 0.36 | 0.09 | 0.26 |
| 17 | 1 | 1 | 3 | 2 | 2 | 2 | 8.08 | 1.5 | 2 | 5.74 | 7.65 | 1.42 | 5.43 |
| 18 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0.41 | 0 | 1.57 | 0 | 0.46 | 1.77 |
| 19 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0.09 | 0 | 0.35 | 0 | 0.06 | 0.22 |
| 20 | 4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.06 | 0.22 |
| 21 | 1 | 2 | 3 | 10 | 10 | 10 | 3.92 | 6.4 | 10 | 2.78 | 4.35 | 7.1 | 3.09 |
| 22 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 2.8 | 0 | 1.22 | 0 | 2.32 | 1.01 |
| 23 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.29 | 0.13 |
| 24 | 4 | 2 | 3 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0.35 | 0 | 0.29 | 0.13 |
| 25 | 1 | 1 | 4 | 10 | 10 | 10 | 6.73 | 9 | 10 | 5.74 | 6.38 | 8.52 | 5.43 |
| 26 | 2 | 1 | 4 | 2 | 2 | 2 | 1.12 | 2.45 | 2 | 1.57 | 1.28 | 2.78 | 1.77 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0.55 | 0 | 0.35 | 0 | 0.35 | 0.22 |
| 28 | 4 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.35 | 0.22 |
| 29 | 1 | 2 | 4 | 0 | 0 | 0 | 3.27 | 0 | 0 | 2.78 | 3.62 | 0 | 3.09 |
| 30 | 2 | 2 | 4 | 0 | 0 | 0 | 0.87 | 0 | 0 | 1.22 | 0.72 | 0 | 1.01 |
| 31 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 |
| 32 | 4 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0.35 | 0 | 0 | 0.13 |

Table A.37 Predicted and Actual counts of log-linear models for head treatment (C), area-of-birth (B), and cluster in K14 (S)

| | C | B | S | true count | Saturated | CB+CS+BS | CB+CS | CB+BS | CS+BS | CB | CS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1.36 | 0 | 0 | 3.52 | 1.17 | 0 | 3.02 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.72 | 0 | 0.58 |
| 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0.19 | 0 | 0 | 0.14 |
| 4 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0.19 | 0 | 0 | 0.14 |
| 5 | 1 | 2 | 1 | 3 | 3 | 3 | 1.64 | 6.97 | 3 | 4.26 | 1.83 | 7.78 | 4.75 |
| 6 | 2 | 2 | 1 | 7 | 7 | 7 | 7 | 2.42 | 7 | 1.48 | 4.28 | 1.48 | 0.91 |
| 7 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.19 | 0 | 0.37 | 0.23 |
| 8 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.19 | 0 | 0.37 | 0.23 |
| 9 | 1 | 1 | 2 | 10 | 10 | 9.35 | 7.69 | 9.95 | 8.9 | 7.39 | 6.61 | 8.56 | 6.35 |
| 10 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0.52 | 0 | 0.39 | 1.63 | 1.21 |
| 11 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 0.52 | 1.05 | 0.39 | 0.78 | 0.41 | 0.3 |
| 12 | 4 | 1 | 2 | 0 | 0 | 0.65 | 0.5 | 0.52 | 0.52 | 0.39 | 0.39 | 0.41 | 0.3 |
| 13 | 1 | 2 | 2 | 7 | 7 | 7.65 | 9.31 | 6.97 | 8.1 | 8.94 | 10.39 | 7.78 | 9.98 |
| 14 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2.42 | 0.48 | 3.11 | 0.61 | 1.48 | 1.9 |
| 15 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 0.3 | 0.95 | 0.39 | 1.22 | 0.37 | 0.48 |
| 16 | 4 | 2 | 2 | 1 | 1 | 0.35 | 0.5 | 0.3 | 0.48 | 0.39 | 0.61 | 0.37 | 0.48 |
| 17 | 1 | 1 | 3 | 3 | 3 | 3.65 | 6.33 | 3.62 | 3.73 | 5.28 | 5.44 | 3.11 | 4.54 |
| 18 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.59 | 0.86 |
| 19 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0.19 | 0 | 0.28 | 0 | 0.15 | 0.22 |
| 20 | 4 | 1 | 3 | 1 | 1 | 0.35 | 0.5 | 0.19 | 0.27 | 0.28 | 0.39 | 0.15 | 0.22 |
| 21 | 1 | 2 | 3 | 11 | 11 | 10.35 | 7.67 | 7.67 | 10.27 | 6.39 | 8.56 | 8.56 | 7.13 |
| 22 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 2.67 | 0 | 2.22 | 0 | 1.63 | 1.36 |
| 23 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0.33 | 0 | 0.28 | 0 | 0.41 | 0.34 |
| 24 | 4 | 2 | 3 | 0 | 0 | 0.65 | 0.5 | 0.33 | 0.73 | 0.28 | 0.61 | 0.41 | 0.34 |
| 25 | 1 | 1 | 4 | 6 | 6 | 6 | 3.62 | 5.43 | 6 | 2.81 | 3.11 | 4.67 | 2.42 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.89 | 0.46 |
| 27 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0.29 | 0 | 0.15 | 0 | 0.22 | 0.12 |
| 28 | 4 | 1 | 4 | 0 | 0 | 0 | 0 | 0.29 | 0 | 0.15 | 0 | 0.22 | 0.12 |
| 29 | 1 | 2 | 4 | 2 | 2 | 2 | 4.38 | 1.39 | 2 | 3.41 | 4.89 | 1.56 | 3.8 |
| 30 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.48 | 0 | 1.19 | 0 | 0.3 | 0.72 |
| 31 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0.06 | 0 | 0.15 | 0 | 0.07 | 0.18 |
| 32 | 4 | 2 | 4 | 0 | 0 | 0 | 0 | 0.06 | 0 | 0.15 | 0 | 0.07 | 0.18 |

