POPULATION DYNAMICS AND SOCIOPOLITICAL INSTABILITY IN THE CENTRAL MESA VERDE REGION, A.D. 600-1280

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the thesis of SARAH COLE find it satisfactory and recommend that it be accepted.

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Abstract

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This thesis examines the relationship between population and warfare in the archaeological record of the central Mesa Verde region of southwest Colorado and southeast Utah between A.D. 600 and 1280. Analysis of human skeletal data from a total of 621 individuals from 88 sites forms the basis of this study. The total sample of 621 individuals was divided into the modeling periods used in the Village Ecodynamics Project.

I examine the skeletal remains data following Peter Turchin and Andrey Korotayev's (2006) non-linear, dynamic model of population and warfare. In a dynamic relationship, population growth leads to increased warfare, but increased warfare in turn causes population to decline. I argue that this type of dynamic relationship between population and warfare is apparent at certain time periods between A.D. 600 and 1280.

The portion of the Basketmaker III period (A.D. 600-700) included in this thesis suggests a slightly higher-than-expected level of warfare. It is likely this level of warfare may actually be an accurate interpretation. I did not merely focus on evidence of human

modification and disarticulation on skeletal remains which is a common interpretation by some researchers as evidence of warfare.

The first cycle of population and warfare, which includes the entire Pueblo I period and the first part of the Pueblo II period, is in accord with the model's predictions. However, from about A.D. 1000-1200, the data do not fall within the model's predictions. It is highly likely that the northward expansion of the Chacoan system on the south and its later demise significantly impacted the central Mesa Verde region during this period.

In the final cycle of population and warfare in the 1200s, I see a lower-than-expected level of warfare. This is likely due to a combination of three factors: (1) the small number of large sites systematically excavated; (2) the loss of women to raiders from the Totah region; and (3) underestimating the impact of village-level massacres when I calculated the warfare index.

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Dedication

This thesis is dedicated to my parents, Ken and Anne Cole, for their unwavering support, and to my son, Cameron Michael Cole, who has changed my life in ways I never thought possible. Without their positive influence, this thesis would never have been completed.

CHAPTER 1 INTRODUCTION

Throughout the history of anthropology, the study of warfare has often been avoided. Otterbein (1973) and Keeley (2001) both argued that one reason for this neglect is because of the pacifist and humanitarian positions taken by many anthropologists. During the 1980s, however, researchers witnessed an increase in archaeological studies of warfare. Ferguson (1984) considered this to be the result of several factors that affected our lives since the 1960s, especially the Vietnam War and the Cold War. A change in theoretical orientation had also taken place in the 1960s. Marxist perspectives that focused on social conflict were being published as well as cultural ecological perspectives that focused on warfare as a possibly maladaptive human institution (Ferguson 1984). However, even in the 1990s it was still argued that "[t]here is no very good proof that precontact societies engaged in warfare that was either common or particularly fierce, and the weight of evidence suggests that they were for the most part pacific" (Sale 1990:318). It remains to be seen whether contemporary turmoil will stimulate an even greater emphasis on understanding the causes and consequences of warfare.

In this thesis, I examine archaeological data from precontact groups in the central Mesa Verde region of southwest Colorado and southeast Utah. In contrast to Sale's (1990:318) argument that archaeological evidence of precontact societies in general has not been able to provide enough data that warfare was common, using human remains data as direct evidence, I suggest that throughout the entire time span covered in this study, from A.D. 600 through 1280, there is evidence of varying degrees (i.e., intensities) of warfare.

Furthermore, in contrast to research that has downplayed a relationship between population and warfare, I examine the skeletal remains data following Peter Turchin and Andrey Korotayev's (2006) non-linear, dynamic model concerning these two variables. I argue that this type of dynamic relationship between population and warfare is apparent at certain time periods. However, from about A.D. 1000-1200, the data do not accord with the model's predictions. It is highly likely that the expansion of the Chacoan system to the south and its demise significantly impacted the central Mesa Verde region during this period.

The Warfare Debate in the American Southwest

The American Southwest has received an enormous amount of attention with respect to the presence of prehistoric warfare. Some of this debate has been definitional – whether or not warfare should include a wide range of behaviors such as raiding and feuding in small-scale societies as well as institutionalized combat on a village or multiple – village scale. This has in turn prompted many archaeologists to clarify their definition of warfare prior to discussing their research to eliminate confusion in interpretation (Haas 1996; Haas and Creamer 1996; Keeley 2001; Kramer 2002; Kuckelman et al. 2002; LeBlanc 1999; LeBlanc and Rice 2001; Lekson 2002; Oliver 2001; Rice 2001; Solometo 2004; Wallace and Doelle 2001).

This debate is also due to the different lines of evidence researchers have used to represent the presence of warfare in the American Southwest. This evidence typically includes examples of stockades, towers, site-enclosing walls, burned sites and structures, iconography, and site location. Alternative interpretations for such evidence, however,

are possible (Fewkes 1916; Green 1962; Hibben 1948; Johnson 2003; Rohn 1989a; Walt 1985), and many take a ritualistic perspective (Cameron 1990; Creel and Anyon 2003; Darling 1999; Lancaster and Pinkley 1954; Lightfoot 1994; Rohn 1977, 1989a; Walker 1998). Ritual hypotheses include considering intentional structural burning at time of abandonment as ritual "retirement," perceiving towers as ceremonial structures or shrines, and considering violence to be ritual in the form of persecuted witches. These are indeed complicated issues; as the documented uses of strongly built churches in many parts of medieval Europe demonstrate, structures that are useful in times of strife may have other uses in other times.

Current Research

Recently, more attention has been placed on a line of evidence which can directly speak to the pattern of violence if not warfare: skeletal remains. This research has gone beyond merely looking for the rare occurrence of embedded projectile points. Several cases have been identified in which prehistoric cultural modification and disarticulation of human remains in the central Mesa Verde region of southeast Utah and southwest Colorado suggest cannibalism or extreme violence (Baker 1990; Billman et al. 2000; Dice 1993a; Fink 1989; Kuckelman 2002; Kuckelman et al. 2002; Lambert 1999; Lightfoot and Kuckelman 2001; Luebben and Nickens 1982; Malville 1989; Turner 1988; Turner and Turner 1992, 1999; White 1988, 1992). Most researchers are in agreement that such instances represent some sort of violent encounter between prehistoric peoples.

Recent research has also included gender-based perspectives within a broader economic and biocultural context through the examination of skeletal remains. Martin (1997) and Martin and Akins (2001) focused on female skeletal remains associated with informal burials in the La Plata River Valley and suggested they may have represented a servant or laborer class likely captured in raids. Kramer (2002) demonstrated that the sex ratio for the 1200s in the Northern San Juan region – which includes my study area here – is significantly high (male biased). She suggested that this may be "attributed to a more defensive conflict where people are staying closer to the settlements trying to defend their homes but never the less losing some women to the raiders" (2002:117). Furthermore, Kohler and Turner (2006) argue that there is strong evidence for women having been obtained through warfare in the northern Southwest during the 1200s, and perhaps earlier.

Despite this new work, to my knowledge there has not been an attempt to empirically delineate a distinction between spontaneous interpersonal violence and warfare in the American Southwest through the examination of skeletal remains. This is crucial since it seems likely that the causes and consequences of such differing actions are distinct. Warfare-related violence has group-level consequences and causes on a much larger social and spatial scale than the causes of one-on-one violent interactions. Of course, although these types of violence can be conceptually distinguished, we should recognize that interpersonal violence can sometimes escalate to the level of warfare between groups (Chagnon 1990).

The Consequences of Warfare

From an evolutionary perspective, group-level consequences from warfare could encourage cultural group selection, whereas interpersonal violence may encourage within-group (individual-level) selection. Cultural group-level selection will only occur, however, if it is powerful enough to override other processes, especially competition within the group at the individual level (Shennan 2002:31,238). If a favorable trait such as cooperation at the group level benefits individuals within the group, then group selection could predominate over individual selection. Skyrms (1996) and Bowles and Gintis (1998), among others, have described mechanisms by which this might occur.

Soltis et al. (1995) have suggested that the key process for the occurrence of cultural group selection is inter-group competition; therefore, "cooperation at one level is a requirement for successful competition, including warfare, at the next level up" (Shennan 2002:241). For example, in the community of Conambo in the Ecuadorian Amazon, Patton (2000) has demonstrated that the willingness to fight in violent conflicts was based on a principle of reciprocal altruism in which warriors were repaid with social status, and better warriors were given greater status.

Furthermore, for group-level selection to occur from inter-group competition, the winning groups must replace the losing groups. The losing group does not need to be killed; instead they just have to disperse via migration or be assimilated into the winning group, thus becoming socially extinct (Richerson and Boyd 2005:207-208). Such phenomena have been demonstrated in early ethnographic reports from highland New Guinea (Soltis et al. 1995).

Warfare (and merely the threat of warfare) at a local or regional level can greatly impact the social structure, settlement patterns, and health (both physically and psychologically) of prehistoric groups. Therefore, people subject to such threats would be expected to adapt to "minimize the negative effects through passive and active postures or offensive and defensive strategies" (Wilcox and Haas 1994:233). For example, among the Yanomamo, if raiding is expected, defense becomes crucial and palisades are built to surround the village and its gardens. If a large fighting force is needed, villages may tolerate larger groups of people residing together and cede more authority to the headmen (Ferguson 1995). Therefore, there is a "great adaptive advantage toward social structures that [are] effective in integrating" (LeBlanc 1999:305) larger groups. Architectural features such as kivas, protokivas, great kivas, great houses, biwall and triwall structures, plazas, and "roads" have been suggested as indicators of practices and institutions that might promote social integration in the American Southwest (e.g., Lipe and Hegmon 1989).

Changes in settlement patterns resulting in larger aggregated settlements have also been posited as having a defensive (and offensive [Kuckelman 2002]) function in the American Southwest (Haas 1986, 1989; Hunter-Anderson 1979; Kohler 1989; LeBlanc 1999:283; Wilcox and Haas 1994). Although aggregation can be beneficial for defense, substantial social, economic, and health costs are incurred by living in aggregated settlements (Colton 1960; Cordell et al. 1994; Kohler 1989; Kuckelman 2002; LeBlanc 1999:295; Preucel 1987; Varien et al. 1996; Wilcox and Haas 1994). Apparently the benefits of aggregation must have outweighed the costs in these cases. As Johnson and Earle suggest, "the need to defend one's own group from powerful outside threats is in

itself enough to encourage political integration within, in order to resist annihilation and to pose effective counterthreats" (2000:15).

Although many consider abandonment in the central Mesa Verde region to have occurred amid conflict, warfare can also cause depopulation. Warfare reduces the range of options available to settled populations by limiting residential mobility, which in turn may result in overexploitation of local resources (Wilcox and Haas 1994).

The Causes of Warfare

The primary causes of warfare in small-scale societies of the American Southwest and elsewhere have long been debated in anthropology. Some researchers suggest that the cause is competition for scarce resources (Billman et al. 2000; Carneiro 1972; Ember 1982; Ferguson 1984, 1990; Haas 1990; Harris 1977, 1984; Johnson and Earle 2000:25; Kantner 1999a; Kuckelman 2002; LeBlanc 1999; Meggit 1977; Price 1984; Rappaport 1968; Shankman 1991; Stone and Downum 1998; Varien et al. 1996; Webster 1975). Many argue that in the absence of technological or social innovations to increase the sustainable human population size, as population increases resources such as arable land, water, or hunting territories become scarce and conflicts can develop between groups. Additionally, such resource scarcities can be the result of environmental degradation; however, it should be noted that this "had a significant impact on the local adaptive strategies only in the face of high population densities" (Haas 1990:183).

Other researchers suggest there is no relationship between population increase and warfare (Billman 1997; Billman et al. 2000; Chagnon 1983, 1990; Cowgill 1975a; Ember and Ember 1992; Helms 1994; Johnson and Earle 2000:20; Kang 2000; Keeley

1996:117-121; Lekson 2002; Maschner 1997; Patton 2000; Redmond 1994; Vayda 1974; Wright and Johnson 1975). Alternative explanations for warfare that have been posited include, for example, 1) a corrective response to environmental stress without population stress due to "sudden and unpredicted climatic change over a short period, including drought, heavy rain, typhoon, frost, unusual temperature fluctuation, volcanic eruption, earthquake, and snow" (Kang 2000:878); 2) a response to underpopulation where the groups are small enough that they are subject to fluctuations in size, sex ratio, and age distributions and compensate by taking captives belonging to appropriate age and sex categories (see Oberg 1955); 3) competition over increasing wealth; 4) status striving; 5) revenge; 6) socialization for fear or intimidation; or 7) competition for mates.

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A Dynamic Approach to Population and Warfare

Some research that downplays the relationship between population and warfare does so because tabulations across societies of current measures of population and warfare often fail to identify a positive correlation between the two variables. Turchin and Korotayev have argued that this is a wrong approach, since "population and warfare are two aspects of a nonlinear dynamical system, in which population growth leads to increased warfare, but increased warfare in turn causes population numbers to decline" (2006:2), though with a temporal lag. One possibility, in such a system, is that the two dynamic variables cycle with the same period, but are phase-shifted (or lagged) with respect to one another (Turchin 2003a).

To my knowledge, this type of nonlinear dynamic approach has not been considered in the prehistoric Southwest, nor have Turchin and Korotayev empirically

tested their model-derived predictions on non-state societies. This study examines the relationship suggested by Turchin and Korotayev with information on human remains from prehistoric sites in the central Mesa Verde region and an extensive demographic dataset developed in the context of an NSF Biocomplexity Project ("The Village Ecodynamics Project") (see recent publications by Cowan et al. 2006; Johnson et al. 2005; Kohler et al. 2005; Kohler et al. 2007; Ortman et al. 2007; Varien et al. 2007).

The time span covered in this study, from A.D. 600 through 1280, is subdivided into the 14 modeling periods established by the Village Project. This finely divided 680-year span allows for a comparison through time of varying measures of population and warfare as well as social complexity, beginning in the Basketmaker III period at A.D. 600 and ending with the depopulation of the central Mesa Verde region at approximately A.D. 1280.

Underestimating Evidence of Warfare on Skeletal Remains

Using skeletal remains to infer the presence of warfare has recently been criticized. Although Solometo (2004:128-129) has acknowledged that making a case for warfare is weakened without direct evidence of combat-related injuries on skeletal remains, she suggests that several factors remove this type of data from consideration. One major factor includes the inability to delineate between interpersonal and intergroup conflict. In this study, however, I will attempt to make this distinction by excluding from my warfare index certain types of cranial injuries often attributed to interpersonal violence.