Table A.38 Predicted and Actual counts of log-linear models for grave disturbance (G), diet (D), and area-of-birth (B)

| | A | D | G | true count | Saturated | AD+AG+DG | AD+AG | AD+DG | AG+DG | AD | AG | DG | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 11 | 11 | 11 | 11 | 10.35 | 6.77 | 7.94 | 5.19 | 4.89 | 3.75 |
| 2 | 2 | 1 | 1 | 5 | 5 | 5 | 3.6 | 5.65 | 9.23 | 4.33 | 7.08 | 11.11 | 8.53 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 4.23 | 0 | 5.81 | 3.06 | 4.19 |
| 4 | 2 | 2 | 1 | 10 | 10 | 10 | 11.4 | 10 | 5.77 | 13.72 | 7.92 | 6.94 | 9.53 |
| 5 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0.65 | 0 | 1.53 | 0 | 0.31 | 0.72 |
| 6 | 2 | 1 | 2 | 1 | 1 | 1 | 1.2 | 0.35 | 1 | 0.83 | 2.36 | 0.69 | 1.64 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.22 | 0.81 |
| 8 | 2 | 2 | 2 | 4 | 4 | 4 | 3.8 | 4 | 4 | 2.64 | 2.64 | 2.78 | 1.83 |
| 9 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1.53 | 0 | 0 | 0.72 |
| 10 | 2 | 1 | 3 | 0 | 0 | 0 | 1.2 | 0 | 0 | 0.83 | 2.36 | 0 | 1.64 |
| 11 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.53 | 0.81 |
| 12 | 2 | 2 | 3 | 5 | 5 | 5 | 3.8 | 5 | 5 | 2.64 | 2.64 | 3.47 | 1.83 |

Table A.39 Predicted and Actual counts of log-linear models for grave disturbance (G), diet (D), and cluter in K14