Solometo suggests that other factors can remove individuals from the archaeological record, including the taking of captives and poor preservation of victims from the attacked site. In addition, warfare casualties may not be returned to their communities and an apparent absence of male warriors can result if the burial population includes captured females of similar age. Finally, other factors include cremation that removes all skeletal evidence (as among the Yanomamo), differential burial practices, and legislation that limits or prohibits the excavation of human remains.

Although I do agree with Solometo that such circumstances can alter the dataset, removing skeletal evidence from consideration is not the solution. If archaeologists conducted research and drew conclusions only on "complete" datasets, the discipline would come to a standstill.

I have thus attempted in this thesis to combat the effects of such alterations to the dataset. A majority of the skeletal information was collected from completely excavated or systematically tested sites to counteract the problems of poor preservation and differential burial practices. Furthermore, if poor preservation, differential burial practices, current legislation, and capturing of females taken to groups outside of the central Mesa Verde region results in a non-representative dataset, then the data used in this thesis may actually underestimate the extent of warfare.

As we will see using skeletal remains as direct evidence, I suggest that the relationship between population and warfare proposed by Turchin and Korotayev (2006) is apparent at certain time periods in the central Mesa Verde region, at least when exogenous factors (e.g., environmental stress without population stress, raiding from non-Ancestral Puebloan groups from the north and west [see Rohn 1975; Chenault and

Motsinger 2000]) appear to have been weak enough not to mask this relationship. However, data from two centuries in particular (about A.D. 1000-1200) are not in accord with the model's predictions. I suggest that the expansion of the Chacoan system to the south and its demise significantly impacted the central Mesa Verde region during this period.

CHAPTER 2 INTERPRETING WARFARE

The struggle with interpreting warfare in small-scale societies is not merely limited to research in the Mesa Verde region. Over the years, several researchers have developed varying definitions of warfare, some including informal raiding and others including inter-group conflict that is not socially sanctioned. Such differences in defining warfare can also affect interpretations of the archaeological record.

In this chapter, I examine various proposed definitions of warfare and conclude that Ferguson's (1984) definition is most useful for this study. I also examine the variety of evidence that has been used to interpret evidence of warfare in the central Mesa Verde region. A problem with most categories of evidence, however, is that they are not recognized consistently throughout the entire Basketmaker III to Pueblo III sequence, and many of the architectural correlates of warfare have multiple functions. But the frequency of violent trauma on skeletal remains is a consistent index which can be used to determine the presence or absence of warfare.

Defining Warfare

At a symposium on war at the 1967 American Anthropological Association meetings, several well-known anthropologists considered warfare to be distinctive from raiding (Fried et al. 1968). For example, Margaret Mead considered warfare to consist of "groups…in purposeful, organized and socially sanctioned combat involving killing" (McCauley 1990:2). Robert Carniero interpreted warfare as "a subset of human aggression involving the use of organized force between politically independent groups" (McCauley 1990:1). In 1977, Mervyn Meggitt suggested that warfare was "a state or

period of armed hostility existing between politically autonomous communities, which at such times regard the actions (violent or otherwise) of their members against the opponents as legitimate expressions of the sovereign policy of the community" (1977:10). In 1996, Jonathan Haas defined warfare as "armed conflict and associated activities and relations between independent political units in all types of societies" (1996:1357). The problems with these definitions include Mead's emphasis on groups in organized combat, Carniero's emphasis on groups with both organized combat and political independence, and Meggitt's and Haas' emphasis on politically independent groups.

By insisting that an approach to warfare focus only on conflicts that involve organized combat or between politically independent groups, we lose sight of the importance of conflicts in small-scale societies. Such conflicts often include raiding in which the group being attacked may not be organized for combat at that moment. For example, the primary raiding strategy among the Yanomamo is to avoid open combat with the enemy; rather, they attempt to ambush people along a trail close to the enemy settlement while trying to avoid being discovered. Non-lethal violence also occurs among the Yanomamo, including the well-known – "institutionalized forms of dueling that include chest striking and club fights" (Ferguson 1995:39) – and rarely cause serious injury. Furthermore, "[c]onflicts between…groups…break out within many band and tribal societies, but the groups contesting are not always (at the time) politically independent" (Chagnon 1990:79-80).

This distinction between raiding and warfare often results in interpreting conflict in non-state-level societies as merely symbolic, ceremonial, or economic (Keeley 2001).

Keeley (1996) notes that popular undergraduate textbooks on archaeology, such as the 1986 edition of Fagan, do not refer to warfare until discussing the formation of state-level civilizations. Even given the growing awareness of the importance of warfare in small-scale societies, Fagan's 2004 edition still did not acknowledge its presence prior to the existence of urban societies.

One researcher proposed a definition in which violence between family members that is not socially sanctioned is also warfare. David Webster (2000:72) has defined warfare as "planned confrontations between organized groups of combatants who share, or believe they share, common interests." He elaborates by suggesting that combatants can range from polities to "family members engaged in intracommunity feud" (Webster 2000:72). Although I agree with Webster that warfare does not need to occur between politically independent groups, I do not agree that both groups need to be organized for combat.

For our purposes, Ferguson's definition of warfare is the most useful. Warfare is "organized, purposeful group action, directed against another group that may or may not be organized for similar action, involving the actual or potential application of lethal force" (Ferguson 1984:5). This definition includes raiding by requiring "no particular level of organizational complexity or use of specific military tactics" (Kuckelman 2002:234) and includes conflict between groups that are not necessarily politically independent, while excluding interpersonal conflict such as homicide or domestic violence.

The Evidence for Warfare

The primary lines of evidence for warfare used in the prehistoric Mesa Verde region for warfare include stockades and palisades, site location, towers, skeletal remains, site-enclosing walls, settlement aggregation, and burned sites and structures. Although I briefly discuss these lines of evidence below, this thesis focuses primarily on evidence for skeletal trauma apparently due to violence and attempts to distinguish indicators of interpersonal violence from warfare.

Stockades

In the Mesa Verde region, stockaded or partially stockaded sites are not known to predate the Basketmaker III period, and most seem to date to the first half of the Basketmaker III period (Chenault and Motsinger 2004). Only a few stockaded sites have actually been discovered, however. Rohn (1975) excavated two in the Yellow Jacket area of southwestern Colorado: the Gilliland and Payne sites. Fuller and Morris (1991) and McNamee et al. (1992a, 1992b) have also discovered stockaded Basketmaker III sites north of Cortez, Colorado, and Kuckelman and Morris (1988) have argued that such sites also existed in the Pueblo II period.

Stockades and palisades in state-level societies are almost exclusively considered to have served a defensive function. Rohn (1989a) and Walt (1985) argue that this is not always the case in the prehistoric Southwest. They suggest palisades actually marked household boundaries or kept children, dogs, or turkeys inside. However, Wilcox and Haas (1994) argue palisades entailed more effort than would be warranted, were their main function to pen turkeys. Furthermore, turkeys were only a minor component of Mesa Verde Pueblo diets until the late Pueblo III period (Muir and Driver 2002).

In contemporary small-scale African groups, stockades are predominantly used for protection from enemies or wild animals; however, a few provide a degree of privacy and may be a reflection of social organization (Chenault and Motsinger 2004). A symbolic function has also been considered for fortifications. Although a fortification would have symbolic value, that does not rule out a defensive purpose. "A fortification symbolizes power and possession because it enhances the military power of its users to retain possession of their lives, territory, and property" (Keeley 2001:333).

Although a wooden stockade would be somewhat ineffective against attackers since it could be set on fire (Lindblom 1920), this does not completely exclude a defensive function for stockades in the Mesa Verde region. They still have the ability to slow down attacks and prevent complete surprise. In addition, tribal warfare is low-level: "large-scale pitched battles are a rare exception; casualties are low; there are no armies and few if any specialized weapons; hit-and-run raiding is common, organized attacks and sieges are not" (Wilcox and Haas 1994:235). It also appears that stockades did not always provide the desired protection since several of the stockaded sites during the Late Basketmaker III period in the Mesa Verde region were burned and artifacts littered the structure floors (Chenault and Motsinger 2004). One of the pit houses at the stockaded Dead Dog site also contained the remains of an adult male draped across the hearth in the main chamber (Chenault and Motsinger 2000).

Burned Sites and Structures

The discovery of entirely burned sites is fairly rare in the greater Southwest and virtually nonexistent in the Mesa Verde region. An overwhelming majority of the known burned sites are located in Arizona and all postdate A.D. 1000 (Wilcox and Haas 1994).

Burned structures are much more common (over 75 percent of known pitstructures in the Pueblo I period are burned [Wilshusen and Ortman 1999]) though these ignitions are sometimes interpreted as having had a ritual purpose in the process of abandonment (Lightfoot 1994; Wilshusen 1986a) or as due to accident. However, experiments show that pithouses are rather difficult to burn (Glennie 1983; Wilshusen 1986a). Catherine Cameron (1990) conducted a library study of burned sites in the Four Corners region and argued against a warfare interpretation. Wilcox and Haas (1994:225), however, examined her tables and noted that half of the burned sites had intact floor assemblages. They argue that this "increases the probability that the occupants were caught unawares by the event" (Wilcox and Haas 1994:225).

The notion of a ritual purpose is certainly plausible but does not explain the rare instances where a structure was burned with apparently alive individuals inside, unless their destruction is defined as ritual as well. Of the 621 individuals from 88 sites recorded for this thesis, only two individuals appeared to have been burned alive. At Golondrinas Oriental (5MT5108), Burial/Individual #s 46-1 and 46-2 appeared to have been grasping their throats, suggesting that they were alive when the structure was burned.

Wilcox and Haas (1994) argue that a regional pattern showing high percentages of burned settlements with structure floor assemblages indicating catastrophic abandonment or burned bodies, could indicate warfare. Similarly, violent destruction and abandonment make a stronger case for warfare if found with unburied skeletal remains (Ferguson 1997). LeBlanc (1999:82) also suggests that the presence of tunnels from a kiva to a

tower "reinforces the notion that getting trapped in a kiva was a real enough worry that an exit plan became a priority in some cases."

Towers

Towers in the Mesa Verde region appear with the advent of masonry architecture (Varien 1999). However, they increase in frequency throughout the Pueblo III period until regional abandonment (Lipe and Ortman 2000) in conjunction with population increase.

Towers have often been interpreted as defensive in purpose (Holmes 1878; Jackson 1878; Lancaster and Pinkley 1954; Mackey and Green 1979) as they can facilitate signaling between sites (Ellis 1991; Haas and Creamer 1993; Morley and Kidder 1917). However, most towers are not located optimally for signaling, and many are on boulders below the canyon rims. As discussed above, many towers in the Pueblo III period are not isolated on the landscape. They are connected to kivas by tunnels and almost always components of larger settlements. In contrast to LeBlanc's (1999) argument, Rohn (1971) and Lancaster and Pinkley (1954) suggest towers connected to kivas were ceremonial structures, and the isolated towers were consistent with shrines. However, Wilcox and Haas (1994) assert that tunnels connecting kivas to towers strengthen the warfare hypothesis. If kivas were actually primary habitation structures, as Lekson (1988) suggests, then an escape hatch from one's habitation would be sensible in the context of high probability of attack.

Researchers have also argued that towers served as storage facilities (Fewkes 1916; Green 1962; Hibben 1948), and recent analyses suggest they were constructed strategically in the Mesa Verde region to monitor areas with the most successful dry

farming (Johnson 2003). Although towers connected to kivas in the Hovenweep area during the Pueblo III period are also associated with hearths, mealing bins, and tools (Winter 1981), this does not invalidate the warfare hypothesis. Towers may have served many purposes (Kenzle 1993) including combinations of ceremonial, economic, and defensive uses.

Site-Enclosing Walls

Kenzle (1993) analyzed variability in site-enclosing walls and assessed their plausible functional interpretations. To classify walls as site-enclosing, they must restrict access to certain areas of a site, and at multi-unit pueblos they appear to make buildings more united (Kenzle 1993). However, such walls may have other functions besides defense, such as retaining soils and controlling water. Interestingly, even though retaining walls can be used to prevent hillside erosion, some walls are located on the tops of mesas, precluding that function. In addition, although some may be water-control features, there are several sites on mesa rims which would have been affected by floodwater but are not walled. What is important to note with site-enclosing walls is that they need to be tall enough to provide cover and conceal the defenders; this does not mean, however, that they need to be of great height. Cases where sites with enclosing walls are also near permanent water sources would seem to enhance the defense hypothesis (Kenzle 1993). Indeed, many of the late Pueblo III walls enclose both a site and spring.

Site Location

A variety of potentially defensive characteristics on the landscape can be subsumed under the term "site location." These include no-man's lands between

settlements, sites placed at a canyon rim or head, in a cliff face, or on a talus slope. No-man's-lands are areas between settlement clusters that are habitable but not occupied. No-man's-lands apparently date back to Basketmaker and Pueblo I times in the northern Southwest (Aikens 1966; Fairly 1989; Matson et al. 1988; Rohn 1989b; Steward 1941). Alternative perspectives are possible here; according to Wilcox and Haas (1994:230), Jeffrey Dean proposed that these features are actually "everyman's lands," which suggests that limited activity sites or even use without recognizable sites could have been present in them.

Some researchers associate the placement of sites at a canyon rim or head as a preferable location because of the need for water from nearby water supplies, and most are clear examples of "guarding" water sources. For example, in the Mesa Verde region, prior to the late Pueblo III depopulation, sites were increasingly located around canyon-head springs; LeBlanc (1999) and others argue this was due to fear of being ambushed.

Sites in a cliff face or alcove, often termed cliff-dwellings, usually contain narrow passages for their entrances. Such site locations make a strong case for warfare since it is highly unlikely groups would choose to build in an area with such difficult access. Cliff-dwellings were not used during all time periods in the Mesa Verde region. There are also examples of canyon-oriented late Pueblo III settlement patterns where suitable shelters were present; thus, one encounters cliff dwellings at some canyon-oriented sites.

Settlement Aggregation

Settlement aggregation as a response to hostilities has also been suggested for the thirteenth century in the Mesa Verde region (Kuckelman 2002; LeBlanc 1999:62-63, 200-225) as well as other areas in the Southwest at this time (Haas 1986, 1989; Haas and

Creamer 1996; Hunter-Anderson 1979; Kohler 1989; Rice and LeBlanc 2001; Solometo 2004; Wilcox and Haas 1994). Such tactics have both defensive advantages to prevent attacks (Crown et al. 1996:200-201; Haas and Creamer 1996:209-210; Kidder 1924; LeBlanc 1999; Reid et al. 1996:77; Solometo 2004:40; Tuggle and Reid 2001) and offensive advantages by "amassing greater strength with which to attack other groups" (Kuckelman 2002:235). In the central Mesa Verde region during the thirteenth century, most of the population was living in aggregated villages (Varien 1999:149).