| | G | D | S | true count | Saturated | GD+GS+DS | GD+GS | GD+DS | GS+DS | GD | GS | DS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 4.57 | 0 | 6.79 | 0 | 4.29 | 6.36 |
| 2 | 2 | 1 | 1 | 6 | 6 | 6 | 7.2 | 2.06 | 5.05 | 3.05 | 7.5 | 2.14 | 3.18 |
| 3 | 3 | 1 | 1 | 2 | 2 | 2 | 3.82 | 1.37 | 2.95 | 2.04 | 4.38 | 1.57 | 2.33 |
| 4 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 5.24 | 0 | 3.39 | 0 | 5.89 | 3.82 |
| 5 | 2 | 2 | 1 | 6 | 6 | 6 | 4.8 | 3.14 | 6.95 | 2.04 | 4.5 | 2.95 | 1.91 |
| 6 | 3 | 2 | 1 | 5 | 5 | 5 | 3.18 | 2.62 | 4.05 | 1.7 | 2.63 | 2.16 | 1.4 |
| 7 | 1 | 1 | 2 | 11 | 11 | 11 | 8.67 | 9.14 | 11.56 | 6.43 | 8.13 | 8.57 | 6.03 |
| 8 | 2 | 1 | 2 | 2 | 2 | 2 | 1.2 | 4.11 | 1.78 | 2.89 | 1.25 | 4.29 | 3.01 |
| 9 | 3 | 1 | 2 | 3 | 3 | 3 | 1.64 | 2.74 | 2.67 | 1.93 | 1.87 | 3.14 | 2.21 |
| 10 | 1 | 2 | 2 | 2 | 2 | 2 | 4.33 | 0.95 | 1.44 | 3.21 | 4.87 | 1.07 | 3.62 |
| 11 | 2 | 2 | 2 | 0 | 0 | 0 | 0.8 | 0.57 | 0.22 | 1.93 | 0.75 | 0.54 | 1.81 |
| 12 | 3 | 2 | 2 | 0 | 0 | 0 | 1.36 | 0.48 | 0.33 | 1.61 | 1.12 | 0.39 | 1.33 |
| 13 | 1 | 1 | 3 | 1 | 1 | 1 | 6 | 1.14 | 1.8 | 3.57 | 5.62 | 1.07 | 3.35 |
| 14 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0.51 | 0 | 1.61 | 0 | 0.54 | 1.67 |
| 15 | 3 | 1 | 3 | 1 | 1 | 1 | 0.55 | 0.34 | 0.2 | 1.07 | 0.62 | 0.39 | 1.23 |
| 16 | 1 | 2 | 3 | 8 | 8 | 8 | 3 | 3.81 | 7.2 | 1.79 | 3.37 | 4.29 | 2.01 |
| 17 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 2.29 | 0 | 1.07 | 0 | 2.14 | 1 |
| 18 | 3 | 2 | 3 | 0 | 0 | 0 | 0.45 | 1.9 | 0.8 | 0.89 | 0.37 | 1.57 | 0.74 |
| 19 | 1 | 1 | 4 | 8 | 8 | 8 | 5.33 | 5.14 | 8 | 3.21 | 5 | 4.82 | 3.01 |
| 20 | 2 | 1 | 4 | 1 | 1 | 1 | 0.6 | 2.31 | 1 | 1.45 | 0.62 | 2.41 | 1.51 |
| 21 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 1.54 | 0 | 0.96 | 0 | 1.77 | 1.1 |
| 22 | 1 | 2 | 4 | 0 | 0 | 0 | 2.67 | 0 | 0 | 1.61 | 3 | 0 | 1.81 |
| 23 | 2 | 2 | 4 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0.96 | 0.37 | 0 | 0.9 |
| 24 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0 | 0.66 |

Table A.40 Predicted and Actual counts of log-linear models for grave disturbance (G), area-of-birth (B), and cluster in K14 (S)