Skeletal Remains

All of the lines of evidence previously discussed have not been recognized throughout the entire Basketmaker III to Pueblo III periods in the Mesa Verde region, and it is likely there are multiple functions for most if not all of the architectural features discussed. This makes it difficult to employ any of them as a consistent index for the presence or absence of warfare. One line of evidence that can be used to form such an index is the frequency of violent trauma on skeletal remains.

Skeletal evidence of violent trauma can be either biological (i.e., scalping, face removal, etc.) or contextual (i.e., informal burials, etc.). Although ambiguity can affect the analysis of skeletal remains, as it does with the other indications of warfare reviewed above, detailed descriptions can help distinguish interpersonal violence from warfare as well as violence in general from mishaps such as accidental falls.

Walker (1997) has demonstrated that interpersonal violence usually entails nasal or orbital fractures rather than injuries to the parietal or frontal bones. He further argues that facial blows "serve as highly visible symbol[s] of the aggressor's social dominance" (1997:160), a more common strategy among interpersonal interactions than warfare.

In addition, cranial trauma produced from accidental falls differs from those caused by interpersonal violence. Although for people between the ages of 15 and 50, violence is the most common cause of cranial trauma, among children and the elderly, accidental falls are the most common source of cranial trauma (Hussain et al. 1994). In addition, nasal fractures from falls are more common among the elderly than in the general population (Falcone et al. 1990).

Weapons used in violent assaults, such as spears, rocks, and clubs, are more likely to cause localized depressed fractures than linear cracks (Bagchi 1980; Courville 1962a, 1962b; Zimmerman and Bilaniuk 1983); thus, depression fractures are the most common evidence for violence in prehistoric skeletal remains (e.g., Cybulski 1990, 1993; Lambert 1994; Milner et al. 1991; Walker 1989; Webb 1989; Willey 1990). However, it should also be noted that depression fractures are not always lethal, and healed perimortem fractures can still indicate violence.

Parry fractures, non-lethal trauma to the radius and/or ulna, have also been suggested as evidence of intergroup violence (Angel 1974; Lahren and Berryman 1984; Wood-Jones 1910). Although other research has associated parry fractures in conjunction with cranio-facial trauma as interpersonal (female-directed) rather than intergroup violence (Martin et al. 1993; Martin and Akins 1994; Shermis 1982/84; Wilkinson and Van Wagenen 1993), the eight adult (six females) in this thesis with fractures to the radius and/or ulna did not exhibit evidence of cranial trauma. Thus, it is possible that such instances can be ruled out as interpersonal violence.

Other possible indicators of warfare from skeletal remains include human modification and disarticulation (some examples of which might result from

cannibalism), informal burials, skewed sex ratios, and arrow wounds. Turner and Turner (1999), White (1992), and others have argued for the existence of humanly modified skeletal remains in the northern Southwest, with numerous cases having occurred in the mid-1100s (Lipe and Varien 1999). While some researchers disparage the notion that such instances are linked to warfare, Kuckelman et al. have identified three reasons to suggest violence from this evidence:

> (1) the absence of ethnographic or other evidence that dismemberment and extreme processing are, or ever were, part of considerate treatment of the dead in Puebloan culture; (2) remains that were extremely processed were frequently then discarded in a careless manner, which suggests that the processing was not part of a considerate ritual; and (3) the process of skeletal dismemberment and bone reduction tends to obliterate evidence of fatal trauma, whether the trauma be skull fractures or embedded weapon points (2000:148).

Informal burials have also been referred to as indicative of warfare. These include unburied bodies found in haphazard positions, bodies lacking grave goods, or bodies found on the floors or in the fill of structures. As Martin (1997) suggests, violence on female skeletal remains associated with informal burials in the La Plata River Valley may have represented a servant or laborer class. These lower-class females may have been obtained through warfare, which has been hypothesized elsewhere for the central Mesa Verde region (see below). Additionally, LeBlanc (1999:85-86) has argued that large numbers of informal burials in conjunction with burned sites or structures may further substantiate a warfare hypothesis.

Skewed sex ratios suggesting a deficit of male remains may also be a plausible indicator of warfare activities (Ferguson 1997; Kramer 2002) if the men are being killed away from the village while on a raid. Kramer (2002) and Kohler and Turner (2006) have also demonstrated that the sex ratio for the 1200s in the Northern San Juan region is

significantly high (male-biased). They suggest that this may be attributed to women being taken captive and taken to the Totah region to the south, which exhibits contemporaneous female-biased sex ratios.

Many researchers consider it likely that the bow and arrow were locally introduced at the beginning of the Basketmaker III period, and this may have an effect on the skeletal record. Milner (2005) analyzed nineteenth-century arrow wounds suffered during the Indian Wars and concluded that arrows do not often strike bone. "[W]ounds can be conservatively estimated as being something on the order of three times the number that left indelible marks on skeletons" (Milner 2005:153-154). Thus, such trauma on skeletal remains probably greatly under-represents the actual frequency of wounds.

Smith's (2003) analysis of skeletal materials from the Chickamauga Reservoir of East Tennessee indicated that a small percentage of skeletons showed evidence of violence. She concluded that fighting among groups rarely broke out. However, both Keeley (2001) and Milner (2005) argue that a small percentage of skeletons with trauma does not exclude the presence of warfare.

> Arrows did not always strike bone, and those that failed to do so would leave no direct signs of injury. The same holds true of other forms of conflict-related trauma, with scalping being a notable exception…For the survivors of wounds that involved bone, subsequent remodeling would often obliterate sure signs of injuries unless points remained embedded in bone. Having only a handful of skeletons damaged by arrows means there were several times as many victims of warfare, and that must be considered a conservative estimate because only rarely are skeletons complete and bones perfectly preserved (Milner 2005:152).

Summary

As defined in this thesis, warfare includes raiding and violent conflict between groups that are not necessarily politically independent, but excludes homicides and domestic violence. Stockades, towers, burned sites and structures, site-enclosing walls, site location, settlement aggregation, and skeletal remains can all be used as indicators of warfare for the central Mesa Verde region in certain instances.

Based on such evidence, numerous Southwestern archaeologists have inferred the prevalence and type of warfare through time in the central Mesa Verde region (e.g., Kuckelman et al. 2000; various chapters from LeBlanc 1999). I use these in the following paragraphs to summarize current common interpretations of the prevalence and type of warfare through time in this region.

In the Basketmaker III period, evidence of stockades has been interpreted as indicating a defensive purpose designed to enable inhabitants to survive raids (LeBlanc 1999:148). LeBlanc (1999:149) discusses the difficulty in interpreting changes in the intensity of warfare in the Basketmaker III – Pueblo I periods because, as he notes, the nature of the data changes during this time. He suggests, however, that warfare did increase in the Pueblo I period, especially around A.D. 850 to 900 with evidence of site burnings, defensive site settings, and unburied bodies. Kuckelman et al. (2000) arrive at a similar interpretation based largely on evidence of stockades.

LeBlanc (1999:154-186) interprets the Pueblo II to early Pueblo III periods as largely peaceful due to nondefensively located communities and few cases of burned sites. In contrast, Kuckelman et al. (2000) note the presence of stockades near the northern edge of the central Mesa Verde region in the late Pueblo II period. LeBlanc

(1999) and Kuckelman et al. (2000) acknowledge skeletal evidence for badly treated bodies during this interval; however, LeBlanc interprets this as evidence of terrorism rather than warfare largely because he defines warfare as interaction between politically independent groups.

LeBlanc (1999:197-230) and Kuckelman et al. (2000) characterize the late Pueblo III period as a time of increasing conflict as seen by settlement aggregation, defensive site locations, burned sites, unburied bodies, massacres, rapid construction and abandonment, and prehistoric art. The village-wide massacre at Castle Rock Pueblo in the late 1200s is often referred to when interpreting warfare occurring in the late Pueblo III period. Kuckelman et al. consider this time as a period of "escalating violence between sociopolitically equal settlement groups" (2000:159). LeBlanc also argues that on the basis of increasing defensiveness, development of no-man's-lands, and major abandonments, the late Pueblo III inhabitants experienced more intense warfare than had the Basketmaker III – Pueblo I peoples.

CHAPTER 3 THE TURCHIN-KOROTAYEV MODEL

Anthropologists have long thought about population's role in sociocultural evolution as it relates to subsistence intensification, increasingly hierarchical social structure, and technological change. One variant of population theory that is hotly debated concerns its relationship with warfare which, some suggest, is non-existent. Such arguments, however, are somewhat suspect since these fail to account for the possibility of a dynamic, time-lagged interaction between the two variables.

In this chapter, I first discuss the debate concerning population pressure and its role in both sociocultural evolution and warfare. This is followed by a brief discussion of Jack Goldstone's (1991) research which considered a relationship between population and sociopolitical instability (i.e., warfare). Finally, I describe the model proposed by Peter Turchin and Andrey Korotayev (2006) who were influenced by Goldstone's research. Their model considers population and warfare to have a nonlinear, dynamic relationship.

Although population's precise role has been hotly debated, Johnson and Earle suggest population growth is "undeniably central to the process of sociocultural evolution" (2000:2). Population growth may lead to depletion of resources. In order to combat this problem groups must either 1) turn to more costly alternatives; or 2) improve productivity by intensifying subsistence with new technology and environmental modification. Therefore, "[g]rowth in the subsistence economy results from the positive feedback between population growth and technological development" (Johnson and Earle 2000:24).

With such changes, however, serious problems can arise that must be solved. Johnson and Earle (2000:30) argue that these include production risks, raiding, and warfare, leading to inefficient resource use and resource deficiencies. They suggest that such problems are often resolved by an increasingly hierarchical social structure resulting from the need for community storage, regional networks, technological investment, and trade relationships. Indeed, the concept of population pressure has often been employed to explain major transformations, including the origin of agriculture (Cohen 1977), agricultural intensification (Boserup 1965), and political evolution (Carneiro 1970).

Attempts have also been made in anthropology, however, to suggest that there is no relationship between population and sociocultural evolution. Cowgill (1975a, 1975b) and others have suggested that this approach is based on flawed assumptions. First, they argue that human populations do not have difficulty in regulating their numbers since decisions concerning fertility were under control through measures such as abortion and infanticide. Second, they propose that population-pressure theorists have not been able to clearly distinguish between the needs and problems of a society. Third, they argue that foraging societies maintained population levels below an area's carrying capacity.

Most critics of population pressure theory, including Cowgill, attribute to it the claim that population growth depletes resources to the point of severe, chronic nutritional stress, and that such stress is responsible for cultural evolution. I do not know of any population pressure theorists, besides Boserup (1965), who make such extreme claims.

Furthermore, this notion by critics of population pressure models that a regulated birth rate was for the good of the group in order to keep population below carrying capacity carries with it a group-functionalist perspective that is today regarded with

suspicion. It is important to note, however, that Cowgill (1975a) does not take a group-level perspective on this consistently in his article.

Recent understandings of past population pressure models in the form of life history theory have demonstrated that this form of altruistic group selection, however, must be rejected.

> It makes much more sense to see the processes of fertility regulation observed ethnographically and historically as responses in the individual's interests to the current prospects for reproductive success, which may require, for example, much longer intervals between births than those which are theoretically feasible (Shennan 2002:103-104).

Understanding processes at the individual level enables us to understand what effect such processes have on population patterns at the larger scale (Shennan 2002:108). Thus, it is vital that contemporary archaeologists consider life history theory when models are proposed that "see population as a key variable in the understanding of cultural change" (Shennan 2002:112).

Population and Warfare

One variant of the population pressure theory concerns its relationship with warfare. Again, this relationship is hotly debated in the anthropological literature, and some suggest there is no relationship between the two variables. However, these results are suspect to the extent that these authors assume a non-dynamic interaction between these variables (Cowgill 1975a; Kang 2000; Keeley 1996:117-121; Redmond 1994; Vayda 1974; Wright and Johnson 1975).

For example, Keeley (1996:117-121) compared two cross-cultural samples of societies (from Murdock and Wilson [1972] and Ross [1983]) and concluded there was

no significant positive correlation between the frequency of warfare and the density of human population. He argues that groups with densities of less than one person per square mile are just as likely to engage in warfare as groups whose densities are a hundred times higher or more. Furthermore, Keeley states that the Piegan Indians of the Great Plains had the same casualty rates as the Grand Valley Dani of New Guinea, whose population density was almost 10,000 times greater. The Murngin Aborigines of Australia also had about the same casualty rates as the Dugum Dani, whose population density was 3,000 times higher. Although Keeley acknowledges that using population density by itself without being able to take into account other factors such as carrying capacity is simplistic, he argues that population density is much more correlated with sociocultural evolution than with warfare. He further suggests if there is a relationship between population and warfare it is either very complex, very weak, or both.

Approaches such as Keeley's might be problematic, however, if the relationship between population and warfare is dynamic and involves temporal lags, as I will argue following Turchin and Korotayev (2006). A dynamic approach as used here is the "study of mechanisms that bring about cultural change and explain the observed trajectories [i.e., temporal behaviors]" (Turchin 2003a:3). A common dynamical systems approach includes explaining a holistic phenomenon (system) by mathematically describing how different parts of the system (subsystems) interact with each other through time, taking into account temporal lags.

Jack Goldstone (1991) proposed a demographic-structural theory to explain the relationship between sociopolitical instability and population dynamics in preindustrial states. However, this is not a Malthusian model (1798) in which population growth is the

direct cause of sociopolitical instability. The key process of Goldstone's (1991) theory is how demographic changes affect aspects of social structure. He argues that population growth indirectly causes social crisis, which then affects social stability. In Goldstone's demographic-structural theory, social crisis is likely to occur when a society experiences three kinds of difficulties:

> (1) a state financial crisis, brought on by a growing imbalance between the revenues a government can securely raise and the obligations and tasks it faces; (2) severe elite divisions, including both alienation from the state and intra-elite conflicts, brought on by increasing insecurity and competition for elite positions; and (3) a high potential for mobilizing popular groups, brought on by rising grievances (e.g., regarding high rents or low wages) *and* social patterns that assist or predispose popular groups to action (e.g., large numbers of youth in the population, increasingly autonomous rural villages, growing concentrations of workers in weakly administered cities) (Goldstone 1991:xxiii-xxiv).