| | G | B | S | true count | Saturated | GB+GS+BS | GB+GS | GB+BS | GS+BS | GB | GS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3.15 | 0 | 0 | 2.36 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.4 | 0 | 0.39 |
| 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.75 | 0 | 0.39 |
| 4 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 5.54 | 0 | 3.6 | 0 | 6.75 | 4.39 |
| 5 | 2 | 2 | 1 | 4 | 4 | 4 | 4 | 1.73 | 4 | 1.13 | 2.6 | 1.13 | 0.73 |
| 6 | 3 | 2 | 1 | 5 | 5 | 5 | 5 | 1.73 | 5 | 1.13 | 3.25 | 1.13 | 0.73 |
| 7 | 1 | 1 | 2 | 6 | 6 | 6 | 5.6 | 6 | 5.54 | 4.55 | 4.2 | 4.5 | 3.41 |
| 8 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0.46 | 0 | 0.35 | 0.75 | 0.57 |
| 9 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.75 | 0.57 |
| 10 | 1 | 2 | 2 | 6 | 6 | 6 | 6.4 | 4.31 | 6.46 | 5.2 | 7.8 | 5.25 | 6.34 |
| 11 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1.35 | 0.54 | 1.63 | 0.65 | 0.87 | 1.06 |
| 12 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 1.35 | 0 | 1.63 | 0 | 0.87 | 1.06 |
| 13 | 1 | 1 | 3 | 3 | 3 | 3 | 5.13 | 3 | 3 | 3.85 | 3.85 | 2.25 | 2.89 |
| 14 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.38 | 0.48 |
| 15 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.38 | 0.48 |
| 16 | 1 | 2 | 3 | 8 | 8 | 8 | 5.87 | 4.92 | 8 | 4.4 | 7.15 | 6 | 5.36 |
| 17 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 1.54 | 0 | 1.38 | 0 | 1 | 0.89 |
| 18 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 1.54 | 0 | 1.38 | 0 | 1 | 0.89 |
| 19 | 1 | 1 | 4 | 5 | 5 | 5 | 3.27 | 5 | 5 | 2.45 | 2.45 | 3.75 | 1.84 |
| 20 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.63 | 0.31 |
| 21 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.63 | 0.31 |
| 22 | 1 | 2 | 4 | 2 | 2 | 2 | 3.73 | 1.23 | 2 | 2.8 | 4.55 | 1.5 | 3.41 |
| 23 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0.38 | 0 | 0.88 | 0 | 0.25 | 0.57 |
| 24 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0.38 | 0 | 0.88 | 0 | 0.25 | 0.57 |

Table A.41 Predicted and Actual counts of log-linear models for diet (D), area-of-birth (B), and grave pit lining (L)

| | B | D | L | true count | Saturated | BD+BL+DL | BD+BL | BD+DL | BL+DL | BD | BL | DL | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 12 | 12 | 12 | 12 | 13.44 | 6.15 | 13.67 | 6.25 | 7 | 7.12 |
| 2 | 2 | 1 | 1 | 9 | 9 | 9 | 8.16 | 7.56 | 14.85 | 7.69 | 15.1 | 14 | 14.24 |
| 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5.85 | 0 | 5.75 | 6.67 | 6.55 |
| 4 | 2 | 2 | 1 | 20 | 20 | 20 | 20.84 | 20 | 14.15 | 19.65 | 13.9 | 13.33 | 13.1 |
| 5 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 2.56 | 2.29 | 2.33 | 2.08 | 1.33 | 1.22 |
| 6 | 2 | 1 | 2 | 0 | 0 | 0 | 0.84 | 1.44 | 1.71 | 1.31 | 1.56 | 2.67 | 2.43 |
| 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1.71 | 0 | 1.92 | 1 | 1.12 |
| 8 | 2 | 2 | 2 | 3 | 3 | 3 | 2.16 | 3 | 1.29 | 3.35 | 1.44 | 2 | 2.24 |

| Table A.42 Predicted and Actual counts of log-linear models for grave pit lining (L), diet (D), and cluster in K14 (S) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | D | S | true count | Saturated | LD+LS+DS | LD+LS | LD+DS | LC+DS | LD | LS | DS | No Interaction |
| 1 | 1 | 1 | 1 | 6 | 6 | 5.24 | 9.11 | 6.04 | 6 | 9.71 | 9.64 | 6.4 | 10.29 |
| 2 | 2 | 1 | 1 | 2 | 2 | 2.76 | 3.93 | 1.96 | 2 | 3.14 | 3.21 | 1.6 | 2.57 |
| 3 | 1 | 2 | 1 | 9 | 9 | 9.76 | 5.89 | 10.56 | 9 | 6.29 | 5.36 | 9.6 | 5.71 |
| 4 | 2 | 2 | 1 | 3 | 3 | 2.24 | 1.07 | 1.44 | 3 | 0.86 | 1.79 | 2.4 | 1.43 |
| 5 | 1 | 1 | 2 | 21 | 21 | 21.06 | 14.57 | 16.62 | 21.12 | 12.14 | 15.43 | 17.6 | 12.86 |
| 6 | 2 | 1 | 2 | 1 | 1 | 0.94 | 0.79 | 5.38 | 0.88 | 3.93 | 0.64 | 4.4 | 3.21 |
| 7 | 1 | 2 | 2 | 3 | 3 | 2.94 | 9.43 | 2.64 | 2.88 | 7.86 | 8.57 | 2.4 | 7.14 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0.06 | 0.21 | 0.36 | 0.12 | 1.07 | 0.36 | 0.6 | 1.79 |
| 9 | 1 | 1 | 3 | 1 | 1 | 1.7 | 6.68 | 1.51 | 1.83 | 5.83 | 7.07 | 1.6 | 6.17 |
| 10 | 2 | 1 | 3 | 1 | 1 | 0.3 | 0.79 | 0.49 | 0.17 | 1.89 | 0.64 | 0.4 | 1.54 |
| 11 | 1 | 2 | 3 | 10 | 10 | 9.3 | 4.32 | 8.8 | 9.17 | 3.77 | 3.93 | 8 | 3.43 |
| 12 | 2 | 2 | 3 | 0 | 0 | 0.7 | 0.21 | 1.2 | 0.83 | 0.51 | 0.36 | 2 | 0.86 |
| 13 | 1 | 1 | 4 | 6 | 6 | 6 | 3.64 | 9.82 | 6 | 6.31 | 3.86 | 10.4 | 6.69 |
| 14 | 2 | 1 | 4 | 7 | 7 | 7 | 5.5 | 3.18 | 7 | 2.04 | 4.5 | 2.6 | 1.67 |
| 15 | 1 | 2 | 4 | 0 | 0 | 0 | 2.36 | 0 | 0 | 4.09 | 2.14 | 0 | 3.71 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1.5 | 0 | 0 | 0.56 | 2.5 | 0 | 0.93 |