A fourth difficulty that is generally produced by the conjunction of these three conditions is an "increase in the salience of heterodox cultural and religious ideas; heterodox groups then provide both leadership and an organizational focus for opposition to the state" (Goldstone 1991:xxiv).

He incorporates structural concepts into his theory, because it is not the demographic trend itself that causes the state political crisis but material factors – the impact on economic, political, and social structures – associated with population growth (Goldstone 1991:xxvi). Goldstone seeks to explain a severe kind of state crisis which he calls *state breakdown*. This occurs when "a state crisis leads to widespread overt conflict, including a combination of elite revolts, intra-elite struggles, and popular uprisings" (Goldstone 1991:10). A state crisis may be resolved peacefully, or with a coup d'état, or civil war. The term *crisis* is ambiguous, however. He uses the term *state*

crisis to specifically describe "a shift in elite or popular attitudes toward the state" (Goldstone 1991:8). A range of factors may be present or absent in a political crisis:

> (1) widespread elite or popular belief that the state is ineffective, unjust, or obsolete, producing widespread loss of confidence in, or allegiance to, the state; (2) an elite revolt against the state; (3) popular revolts – either urban, rural, or both – against state or elite authority; (4) widespread violence or civil war; (5) a change in political institutions; (6) a change in the status and power of traditional elites, chiefly landlords in agrarian states; (7) a change in basic forms of economic organization and property ownership; and (8) a change in the symbols and beliefs that justify the distribution of power, status, and wealth (Goldstone 1991:10-11).

Goldstone does not, however, develop his theory into an explicit dynamic model. Rather, he considers population growth as an exogenous variable and considers favorable climate and receding disease as the explanations for the doubling of population in most regions of the world between 1500 and the early 1600s (Goldstone 1991:25). He also emphasizes material factors that bring about state breakdown, as well as culture and ideologies, as forces that shape state reconstruction (Goldstone 1991:27). Building on his experience in population biology (Turchin 2003b), Turchin (2003a) modifies Goldstone's (1991) approach and argues that population is dynamically linked to sociopolitical instability in both state and pre-state (including pre-chiefdom) societies.

Overview of the Turchin-Korotayev Model

Turchin and Korotayev (2006) argue that previous theories, such as Keeley's (1996:117-121), have considered a *linear* and simultaneous relationship between population and warfare (i.e., sociopolitical instability), when in fact they are *dynamic* variables and are *dynamically* interlinked. In other words, they both change with time and they affect each other. Thus, they propose that "population and warfare are two

aspects of a nonlinear dynamical system, in which population growth leads to increased warfare, but increased warfare in turn causes population numbers to decline" (Turchin and Korotayev 2006:2). It should be noted that Turchin and Korotayev (2006) assume that sociopolitical instability is synonymous with warfare (or, at least, proportional to warfare). Others may disagree but for the purposes of this thesis, I will follow Turchin and Korotayev (2006) and assume that the two terms are interchangeable.

Figure 3.1 graphically depicts the relationship between population (*N*) and sociopolitical instability (*W*) to be formalized below. In quadrant *a*, population decrease is at first rapid and then slows to a stop, while warfare at first decreases slowly, and then rapidly. In quadrant *b*, population increases slowly at first, and then rapidly, while warfare at first decreases rapidly and then gradually begins to increase. In quadrant *c*, population increases rapidly and then slows to a stop, while warfare increases slowly at first, and then rapidly. In quadrant *d*, population at first decreases slowly, and then rapidly, while warfare increases rapidly and then slowly. In the absence of changes in carrying capacity (*K*), warfare intensity (*W*) and population density (*N*) eventually find a stable equilibrium.

One possibility in such a system is that the two dynamic variables, population and warfare, cycle with the same period, but are phase-shifted (or lagged) with respect to one another (Turchin 2003a). This type of non-linear dynamic has been recognized in the ecological literature, for example, in the famous predator-prey model proposed by Alfred Lotka and Vito Volterra in the 1920s (Lotka 1925; Volterra 1926). Turchin and Korotayev (2006) do not suggest that the dynamics in human societies are necessarily the

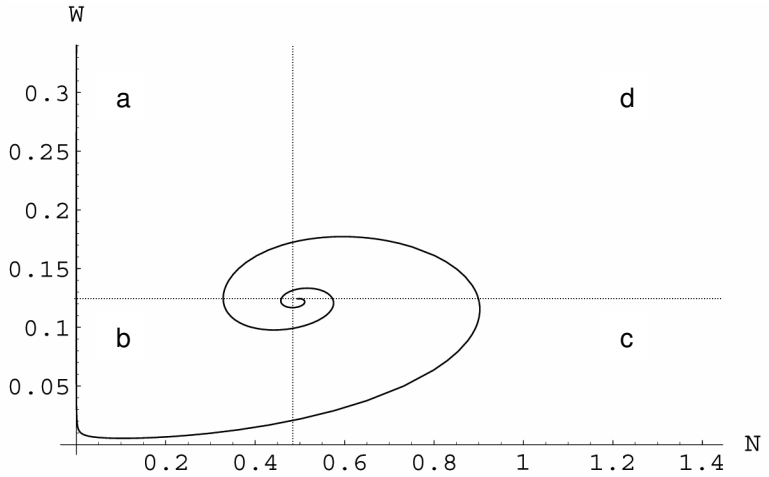


Figure 3.1. Relationship of population density (*N*) and warfare intensity (*W*); time begins at the periphery of the spiral and moves towards the equilibrium point at the center. Parameter values: *r* = .13, *a* = .02, *b* = .04, *K* = 8; initial conditions *N* = 5, *W* = .3. After Kohler et al. (2006:Figure1b).

same as in the predator-prey model, but that the basic concept of a nonlinear, lagged dynamic approach could be useful.

One way to understand the relationships that they propose is to focus on the rates of change of the structural variables rather than the structural variables (population and warfare) themselves. The rate of population change is negatively affected by the intensity of warfare (i.e., sociopolitical instability), and the rate of change in warfare is positively affected by population density. In such a system, the peaks of warfare intensity will follow population peaks. In other words, they will be phase-shifted (or lagged) with respect to one another (Figure 3.2).

In addition, Turchin and Korotayev (2006) argue that the focus should be on internal warfare – between culturally similar groups – because this type of conflict in small-scale societies will be most directly affected by population dynamics. External warfare is an exogenous variable "driven by factors outside [of their] modeling framework" (Turchin and Korotayev 2006:2).

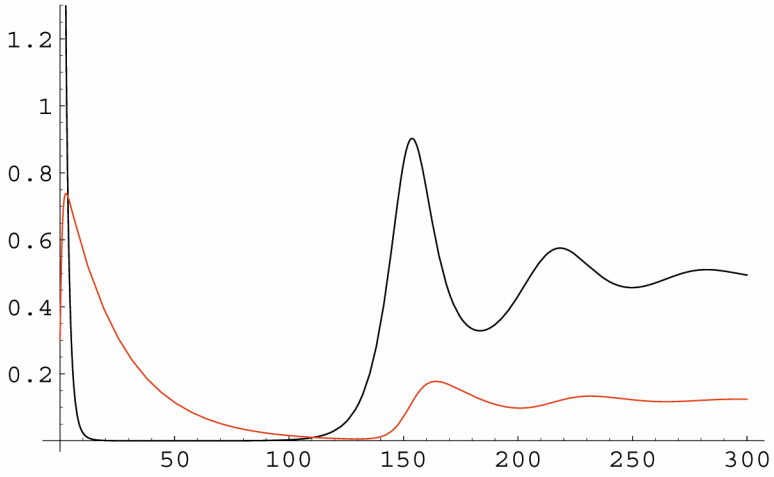


Figure 3.2. The relationship of population density (*N*) (black line) and warfare intensity (*W*) (red line) through time: values for N and W on the y-axis, time units on the x-axis. Parameters and initial conditions as in Figure 3.1. After Kohler et al. (2006:Figure 1a).

Turchin and Korotayev (2006) have created a model for prestate (and pre-chiefdom) societies; however, high-temporal-resolution cases in the archaeological record for non-state societies are relatively few. Thus, they have not empirically tested their model-derived predictions on such information. But, with the benefit of an extensive demographic dataset developed in the context of an NSF Biocomplexity Project in southwestern Colorado, an attempt to explore a dynamic relationship between sociopolitical instability and population is possible in the central Mesa Verde region.

Turchin and Korotayev (2006) proposed two versions for sociopolitical instability in stateless societies. Both consist of two state variables: *N*, population density and *W*, warfare intensity (or frequency). To construct the equation for the rate of change of population density, Turchin and Korotayev (2006) begin with the widely used logistic model of population growth,

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right) \qquad 3.1$$

where r is the rate of population growth when there is no scarcity (the "Malthusian parameter"), and K is the carrying capacity. The rate of population growth is dependent upon population density and restricted by carrying capacity. Therefore, as population increases the growth rate declines, resulting in an s-shaped logistic curve for population growth through time.

Although the effects of resource acquisition and external factors such as climate change are known to have an effect on human population size and growth rates (Boone 2002; Shennan 2002:118-119), the Turchin-Korotayev model is the first that I am aware of to include warfare intensity in its evaluation of population fluctuation.

If we further assume that some deaths are due to warfare, and that the death rate due to warfare is directly proportional to warfare intensity, then equation (1) becomes:

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right) - cWN \qquad 3.2$$

The constant c was added during fitting and is not part of Turchin and Korotayev's published model. This is the rate at which warfare leads to additional deaths in the population.

Warfare Intensity: Version 1

According to Turchin and Korotayev (2006), warfare intensity (W) is governed by two processes. They first assume that "population density causes warfare by increasing the encounter rate between individuals belonging to different groups" (Turchin and Korotayev 2006:4). For example, if a fixed number of foraging parties are sent out, then the total number of foraging parties in the area is proportional to N (population density). "A single party will encounter other parties at the rate also proportional to N^2" (Turchin and Korotayev 2006:4). This incorporates another assumption that "each encounter may

initiate hostility with a certain fixed probability" (Turchin and Korotayev 2006:4). Therefore, the rate of the initiation of hostility is aN^2, where a is the proportionality constant. Two assumptions concerning this equation and Version 2 discussed below are that they both assume foraging parties have no knowledge of others and do not stay within recognized territories.

Another major assumption is that there is a gradual decline in warfare intensity, at an exponential rate b, which reflects the probability that groups are willing to forgive and forget past hostilities if no hostilities have recently occurred. This decline is proportional to W, because "high warfare intensity causes greater degree of war fatigue, and therefore greater willingness to de-escalate conflict" (Turchin and Korotayev 2006:4). Together, these processes increasing and decreasing intensity of warfare result in the following equation:

$$\frac{dW}{dt} = aN^2 - bW \qquad 3.3$$

Warfare Intensity: Version 2

Turchin and Korotayev (2006) propose an alternative version of the second state equation (3.3) which incorporates the assumption that an elevation in warfare intensity causes each group to send out more war parties. Thus, the encounter rate between individuals belonging to different groups will be "proportional to the product of population density and warfare intensity (not to population density squared, as in the previous formulation)" (Turchin and Korotayev 2006:5). This assumption results in the following equation for the rate of change of W:

$$\frac{dW}{dt} = aWN - bW \qquad 3.4$$

The change in warfare intensity over time is equivalent to the encounter rate that is proportional to the product of population density and warfare intensity. This, in turn, is affected by a decline in warfare at an exponential rate that is itself proportional to warfare intensity.

Instantaneous Coefficient of Population Growth (*r*)

The instantaneous coefficient of population growth in equations (3.1) and (3.2) is the growth rate of population density when there is no scarcity. A minimum estimate for this value is calculated based on the assumption that the *N* of households in the Village study area could have grown from 304 households present by ca. A.D. 663 to 1030 households (after smoothing) by A.D. 860, which results in an estimate for *r* of 0.006 (annual). In fitting the Turchin-Korotayev model to the data used in this thesis, values for *r* were used that ranged from 0.007 to 0.014 (Kohler et al. 2006). Ehrlich and Ehrlich (1970) argue that the maximum attainable *r* for human populations may be as high as 0.02. Fluxes were also added to the model where growth was identified "in excess of that achievable through in-place processes, or immigration" (Kohler et al. 2006:10) (see Table 3.1 below). The estimated best-fit values for *a*, *b* and *c* are discussed in Chapter 6 in the context of evaluating the Turchin-Korotayev model.

Population Density (*N*)

The population density used in this analysis is based on data compiled for the Village Ecodynamics Project ("Village"). The Village Project is an interdisciplinary attempt to understand the processes of aggregation and depopulation in an 1800-km^2 area of Southwest Colorado within a modeling framework (Figure 3.3). Reconstructing the

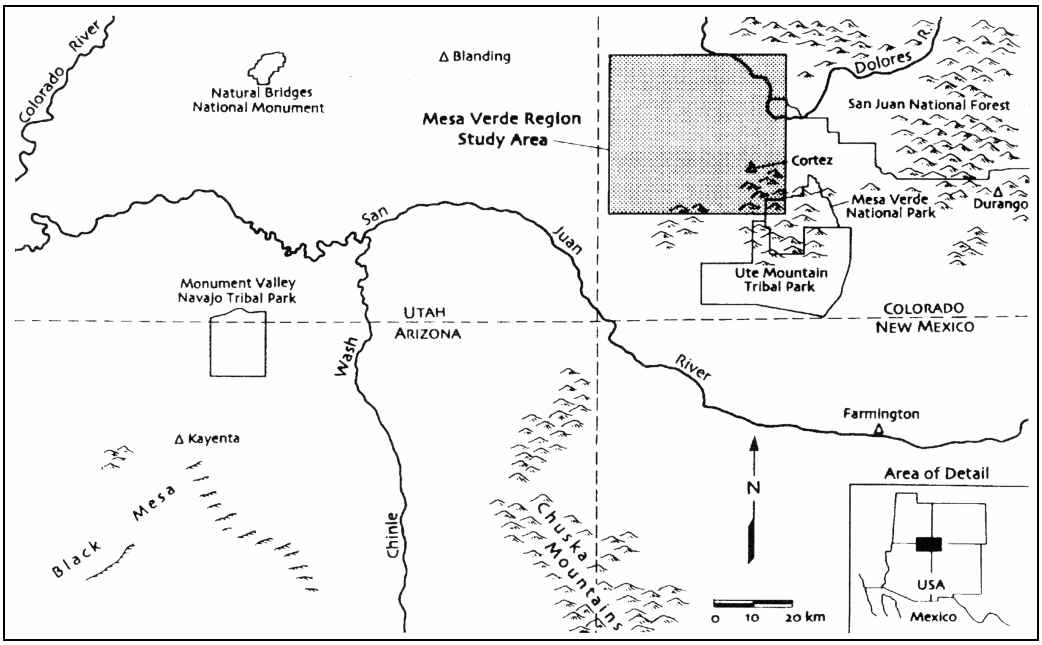


Figure 3.3. Map of the Village Ecodynamics study area in Southwest Colorado. After Kohler et al. (2006:Figure 2).

paleodemography of the study area included reviewing all site forms as well as some new survey resulting in a site database which contains records for approximately 9,000 sites.

Ortman et al. (2007) designed a Bayesian statistical analysis to determine the period of occupation for each site. They began "with a calibration data set of eighty excavated and well-dated site components, which [they] used to estimate the frequencies of eighteen architectural attributes and twenty-four pottery types in sites dating to each of fourteen separate periods between A.D. 600 and 1300" (Kohler et al. 2007:80). The 14 modeling periods vary in length from 20 to 125 years, but most span 40 years. The frequencies resulted in a distribution which specifies the "probability that each pottery type and architectural attribute dated to each of these fourteen periods" (Kohler et al. 2007:80). They then combined the probability distributions for the eighty well-dated sites with the sample data from each site to calculate composite probability density

distributions for three categories: architectural characteristics, undecorated pottery, and decorated pottery. A fifth probability distribution was calculated to reflect site occupation determined by the surveyor. Since the data available for approximately half of the sites in their database were insufficient in determining the most probable period of occupation, a sixth probability distribution for "neighborhoods" around each site were calculated by "weigh[ing] and combin[ing] probability distributions based on samples of eleven or more sherds for all sites within 7 km of each habitation site" (Kohler et al. 2007:80). All six probability distributions were averaged resulting in a mean probability density distribution for each site.

Occupation histories of approximately 3,300 residential sites (consisting mostly of single-household farmsteads) were used to calculate the momentary population estimates for these specific sites. This was calculated by "using the total number of households in each period and factoring in the occupation span of sites and the number of years in each modeling period" (Kohler et al. 2007:81). Three methods were used by Varien et al. (2007) to estimate a range of values for the population of the entire project area based on the surveyed portions of the project area. Kohler et al. (2007:81) favor Method 3 from Varien et al. (2007) as probably yielding the most accurate momentary population estimates of households for each period (see Table 3.1).

Carrying Capacity (*K*)

Estimating carrying capacity for human populations is difficult and complex, and attempts to do so are contentious. Carrying capacity is affected by subsistence intensification (especially agriculture) either from working longer or developing new techniques (Kohler et al. 2006). Carrying capacity depends, in part, upon the existing

Table 3.1. Modeling Periods from the Village Ecodynamics Project with Corresponding Chronology, Population, and Carrying Capacity (after Kohler et al. 2006:Table 1).

Village Modeling Period	Begin (A.D.)	End (A.D.)	Midpoint (A.D.)	Total Momentary Households	Flux	Total Momentary Households (Natural Log)	Carrying Capacity Estimate (*K*)
—	600			0			—
6	600	725	663	304		5.717	1580
7	725	800	763	326		5.787	1580
8	800	840	820	836	180	6.729	1580
9	840	880	860	1030		6.937	1580
10	880	920	900	370	-477	5.914	1580
11	920	980	950	289		5.666	1515
12	980	1020	1000	653	92	6.482	1345
13	1020	1060	1040	671		6.509	1430
14	1060	1100	1080	1385	110	7.233	1635
15	1100	1140	1120	1940		7.570	3234
16	1140	1180	1160	2077		7.639	3234
17	1180	1225	1203	2326		7.752	3234
18	1225	1260	1243	3234		8.081	3234
19	1260	1280	1270	1770	-1430	7.479	1770
—		1300		0			1400

techno-economic adaptation to that environment (Graber 1997:264). Humans use space in a flexible manner and switch patches to maximize return if not limited by ownership or distance. However, since farmers tend to be territorial, this implies that "late arrivals are forced into less-desirable patches" (Kohler et al. 2006:6). Humans also need to satisfy their needs for water and fuel while meeting their needs for subsistence, which can put some areas off limits for exploitation. If buffer zones are created between groups

because of conflict, this also limits the amount of land available for exploitation. If two or more groups can be incorporated into a new larger group, then buffer zones are not needed between them and the land becomes usable. This, in turn, can rapidly increase carrying capacity (LeBlanc 2006:446). Humans are also limited by calories and protein intake because of food taboos and food that is difficult to process or low in density. Furthermore, it is difficult to estimate carrying capacity when inter-annual climatic variability can have a profound effect on temperature and precipitation. Lastly, humans can degrade the environment, and depending upon the techniques that humans use this can have either temporary or permanent impacts (Kohler et al. 2006; see also Rappaport 1968:88-90). Environmental degradation has also been considered a continuous process and there is no threshold at which degradation begins (Dewar 1984) further complicating estimation of carrying capacity. Therefore, many variables are at play when attempting to estimate carrying capacity for a given area.

The estimates of carrying capacity used in this analysis are based on the Village Ecodynamics Project which provides partial solutions for the problems discussed in the previous paragraph through agent-based simulation. In agent-based simulation, caloric production and consumption are tracked by "charging expenses for hunting, gathering of fuel and water, agricultural fieldwork, and basic metabolism, against the production and storage achieved by each household" (Kohler et al. 2006:6-7). Birth and mortality rates are also incorporated into the simulations based on favorable or unfavorable protein and caloric balances. Although the households used in the simulation are not permitted to exit the study area, they can move to a better portion of it if new local production, their

existing storage, or exchange, are insufficient to overcome unfavorable protein and calorie balances.

For the purposes of this thesis, carrying capacity estimates per household (see Table 3.1) are taken from the agent-based simulations which maximize the number of households on the landscape but do not exceed what are considered plausible values for the parameters in the simulation affecting population size. Population estimates for periods 15-18 are higher in the archaeological record than those resulting from the agent-based simulations. This is likely due to intensification techniques not incorporated into the model, especially turkey domestication. Therefore, the highest actual population estimate is used as the carrying capacity for those periods (Kohler et al. 2006). For periods 6-10, carrying capacity is assigned by using the highest simulated agent counts achieved in any of these periods, "since the agent numbers early in the sequence are limited by the fact that we begin our simulations with 200 immigrant households in year 600" (Kohler et al. 2006:8).

The concept of carrying capacity has suffered undeserved criticism in the anthropological literature largely because people perceive it as a fixed value (Sanders 1997:383). One researcher has argued that carrying capacity "cannot be calculated reliably for any archaeological sequence" (Dewar 1984:610). Although the carrying capacity values used in this analysis are admittedly a rough estimate, the agent-based models are beginning to provide methods for estimation that overcome at least some of the criticisms usually mounted against the concept. These estimates of carrying capacity affect only the fitting exercise reported in Figure 6.10 and otherwise do not enter into the analysis.

Summary

Recent attempts to model past populations have provided a greater understanding of the relationship between population and cultural change using approaches somewhat different from those of the 1960s and 1970s. Shennan has suggested that archaeologists studying population have three tasks:

> (1) to characterize regional population patterns through time, (2) to identify the factors affecting these, and (3) to examine the impact of population size and density on other spheres of human activity and social institutions (2002:112).

In this thesis, I attempt all three tasks in the context of analyzing a 680-year span in the central Mesa Verde region of Southeast Utah and Southwest Colorado with (1) measures of population size from the Village Project data, (2) measures of warfare intensity – generated here – as a factor affecting population size through time, and (3) the interplay of population size and warfare intensity through time. I also attempt to examine the impact of both population and warfare on other spheres of human activity and social institutions through time in the central Mesa Verde region in the concluding chapter of this thesis, Chapter 7.

CHAPTER 4 RESEARCH METHODS

In this chapter, I discuss the methods used to select sites for analysis as well as the types of evidence from the skeletal remains data I used to infer warfare. In addition, I describe the information I recorded from the sites and the skeletal remains data.

Selection of Sites

Sites with human remains selected for analysis in this thesis are located within what archaeologists term the central Mesa Verde region (Figure 4.1), and fifty percent are within the spatial boundaries of the Village Ecodynamics Project discussed in Chapter 3 (see Table 3.1). The central Mesa Verde region is larger than the Village Ecodynamics Project area, but I will assume that the cultural processes in this larger area were similar enough that the larger sample this approach makes possible more than outweighs the possibility of encountering slightly different patterns of violence. Furthermore, within this area I used all sites on which I could find appropriate data, as specified below.

Selection of Human Remains Information

The human remains selected for analysis in this thesis did not solely include formal burials; some were determined during excavation to be in a wide variety of natural and cultural depositional contexts. Not all human remains encountered during excavation are included in this analysis. I included only individuals with enough skeletal elements to determine the presence/absence of trauma.

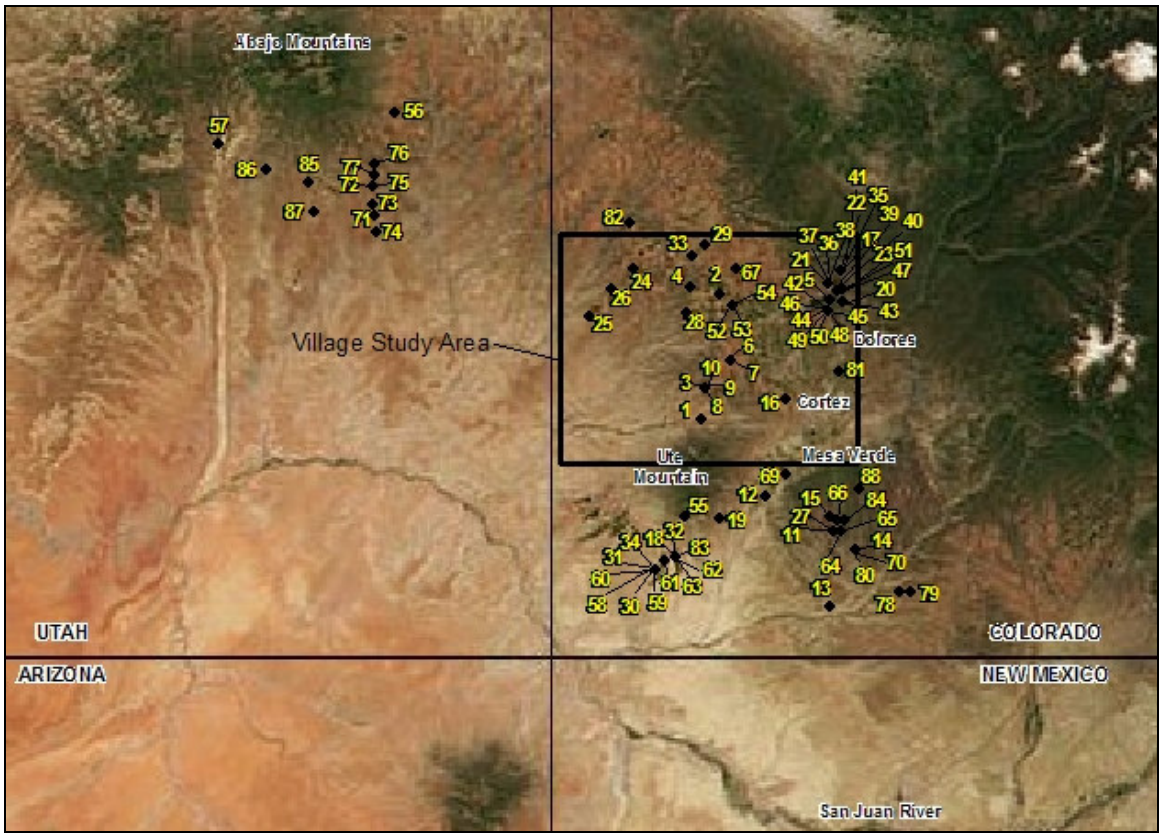


Figure 4.1. Map of the sites selected for analysis in this thesis relative to the Village Ecodynamics Project boundary. Numbered sites are identified in Chapter 5 and in the Appendix.

In turn, only certain types of trauma point to the sort of violence likely in warfare. Fractures of the radius and/or ulna were recorded since such trauma most likely resulted from a blow to the arm raised in defense (Angel 1974; Lahren and Berryman 1984; Wood-Jones 1910). The eight adults (six females) in this thesis with fractures to the radius and/or ulna did not exhibit evidence of cranial trauma. This is consistent with intergroup rather than interpersonal (female-directed) violence (Martin et al. 1993; Martin and Akins 1994; Shermis 1982/84; Wilkinson and Van Wagenen 1993). Thus, it is possible that such instances can be ruled out as interpersonal violence.

Cranial fractures were recorded as well. However, cranial trauma from accidental falls is more common among children or the elderly (Hussain et al. 1994). Similarly, facial fractures to the nasal bone or orbital region are likely to occur during spontaneous interpersonal violence, as mentioned in Chapter 2, and may not indicate warfare. Thus, such fractures from accidental falls or interpersonal violence were not considered to have been warfare-related in this analysis. Cultural modification and disarticulation (as might result from cannibalism) was also recorded as warfare. Sanday (1986) has also noted that cannibalism was strongly associated with warfare. Cultural modification and disarticulation includes instances of what Kuckelman et al. (2000) define as "extreme processing" in which bodies were intentionally dismembered and bones were broken into small fragments. I used Turner and Turner's (1999:24) minimal taphonomic signature of perimortem damage which might result from cannibalism: (1) breakage, (2) cut marks, (3) anvil abrasions, (4) burning, (5) many missing vertebrae, and (6) pot-polishing. Pot-polishing may not be present if the site is preceramic, lacks pottery, or if the remains were not cooked.

Although some fragmentary remains were the result of human modification and disarticulation, this was not always the case. With such instances, I needed enough skeletal elements to determine the presence/absence of warfare. At a minimum, the skeletal elements must include the presence of a cranium, radius, or ulna which must be complete enough to determine the pathologies of interest here. Table 4.1 displays the types of evidence recorded on skeletal remains that I considered as evidence of warfare. I also used additional information to alter my coding in cases where evidence from the investigator suggested that strict adherence to my rules wasn't sensible.

Table 4.1. Skeletal Trauma Inferred as Evidence of Warfare.