Table A.43 Predicted and Actual counts of log-linear models for grave pit lining (L), area-of-birth (B), and cluster in K14 (S)

| | L | B | S | true count | Saturated | LB+LS+BS | LB+LS | LB+BS | LS+BS | LB | LS | BS | No Interaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2.28 | 0 | 0 | 2.73 | 2.67 | 0 | 3.19 |
| 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1.09 | 1.15 | 0 | 0.62 |
| 3 | 1 | 2 | 1 | 7 | 7 | 7 | 4.72 | 9.12 | 7 | 5.64 | 4.33 | 8.36 | 5.17 |
| 4 | 2 | 2 | 1 | 3 | 3 | 3 | 1 | 0.88 | 3 | 0.55 | 1.85 | 1.64 | 1.01 |
| 5 | 1 | 1 | 2 | 9 | 9 | 9 | 6.2 | 7.86 | 9.95 | 5.73 | 7.25 | 9.2 | 6.71 |
| 6 | 2 | 1 | 2 | 2 | 2 | 2 | 1.33 | 3.14 | 1.05 | 2.29 | 0.76 | 1.8 | 1.31 |
| 7 | 1 | 2 | 2 | 10 | 10 | 10 | 12.8 | 9.12 | 9.05 | 11.84 | 11.75 | 8.36 | 10.86 |
| 8 | 2 | 2 | 2 | 0 | 0 | 0 | 0.67 | 0.88 | 0.95 | 1.15 | 1.24 | 1.64 | 2.12 |
| 9 | 1 | 1 | 3 | 3 | 3 | 3 | 4.57 | 2.86 | 3.73 | 4.09 | 5.35 | 3.35 | 4.79 |
| 10 | 2 | 1 | 3 | 1 | 1 | 1 | 0.67 | 1.14 | 0.27 | 1.64 | 0.38 | 0.65 | 0.94 |
| 11 | 1 | 2 | 3 | 11 | 11 | 11 | 9.43 | 10.03 | 10.27 | 8.45 | 8.65 | 9.2 | 7.76 |
| 12 | 2 | 2 | 3 | 0 | 0 | 0 | 0.33 | 0.97 | 0.73 | 0.82 | 0.62 | 1.8 | 1.52 |
| 13 | 1 | 1 | 4 | 3 | 3 | 3 | 1.96 | 4.29 | 4 | 2.45 | 2.29 | 5.02 | 2.87 |
| 14 | 2 | 1 | 4 | 3 | 3 | 3 | 2 | 1.71 | 2 | 0.98 | 1.15 | 0.98 | 0.56 |
| 15 | 1 | 2 | 4 | 3 | 3 | 3 | 4.04 | 2.74 | 2 | 5.07 | 3.71 | 2.51 | 4.65 |
| 16 | 2 | 2 | 4 | 0 | 0 | 0 | 1 | 0.26 | 1 | 0.49 | 1.85 | 0.49 | 0.91 |