1) Fractures of the radius
2) Fractures of the ulna
3) Non-facial cranial trauma on subadults and non-elderly adults
4) Human modification and disarticulation in the form of extreme processing

All of the information on human remains data was obtained through library research in site reports and "gray" literature and not through direct examination of the remains. Although direct examination would have been desirable, since different analysts report different data and make different inferences from these data, it was not logistically feasible. Moreover, some of the remains have been reburied. Regardless, the literature consulted included detailed descriptions of the pathological conditions, the position (i.e., flexed, semi-flexed, etc.) and location (i.e., midden, kiva, pit structure, etc.) of interment of each individual, and any interpretations made by the author. All sites were entered into the database by February 2006.

The Database

A relational database management system, Microsoft Access, was used to record the information for each site and each individual (see tables in Appendix). A one-to-many relationship was created between two tables (Site Information and Human Remains Information) since sites can contain more than one individual. The site information table contains fields for site name, site number, location, and sources. The human remains information table contains fields for individual/burial number, burial type, feature location, feature number, period, sex, age, age description, pathologies, warfare, interpersonal violence, accidental injuries, and comment, as defined below.

Definition of Variables in Site Information Table

Site Name. This field represents the site name designated by the original researchers. A few sites with no names are referred to by their site number.

Site Number. An overwhelming majority of the site numbers are based on the Smithsonian site numbering system. The first number represents the state (5 for Colorado; 42 for Utah) and the next two letters refer to the county in which the site is located (MT for Montezuma County; DL for Dolores County; SA for San Juan County). However, sites within the boundaries of Mesa Verde National Park are designated by the two letters "MV", and sites within the Ute Mountain Ute Reservation boundary are designated by "MTUMR".

A few sites in this thesis are not represented by site numbers based on the Smithsonian numbering system. These include Grinnell (Luebben 1983; Luebben and Nickens 1982; Turner and Turner 1999) and Ackmen 1-1937 (Martin 1938) in Southwest Colorado and six of the seven sites located at Alkali Ridge in Southeast Utah (Brew 1946; Turner and Turner 1999).

Location. This field contains a brief description of the geographic location of each site as well as the geographic coordinates (whenever possible), which were needed in projecting the location of the sites onto the map of the central Mesa Verde region (see Figure 4.1).

Sources. This field represents the published information source, such as site reports and "gray" literature, used for each site included in this thesis. The sources are recorded with the author's name and year of publication. Full citations are in the References Cited.

Definition of Variables in Human Remains Information Table

Individual/Burial Number. The individual/burial number represents the number designated by the original researchers. Since not all of the human remains are burials, such individuals are classified by what is designated as the individual number. If no individual/burial number was specified, this field is blank.

Burial Type. The burial type was only recorded for cases designated as burials. The burials were classified as (SP) single primary interment, (SS) single secondary interment, (DP) double primary interment, (DS) double secondary interment, (MP) multiple primary interment, (MS) multiple secondary interment, or (O) other. "Primary" designates remains that were excavated from their location of original burial. "Secondary" burials are those that were moved prehistorically sometime after their primary burial and were excavated from that second location. The term single refers to one interment, double refers to two interments in the same burial event, and multiple refers to more than two interments in the same burial event. If the original researchers could not determine the burial context or they could not be assigned to the primary or secondary categories, they were included in the other (O) category.

Feature Location. The feature location was recorded for each individual if specified by the original researchers. The feature location was classified as (P) pit structure, (S) surface structure, (K) kiva, (M) midden, (C) cist, (T) contemporary trench, or (O) other. If indicated by the researchers, the feature number was also recorded.

Period. The period represents the date range of the human remains further classified into the periods used in the Village Ecodynamics Project discussed in Chapter 3. For the sites it contains, I used the Village Project database, the McElmo-

Yellowjacket Settlement Data Version 5.4 (Crow Canyon Archaeological Center and Washington State University 2005), as the primary resource for determining the periods of remains from those sites. When the beginning and ending dates of the human remains or site occupation within the Village Project study area spanned more than one modeling period, the period which included the midpoint date, according to the original researcher, was used for the human remains. Furthermore, in the extremely rare cases where the period designations made in the Village Project database conflicted with the placements made by the excavators, I used the Village Project database since it is a more up-to-date source, and provides internally consistent data assignments for the sites it contains.

Sex. I recorded the sex of the individuals as (M) male, (F) female, and (I) indeterminate. Sex estimation is preferentially determined with a well-preserved pelvis and cranium (Meindle et al. 1985). Measurements of the long bones, with male bones typically being longer and larger (more massive) than female bones (Bass 1997:26), can be used but is less accurate. It is impossible to determine sex for children and young adolescents since secondary characteristics do not appear until puberty (Bass 1997:25). Thus, even if the original researchers attempted to determine the sex of children and adolescents, I did not consider this valid and classified these remains as indeterminate. In other words, the sex of individuals younger than subadult were classified as indeterminate.

Age. I recorded ages for individuals as two separate fields: age and age description. The "age" field refers to the actual numerical age (or age range) at death according to the original researchers. The second field, "age description," refers to an interval scale for age since some researchers did not or were unable to indicate a

numerical age. Thus, this allowed for the entire database of human remains to be classified according to a similar scale. The age description field is divided into five categories: infant (0-2), child (3-10), subadult (11-15), adult (16+), and indeterminate (age unknown).

In subadults, age is often estimated from tooth eruption, epiphyseal closure, and length of long bones without epiphyses (Bass 1997). In adults, the development of osteoarthritis can be noted on the joint surfaces of many skeletons from the mid-20s onward, and lipping on the superior and inferior borders of each vertebral centrum also increases with age. However, it is important to note that more than one area, bone, or criterion should be used when estimating the age of a skeleton (Bass 1997:12-25).

Pathologies. Pathologies were recorded as (P) present or (A) absent. If the original researchers could not determine pathologies on an individual (not solely those listed in Table 4.1), then it was not included in the database because this indicates that the presence/absence of warfare-related trauma could also not be determined. The presence/absence of pathologies includes any type determined by the original researchers, such as dental caries, arthritis, and fractures.

Warfare. Warfare was also recorded as (P) present, by inference, or (A) absent. As discussed above, the presence of warfare included fractures to the radius or ulna, non-facial cranial injuries on subadults and non-elderly adults, and evidence of human modification and disarticulation.

Interpersonal Violence. Similar to warfare and accidental injuries, interpersonal violence was recorded as (P) present, by inference, or (A) absent. As discussed above, the inference of interpersonal violence was based primarily on facial fractures among

subadults and non-elderly adults. I also included one instance of several unhealed rib fractures on an infant at Mug House (5MV1229) (Rohn 1971), which were highly unlikely to have been accidental.

Accidental Injuries. Accidental injuries were also recorded as (P) present, by inference, or (A) absent. Accidental injuries were inferred from all other fractures that were not the basis for inferences of warfare-related or interpersonal violence. Such injuries ranged from fractures of the metatarsals and metacarpals to fractures of the ribs. Accidental injuries also included cranial fractures of infants, children, and the elderly.

Comments. Comments were recorded when the presence of warfare, interpersonal violence, or accidental injuries was inferred from the skeletal remains. Comments include a detailed description of the type of fractures and if the fractures were healed, unhealed, or perimortem.

This chapter gave a description of the variables recorded for the sites and their corresponding skeletal remains data. The next chapter consists of a detailed discussion of the specific information that I recorded for the skeletal remains used in this thesis.

Chapter 5 SUMMARY OF THE DATASET

There is a total of 621 individuals from 88 sites in the dataset generated by the procedures discussed in Chapter 4. Of these, 193 (31.1 percent) were determined to evidence warfare-related trauma, 36 (5.8 percent) had evidence of accidental injuries, and 4 (0.6 percent) had evidence of interpersonal violence. This unusually low percentage of interpersonal violence may indicate that I am actually under-recognizing such instances. Using the procedures discussed in Chapter 4, the total sample of 621 individuals was divided into the modeling periods used in the Village Ecodynamics Project discussed in Chapter 3. Here I first present the human remains from each modeling period followed by a summary of the 193 individuals with warfare-related trauma.

Period 6: A.D. 600 – 725

There are eleven individuals from four sites with mid-dates between A.D. 600 and 725 (Table 5.1). Three sites are located within the Village Project study area, and the fourth is located within Mesa Verde National Park.

I consider two individuals to have evidence of warfare-related trauma. An adult female from 5MT0001 exhibited a healed fracture of the left ulna. This individual was "found placed on the (prehistoric) surface of the ground in an extramural area…covered with stones and trash" (Yunker 2001:204). The individual from 5MT9343, an adult male, had a depressed, healed cranial fracture which was approximately 18 mm in diameter and 5 mm deep. This individual was encountered in an oval pit in the southwestern portion of the site outside of the stockaded perimeter (Underwood 2004b). This same individual

exhibited a ligament pull which was recorded as an accidental injury. No evidence in this period indicated interpersonal violence.

Table 5.1. Sites with Human Remains Dated Between A.D. 600 and 725.

No.[a] (n=4)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
67	Porter-Stevenson	5MT0001	6	1	0	0
47	Chindi Hamlet	5MT4684	2	0	0	0
53	Dancing Man Hamlet	5MT9343	2	1	1	0
27		5MV1554	1	0	0	0
Totals			11	2	1	0

[a]Numbers are keyed to the map in Figure 4.1.

Period 7: A.D. 725 – 800

There are ten individuals from seven sites with mid-dates between A.D. 725 and 800 (Table 5.2). One site on Alkali Ridge (Site 13) falls outside of the Village Project study area. This site is in Southeast Utah, 12.9 km east of Blanding, and is the only site with an individual that exhibited warfare-related trauma. Site 13 is a large pithouse village with kivas, plazas, and several storage rooms. Although the osteological report (Brues 1946:328) did not mention trauma, according to Turner and Turner (1999:157-159), the adult male had cut marks on his skull likely from scalping and was possibly unceremoniously dumped into a kiva near the time of its abandonment. One individual, an adult male from 5MT2378, was recorded as having an accidental injury, a fracture of

the left first rib which resulted in misalignment after healing. No individuals from this period exhibited evidence of interpersonal violence.

Table 5.2. Sites with Human Remains Dated Between A.D. 725 and 800.

No.[a] (n=7)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
37	Horsefly Hamlet	5MT2236	1	0	0	0
38	Poco Tiempo	5MT2378	2	0	1	0
39	Rusty Ridge Hamlet	5MT2848	1	0	0	0
22	Apricot Hamlet	5MT2858	1	0	0	0
21	Tres Bobos Hamlet	5MT4545	1	0	0	0
47	Chindi Hamlet	5MT4684	3	0	0	0
72	Alkali Ridge	Site 13	1	1	0	0
Totals			10	1	1	0

[a]Numbers are keyed to the map in Figure 4.1.

Period 8: A.D. 800 – 840

There are six individuals from five sites with mid-dates between A.D. 800 and 840 (Table 5.3). All of these are located within the Village Project study area, and none of the individuals exhibited warfare-related trauma, accidental injuries, or interpersonal violence.

Table 5.3. Sites with Human Remains Dated Between A.D. 800 and 840.

No.[a] (n=5)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
35	Hamlet de la Olla	5MT2181	1	0	0	0
43	House Creek Village	5MT2320	1	0	0	0
78		5MT2831	1	0	0	0
40	Deer Hunter Hamlet	5MT2853	1	0	0	0
41	Periman Hamlet	5MT4671	2	0	0	0
Totals			6	0	0	0

[a]Numbers are keyed to the map in Figure 4.1.

Period 9: A.D. 840 – 880

There are 55 individuals from 13 sites with mid-dates between A.D. 840 and 880 (Table 5.4). Only one site is located outside of the Village Project study area. This site (5MV1676) is in Mesa Verde National Park.

Three individuals were determined to have warfare-related trauma. An adult male from 5MT2182 had healed fractures of the left radius and ulna and was encountered in a pit in the midden deposit, capped with sandstone slabs (Stodder 1987:348). An adult male from 5MT3868 had a healed, depressed fracture of the frontal bone. An adult female, also from 5MT3868, had a well-healed depressed fracture of the skull.

I considered ten individuals to have evidence of accidental injuries. The adult male from 5MT2182, who also exhibited healed warfare-related trauma, had a fracture at the sternal end of a clavicle. An adult male from 5MT2192 had degenerative trauma that resulted from a dislocated pelvis and a twist fracture in the lower back. One adult male from 5MT3868 had a healed fracture of the left fourth rib, and a second adult male had an

Table 5.4. Sites with Human Remains Dated Between A.D. 840 and 880.

No.[a] (n=13)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
17	Grass Mesa Village	5MT0023	1	0	0	0
23	Rio Vista Village	5MT2182	2	1	1	0
36	Pheasant View Hamlet	5MT2192	2	0	1	0
79		5MT2826	5	0	0	0
16	Duckfoot	5MT3868	14	2	2	0
44	McPhee Village	5MT4475	2	0	0	0
46	Rabbitbrush Pueblo	5MT4480	1	0	0	0
48	Tres Chapulines Pueblo	5MT4725	3	0	0	0
49	Weasel Pueblo	5MT5106	4	0	3	0
50	Pueblo de las Golondrinas	5MT5107	8	0	1	0
51	Standing Pipe Hamlet	5MT5985	1	0	0	0
54	Hummingbird Pueblo	5MT7522	5	0	2	0
64		5MV1676	7	0	0	0
Totals			55	3	10	0

[a]Numbers are keyed to the map in Figure 4.1.

old shin bruise, a foot fracture, and a torn insertion of a hip abductor. One adult female from 5MT5106 had evidence of paralysis of the right hip and leg, a second adult female had a healed fracture of the sternum, and an adult male had evidence of hyperextension of a knee. At 5MT5107, an adult male had a greenstick fracture resulting from bending stress to the back of the right leg. Finally, at 5MT7522, one adult female exhibited a

fracture of the right scapula near the spine which was in the process of healing, and a second adult female had torn ligaments of the right lower limb and a broken toe. No evidence of interpersonal violence was indicated on any of the individuals from this period.

Period 10: A.D. 880 – 920

There are 18 individuals from 7 sites with mid-dates between A.D. 880 and 920 (Table 5.5). Two sites are located outside of the Village Project study area: Cottonwood Wash (42SA12209) is in Southeast Utah, 20.8 km northwest of Blanding, and Badger House (5MV1452) is in Mesa Verde National Park.

Six individuals exhibited evidence of warfare-related trauma. All four individuals from 42SA12209 had cranial fractures and evidence of cannibalism. Two are subadults of indeterminate sex, one is an adult male, and one is an adult female. The data from these individuals all indicated "skinning, flesh removal or disarticulation activities evidenced by cutmarks" (White 1988:7). The cranial fractures were accomplished by "percussion with a hammerstone, resulting in anvil scars, adhering flakes and crushing" (White 1988:7).

Excavations at 42SA12209 consisted of a plaza and seven surface rooms. All remains discussed in the previous paragraph were derived from Structure 3, Feature 3. Structure 3, approximately 2 m long and 1.5 m wide, is a rectangular masonry room, and only one-half of this room was excavated. The remains found in Feature 3 were located in the west corner of Structure 3 and were partially contained within a shallow pit that

extended below the surface. These remains were mostly located with refuse and charcoal-stained, ashy fill (White 1992:379).

Table 5.5. Sites with Human Remains Dated Between A.D. 880 and 920.

No.[a] (n=7)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
57	Cottonwood Wash	42SA12209	4	4	0	0
17	Grass Mesa Village	5MT0023	2	0	0	0
20	Kin Tl'iish	5MT2336	2	0	0	0
44	McPhee Village	5MT4475	4	0	0	0
45	Masa Negra	5MT4477	1	0	0	0
42	Golondrinas Oriental	5MT5108	3	2	0	0
65	Badger House	5MV1452	2	0	0	0
Totals			18	6	0	0

[a]Numbers are keyed to the map in Figure 4.1.

The remaining two individuals recorded as having warfare-related trauma are from 5MT5108. One adult male had a small (1 x 1.5 cm) oval-shaped depression fracture on the left posterior aspect of the frontal bone near the coronal suture. This individual was also in association with an adult female. They both appeared to be grasping their throats and were lying in an awkward position on top of the hearth in the main chamber of a pithouse (Stodder 1987:349). No accidental injuries or interpersonal violence were indicated on any of the individuals from this period.

Period 11: A.D. 920 – 980

There are 13 individuals from 3 sites with mid-dates between A.D. 920 and 980 (Table 5.6). Only one of the sites is located outside of the Village Project study area. This site (5MV1452) is in Mesa Verde National Park. No individuals exhibited evidence of interpersonal violence or warfare-related trauma. One individual, an adult female from 5MV1452, had a healed rib fracture that I recorded as an accidental injury.

Table 5.6. Sites with Human Remains Dated Between A.D. 920 and 980.

No.[a] (n=3)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
44	McPhee Village	5MT4475	2	0	0	0
65	Badger House	5MV1452	10	0	1	0
33	Ackmen	Site 1-1937	1	0	0	0
Totals			13	0	1	0

[a]Numbers are keyed to the map in Figure 4.1.

Period 12: A.D. 980 – 1020

There are 20 individuals from 4 sites with mid-dates between A.D. 980 and 1020 (Table 5.7). Only one site (5MT0001) is located within the Village Project study area. 42SA3724 is in Southeast Utah, south of Monticello, and Badger House (5MV1452) and Two Raven House (5MV1645) are both in Mesa Verde National Park.

Five individuals exhibited evidence of warfare-related trauma. At the Porter-Stevenson site (5MT0001), all four individuals (one adult male and three children of indeterminate sex) were commingled in a storage pit, and all exhibited evidence of processing suggesting cannibalism (Yunker 2001:201). Each skull appeared to have been

broken into, and three of the four crania appear to have been scalped. Postcranially, two of the right clavicle fragments, the neck of a proximal femur fragment, and several rib fragments contained cut marks.

The fifth individual, from 42SA3724, is an adult male with a depression fracture on the left parietal and healed fractures of the right radius and ulna. This individual was found in a small cave/crevice. It is difficult to give a more detailed discussion because contextual details in the site report are lacking (White 380-381).

Table 5.7. Sites with Human Remains Dated Between A.D. 980 and 1020.

No.[a] (n=4)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
56		42SA3724	1	1	0	0
67	Porter-Stevenson	5MT0001	4	4	0	0
84	Two Raven House	5MV1645	13	0	1	0
65	Badger House	5MV1452	2	0	0	0
Totals			20	5	1	0

[a]Numbers are keyed to the map in Figure 4.1.

Only one individual exhibited evidence of an accidental injury. An adult male from Two Raven House (5MV1645) had a healed fracture of the tibia. No evidence of interpersonal violence was present on any of the individuals from this period.

Period 13: A.D. 1020 – 1060

There are 70 individuals from 14 sites with mid-dates between A.D. 1020 and 1060 (Table 5.8). Only four sites (5MT0003, 5MT2433, 5MT7522, 5MT8827) are located within the Village Project study area, and three are in Mesa Verde National Park (5MV0866, 5MV0875, 5MV1452). The remaining seven are in Southeast Utah.

Seventeen individuals displayed evidence of warfare-related trauma. Fifteen are from 5MT0003 and are highly fragmented, disarticulated, and may indicate cannibalism. Ten of these were found scattered on a kiva floor with concentrations of larger pieces located in the north and south areas of the kiva. They were also separated by a hearth of approximately 1 m in diameter placed in the center as well as an adjacently located corrugated vessel (White 1992:378). Because of their primarily fragmentary condition, however, only two could be determined as male and one as female. In sum, six are adult, two are infants, and two are children.

The remaining five from 5MT0003 consists of the following: 1) two individuals, one adult and one child both of indeterminate sex, were found scattered in the trash fill of a kiva; 2) one adult male was found scattered in a midden area; 3) one adult of indeterminate sex was found scattered in the fill of several features; and 4) one adult male was found in the fill of the ventilator shaft of a kiva.

One adult female from Aulston Pueblo (5MT2433) also indicated evidence of warfare-related trauma. This individual had a healed fracture of the right ulna and was encountered on the floor of a kiva. Nickens (1986:70) notes that the kiva may have been intentionally burned to complete the burial process after interment. In addition, one adult male from Alkali Ridge (Site 05) had a fracture on the frontal bone. This site consisted

Table 5.8. Sites with Human Remains Dated Between A.D. 1020 and 1060.

No.[a] (n=14)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
86		42SA6396	1	0	0	0
2		5MT0003	18	15	0	0
28	Aulston Pueblo	5MT2433	1	1	0	0
54	Hummingbird Pueblo	5MT7522	3	0	0	0
29	Dobbins Stockade	5MT8827	1	0	0	0
70		5MV0866	13	0	0	0
80		5MV0875	1	0	0	0
65	Badger House	5MV1452	9	0	2	0
74	Alkali Ridge	Site 03	4	0	0	0
71	Alkali Ridge	Site 05	12	1	0	0
75	Alkali Ridge	Site 07	1	0	0	0
76	Alkali Ridge	Site 08	2	0	0	0
77	Alkali Ridge	Site 12	3	0	0	0
72	Alkali Ridge	Site 13	1	0	0	0
Totals			70	17	2	0

[a]Numbers are keyed to the map in Figure 4.1.

of slab and masonry houses, two kivas, and a refuse mound. The adult male was encountered in a flexed position in the refuse mound (Turner and Turner 1999:157-159).

Two individuals, both from Badger House (5MV1452), had evidence of accidental injuries. One adult male had a healed fracture of the sternum, and one adult female had a healed fracture on the distal end of a radius which indicated a broken wrist

likely due to a fall. No individuals from this period exhibited evidence of interpersonal violence.

Period 14: A.D. 1060 – 1100

There are 45 individuals from 10 sites with mid-dates between A.D. 1060 and 1100 (Table 5.9). Five sites are located outside of the Village Project study area. One of these is in Southeast Utah (42SA18434), 4.5 km northeast of Blanding, and the remainder (5MT7723, 5MT8651, 5MT8943, 5MT11884) are south of Sleeping Ute Mountain in Colorado.

Twenty-four individuals exhibited evidence of warfare-related trauma. Of these, twenty are from Rattlesnake Ruin (42SA18434) in Southeast Utah and indicate perimortem damage, disarticulation, and cannibalism. Although it has been argued that Rattlesnake Ruin dated to the mid-1100s (Lipe 2006:313), I used the dates of occupation suggested by Kuckelman et al. (2000). This site is a small, seasonally occupied structure that is often referred to as a "fieldhouse." Baker (1994:36) notes that such a large group of people would not normally be present at one time at such a site. He suggests that these individuals were likely brought to this location from somewhere else. Several of the individuals' crania had been heavily damaged with indications of heavy blunt blows that fractured the brain cases. Thin, multiple cut marks were also present on several crania in the frontal, occipital, and temporal regions indicating that they had been scalped. An overwhelming majority of the long bones were also fractured with an anvil-and-hammer technique. Of the 10 adults, two were classified as males, five as females, and three as

indeterminate sex. The remaining 10 individuals include four subadults, four children, and two infants.

Table 5.9. Sites with Human Remains Dated Between A.D. 1060 and 1100.

No.[a] (n=10)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
85	Rattlesnake Ruin	42SA18434	20	20	0	0
67	Porter-Stevenson	5MT0001	5	0	1	0
24	Herren House	5MT2519	3	0	0	0
26	Roundtree Pueblo	5MT2544	1	0	0	0
19		5MT7723	4	1	0	0
30		5MT8651	1	1	0	0
63		5MT8943	7	2	1	0
52	Rabbit Site	5MT9168	1	0	1	0
6	G and G Hamlet	5MT11338	1	0	0	0
55	Conejos Camp	5MT11884	2	0	0	0
Totals			45	24	3	0

[a]Numbers are keyed to the map in Figure 4.1.

One adult of indeterminate sex from 5MT7723 exhibited evidence of disarticulation and cannibalism, according to Turner and Turner (1999:308-310). This individual was found scattered on a kiva floor and in the floor fill, hearth, and southern recess. Although Dice (1993a:69-73) argued that this individual did not meet Turner and Turner's (1999:22-23) minimal taphonomic signature of cannibalism, the Turners disagree.

One adult male from 5MT8651 had a well-healed fracture of the left radius. Two adult females from 5MT8943 exhibited warfare-related trauma as well. One had a well-healed fracture of the right radius and was encountered southwest of Kiva 1 in midden deposits. The other female had a healed fracture of the left ulna and was located in the most northern portion of 5MT8943 in a shallow pit.

Three individuals had skeletal trauma that I recorded as accidental injuries. One adult female from the Porter-Stevenson site (5MT0001) had a fracture of the right humerus and scapula. One adult female from 5MT8943 had a dislocated right ulna, and one adult female from the Rabbit Site (5MT9168) had a sprained left ankle. No indications of interpersonal violence were evident on the individuals from this period.

Period 15: A.D. 1100 – 1140

There are 108 individuals from 12 sites with mid-dates between A.D. 1100 and 1140 (Table 5.10). Only three sites are located within the Village Project study area. The remainder are located south of Sleeping Ute Mountain (5MT8651, 5MT9924, 5MT9942, 5MT9943, 5MT10967), in Mesa Verde National Park (5MV0499, 5MV1595), south of Mesa Verde National Park along the Mancos River (5MTUMR2346), and in Southeast Utah (Alkali Ridge Site 13).

Of the 108 individuals, 44 exhibit evidence of warfare-related trauma. Of these, 29 are from Mancos (5MTUMR2346), a unit pueblo with several rooms, a kiva, and a midden. White notes that during occupation at 5MTUMR2346, the area was "very dense, and this pueblo would have been but one element of a large farming community" (White 1992:43). Although Lipe (2006:313) argues that this site was occupied in the mid-1100s,

Table 5.10. Sites with Human Remains Dated Between A.D. 1100 and 1140.

No.[a] (n=12)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
67	Porter-Stevenson	5MT0001	1	0	0	0
2		5MT0003	16	3	1	0
5	Marshview Hamlet	5MT2235	6	6	0	0
58		5MT8651	1	0	1	0
60		5MT9924	11	1	2	1
31		5MT9942	3	0	0	0
34		5MT9943	7	3	3	1
69		5MT10967	1	1	0	0
13	Mancos	5MTUMR2346	29	29	0	0
14		5MV0499	10	1	0	0
66	Big Juniper House	5MV1595	20	0	1	0
72	Alkali Ridge	Site 13	3	0	0	0
Totals			108	44	8	2

[a]Numbers are keyed to the map in Figure 4.1.

I referred to Kuckelman et al. (2002) who noted occupation was between 1100 and 1150, and Turner and Turner (1999:220) who dated the site to about 1100. Most compellingly, however, White (1992:57) noted that Mancos was a multiple occupation site dating to between 1100 and 1150. He further argues that the sequence of events that led to deposition of the human bone assemblage, within the context of a multiple occupation with remodeling, is obscure; thus, making interpretation difficult. Taking into account all three of these interpretations, I decided to place this site into Period 15. All remains at

Mancos that were encountered indicated perimortem damage, disarticulation, and possible cannibalism (White 1992). These remains were found scattered in the fill of several rooms. Because of the fragmentary and spatially mixed nature of this assemblage, only two of the eighteen adults could be classified as males and two as females. The remaining 11 individuals consist of eight children and three subadults.

Three individuals (two adult females and one adult of indeterminate sex) from 5MT0003 exhibited evidence of warfare-related trauma which also consisted of perimortem damage, disarticulation, and cannibalism. Although Lipe (2006:313) considers occupation at this site to date to the mid-1100s, as noted in Chapter 4, I referred to the Village Project database, the McElmo-Yellowjacket Settlement Data Version 5.4 (Crow Canyon Archaeological Center and Washington State University 2005), as a primary source for determining site occupation. One of the females and the adult of indeterminate sex at 5MT0003 were interred together on the fill of a mealing room and covered with trash and fill (Yunker 2001:218). The second female was encountered in the fill of a masonry room mixed with dog bones and trash (Yunker 2001:220).

Six of six individuals from Marshview Hamlet (5MT2235) exhibit characteristics similar to those from 5MT0003 and 5MTUMR2346. I also used the Village Project database as a primary source for determining site occupation; thus, my period of occupation differs slightly from Kuckelman et al. (2000), which dated this site to ca. 1150, and Lipe (2006:313), which dated this site to the mid-1100s. The remains from Marshview Hamlet were found in the floor fill, upper fill, and outside a large pitstructure classified as Pithouse 1. Some fragments were also encountered in a ventilator shaft and a firepit (White 1992:377). Because of the fragmentary nature of the remains, sex could

not be determined; however, the assemblage consists of four adults, one infant, and one child. Wiener (1988) was cautious in considering evidence of cannibalism at Marshview Hamlet; however, the Turners disagreed (Turner 1988; Turner and Turner 1999:270-273). They argue that this assemblage does in fact meet the minimal criteria for hypothesizing cannibalism. In addition, they also disagree with Wilshusen (1988:34-36), who argued that these individuals were buried, and suggest instead that they were dumped into the pithouse.

One adult male from 5MT9924 had two healed depression fractures on the posterior right parietal bone. Three individuals from 5MT9943 also exhibited characteristics of warfare-related trauma. One adult female had a depression fracture on the left parietal and one adult female had a well-healed fracture of the left ulna. In addition, one adult male had a well-healed fracture on the right frontal bone as well as a depression fracture on the right parietal.

One adult male from 5MT10967 had massive head trauma in which the force of two blows to the left side of the head resulted in the left frontal, parietal, and temporal bones literally breaking into small pieces. This individual was an isolated burial encountered during construction of Reach III of the Bureau of Reclamation's Towaoc Canal Project in 1992. Nickens and Mabry (2000:16-17) suggest that this individual was likely an intruder from the Fremont culture because of the associated Fremont-like projectile points as grave goods and the atypical burial location.

One adult male from 5MV0499 was encountered with a bone awl in his chest cavity and appeared to have been stabbed. Although this by itself does not necessarily indicate warfare, as noted in Chapter 4, I will use additional information to alter my

coding in cases where evidence from the investigator suggests strict adherence to my rules isn't sensible. Kuckelman et al. (2000) noted occupation at this site to date between 1123 and 1150, Lipe (2006:313) dated this site to the mid-1100s, and Turner and Turner (1999:182) dated it to 1100-1150 and also noted two tree-ring dates of 1123. With these three interpretations, I decided to place this site in Period 15. The adult male from 5MV0499 was encountered on the floor of a kiva between the firepit draft deflector and the entrance to the ventilator tunnel (Lister 1964:37). The position of the skeleton as well as other factors which are mentioned below suggest that this individual had been killed or injured prior to being thrown or placed on the kiva floor.

> The skeleton rested on its left side with the right leg crossed over the left. The left arm was flung back over the head. The individual's back was bent backward and the neck so twisted that the head faced to the rear. The head had been crushed by [five large slabs of] stones which appear to have been thrown upon the ill fated person. The corpse may have been mutilated by dogs or wild animals before it was completely covered by debris in the abandoned kiva because the right hand and the right radius were missing. No burial furnishings were associated with the skeleton (Lister 1964:79).

Turner and Turner (1999:183-184) also note that further taphonomic study is needed to determine if the missing hand had been cut off rather than removed by scavengers. They describe an instance where cutting off a hand as a war trophy was practiced by the Zuni well into the early part of historic contact.

Eight individuals from this period exhibited accidental injuries. One child from 5MT0003 had a fracture on the central aspect of the occipital. One adult female from 5MT8651 had a well-healed rib fracture. One adult male from 5MT9924 had well-healed fractures of two left ribs, and an adult female had an old wrist injury. At 5MT9943, one adult female had a well-healed fracture of the 11th right rib, one adult male had healed

fractures of three right ribs as well as a well-healed fracture of the distal end of the left ulna, and one child had a well-healed fracture on the right side of the frontal bone. Finally, one adult male from Big Juniper House (5MV1595) had a healed fracture of the left clavicle. Two adult females from 5MT9924 and 5MT9943 had well-healed fractures of the nasal bone that I consider as evidence of interpersonal violence.

Period 16: A.D. 1140 – 1180

There are 35 individuals from five sites with mid-dates between A.D. 1140 and 1180 (Table 5.11). All sites are located outside of the Village Project study area, but in Southwestern Colorado. It is important to note, however, that this period is poorly known in the Village Project study area as well as in the entire central Mesa Verde region. Grinnell is located east of Sleeping Ute Mountain, and the remaining four sites are south of Sleeping Ute Mountain.

Table 5.11. Sites with Human Remains Dated Between A.D. 1140 and 1180.

No.[a] (n=5)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
12	Grinnell		7	7	0	0
62		5MT7704	1	0	0	0
32		5MT10010	11	8	1	0
83		5MT10206	2	2	0	0
18		5MT10207	14	13	1	0
Totals			35	30	2	0

[a]Numbers are keyed to the map in Figure 4.1.

Of the 35 individuals, 30 exhibit evidence of warfare-related trauma. Skeletal data from all seven individuals at the Grinnell Site demonstrated disarticulation, fragmentation, spiral fracturing, charring, and cutting, which suggests cannibalism (Turner and Turner 1999:248-250). The Grinnell Site is a small ceremonial complex consisting of two surface structures, a circular tower, subterranean room, tunnel, and two kivas. In this assemblage, two adult males, one adult female, two adults of indeterminate sex, and two children were present. Most of the remains were found in an oval cist classified as Cist 2, which was cut into the natural shale near the southeast corner of Kiva 2. The remaining bone fragments were encountered on the kiva floor and in the fill of an adjacently located corrugated jar (White 1992:376).

At 5MT10010, seven of the eight individuals with warfare-related trauma also exhibited evidence suggestive of cannibalism. These individuals were "systematically dismembered and defleshed" (Billman 2000:145) and scattered on the floors of two pithouses. This assemblage consisted of one child, two subadults, three adult males, and one adult female. In addition to an overwhelming number of perimortem fractures cranially and postcranially on the seven individuals, one of the subadults also had two healed depression fractures on the right frontal and right posterior parietal bones. The eighth individual, an adult male, had a healed depression fracture on the left side of the frontal bone near the coronal suture.

Two individuals from 5MT10206, one adult female and one subadult, both indicated evidence of cannibalism. This disarticulated bone assemblage showed evidence of cutting, fracturing, and burning and was deposited in a surface room, a subterranean storage and mealing room, and a kiva.

All of the 13 individuals from 5MT10207 with warfare-related trauma exhibited evidence of cannibalism. This disarticulated bone assemblage showed evidence of cutting, cracking and burning marks and was deposited in two surface rooms and a kiva. These 13 individuals are comprised of three adult males, three adult females, one adult of indeterminate sex, one subadult, four children, and one infant.

Accidental injuries from this period were evident on two individuals. One adult male from 5MT10010 had a well-healed fracture in the body of a left middle rib. One adult male from 5MT10207 also had a well-healed rib fracture but of a lower right rib. No individuals exhibited evidence of interpersonal violence.

It is important to note here that I did not include Hanson Pueblo (5MT3876) in this analysis as I was unable to ascertain the site report. This is a well-dated site (A.D. 1134-1175) in Southwest Colorado (Kuckelman et al. 2000) and would presumably be placed in this period. Had I included this site, with two individuals exhibiting disarticulation and human modification found scattered on a kiva floor, it would only slightly increase the already very high level of warfare for this period.

Period 17: A.D. 1180 – 1225

There are 34 individuals from 11 sites with mid-dates between A.D. 1180 and 1225 (Table 5.12). Six of the sites are located outside of the Village Project study area: 1) Happy Salamander Site (42SA7660), Alkali Ridge (42SA1), and Alkali Ridge (Site 13) are in Southeast Utah; 2) Soda Canyon Pueblo (5MV0034) and Badger House (5MV1452) are in Mesa Verde National Park; and 3) 5DL0975 is located near the boundary of the Village Project study area in Dolores County.

Of the 34 individuals, 4 exhibited evidence of warfare-related trauma. One adult male from 5DL0975 had two depressed fractures with radiating fracture lines on the cranial vault and appeared to have been scalped. One adult female from Troy's Tower (5MT3951), which consists of a tower, kiva, two large pits, and a small trash area, had a depression fracture on the frontal bone. This individual was encountered against a wall in a large storage pit, classified as Structure 4, with sandstone rocks and slabs placed around the burial (Katzenberg 1999).

Table 5.12. Sites with Human Remains Dated Between A.D. 1180 and 1225.

No.[a] (n=11)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
87	Happy Salamander Site	42SA7660	1	0	0	0
82		5DL0975	1	1	0	0
67	Porter-Stevenson	5MT0001	3	0	1	0
25	Knobby Knee Stockade	5MT2525	2	0	0	0
26	Roundtree Pueblo	5MT2544	1	0	0	0
7	Roy's Ruin	5MT3930	1	0	0	0
8	Troy's Tower	5MT3951	1	1	0	0
88	Soda Canyon Pueblo	5MV0034	19	0	0	0
65	Badger House	5MV1452	2	0	1	0
73	Alkali Ridge	42SA1	1	0	0	0
72	Alkali Ridge	Site 13	2	2	0	0
Totals			34	4	2	0

[a]Numbers are keyed to the map in Figure 4.1.

One adult male from Alkali Ridge (Site 13) had the tip of a projectile point broken off in one of the dorsal vertebrae, exhibited strong blows to the left side of the head, and appeared to have been scalped. This individual had apparently been dumped into a kiva on top of and in contact with another adult male who was also in a sprawled position.

Two individuals from this period exhibited evidence of accidental injuries. One child from Porter-Stevenson (5MT0001) had a fracture on the occipital bone, and one adult male from Badger House (5MV1452) had a healed fracture of the collarbone. No individuals from this period exhibited evidence of interpersonal violence.

Period 18: A.D. 1225 – 1260

There are 75 individuals from 7 sites with mid-dates between A.D. 1225 and 1260 (Table 5.13). Five of the seven sites are located outside of the Village Project study area. Mug House (5MV1229) is located in Mesa Verde National Park, and the remaining four (5MT8651, 5MT9541, 5MT9933, 5MT9943) are south of Sleeping Ute Mountain.

Of the 75 individuals, 6 exhibited evidence of warfare-related trauma. One adult female from 5MT9541 had a traumatic cranial injury on the posterior left parietal bone. Skeletal data concerning five individuals from 5MT9943 also indicated warfare-related trauma. One adult female had a traumatic cranial injury on the left parietal and was found on her back on the floor of a pitstructure in a sprawled position, and one adult female had a well-healed fracture of the right ulna. Three individuals (two children and one subadult) were interred together, and all exhibited several depression fractures of the cranial vault.

Table 5.13. Sites with Human Remains Dated Between A.D. 1225 and 1260.

No.[a] (n=7)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
81	Wallace Ruin	5MT6970	10	0	0	0
58		5MT8651	1	0	0	0
59		5MT9541	1	1	0	0
61		5MT9933	1	0	0	0
34		5MT9943	5	5	1	0
4	Woods Canyon	5MT11842	11	0	1	0
15	Mug House	5MV1229	46	0	2	1
Totals			75	6	4	1

[a]Numbers are keyed to the map in Figure 4.1.

I consider four individuals from this period to have accidental injuries. One adult of indeterminate sex from Woods Canyon (5MT11842) had a well-healed fracture of the left fifth metatarsal. One adult male from Mug House (5MV1229) had a broken finger, and one adult male had a healing fracture of the collarbone and a healed rib. One adult female from 5MT9943 had well-healed injuries on several foot bones.

One individual exhibited evidence of interpersonal violence. This infant from Mug House (5MV1229) had three unhealed rib fractures. Considering this individual was an infant at time of death, it is highly unlikely that the rib fractures were accidental (Rohn 1971).

Period 19: A.D. 1260 - 1280

There are 121 individuals from 7 sites with mid-dates between A.D. 1260 and 1280 (Table 5.14). Only two sites from this period are located outside of the Village

Project study area. These sites, Long House (5MV1200) and Badger House (5MV1452), are located in Mesa Verde National Park.

Fifty-one individuals exhibited evidence of warfare-related trauma. Of these, 41 are from Castle Rock (5MT1825), and all were apparently killed during one warfare event (Kuckelman et al. 2002). Castle Rock was a rather large village with "15 ordinary-sized kivas, one oversized kiva, a minimum of 37 masonry rooms, nine possible towers, two plazas, one D-shaped structure, and several sections of retaining and village-enclosing walls, all built and used during a single occupation" (Kuckelman et al. 2002:488).

Table 5.14. Sites with Individuals Dated Between A.D. 1260 and 1280.

No.[a] (n=7)	Site Name	Site Number	Human Remains	Warfare	Accidental Injuries	Interpersonal Violence
68	Yellow Jacket	5MT0005	5	1	0	1
3	Sand Canyon	5MT0765	33	8	0	0
1	Castle Rock	5MT1825	41	41	1	0
9	Lester's Site	5MT10246	1	0	0	0
10	Lookout House	5MT10459	1	0	0	0
11	Long House	5MV1200	39	1	0	0
65	Badger House	5MV1452	1	0	0	0
Totals			121	51	1	1

[a]Numbers are keyed to the map in Figure 4.1.

Evidence of violent death includes "unhealed, depressed skull fractures, concentrations of disarticulated, commingled remains, and perimortem modifications such as fractures, cutmarks, thermal alteration, and absence of cancellous bone" (Kuckelman et al. 2002:499). For example, one adult male, encountered on the floor of a subterranean kiva (Structure 101) in a sprawled position, had a depression fracture on the back of his skull and two depression fractures on the frontal bone. Another adult male was found in a sprawled position on the floor of a subterranean kiva (Structure 103) and had several multiple lethal fractures that shattered his skull. In addition, the locations of cutmarks on several individuals are indicative of legs being removed from the torso at the hip and at the knee, lower arms being removed at the elbow, and the removal of flesh from the upper and lower parts of the legs (Kuckelman et al. 2002). Because of the highly fragmentary nature of most of the individuals from this assemblage, not all of the adults could be sexed. The age and sex distribution includes five adult males, three adult females, one infant, eleven children, three subadults, seventeen adults of indeterminate sex, and one individual of indeterminate sex and age.

Eight individuals from Sand Canyon Pueblo (5MT0765) also exhibited warfare-related trauma. Sand Canyon is also a large village with an enclosing wall, approximately "420 rooms, 90 kivas, 14 towers, a plaza, a D-shaped multi-walled structure, and a great kiva" (Kuckelman et al. 2002:489). These individuals show evidence of skull trauma and/or perimortem bone modification, and it is possible all died in one violent event at the end of site occupation (Kuckelman et al. 2002).

One adult male was encountered in a sprawled position on a room floor and had a small healed depression fracture on the left parietal as well as a large depression fracture

on the left frontal bone that likely caused his death. One subadult had crushing on the base of the skull and two small depression fractures on the left parietal. Another subadult was encountered face down on the floor of a kiva, had a large depression fracture on the occiput, multiple skull fractures, numerous cutmarks on several postcranial bones, and appeared to have been scalped. One adult male had at least three depression fractures on the back of the skull, anvil abrasions on the pelvis, and a healed depression fracture of the frontal bone. One child found in a kiva hearth had a fracture on the back of the skull and appeared to have been scalped. A third adult male appeared to have been decapitated and had several spiral fractures on the pelvis and leg bones. A third subadult had fractures on the frontal bone, and the face of an adult female appeared to have been removed.

Individuals from two more sites of this period exhibited evidence of warfare-related trauma. One adult female from Yellow Jacket (5MT0005) had a healed depression fracture on the frontal bone. The head of one adult male from Long House (5MV1200) appeared to have been twisted off while some skin or ligaments remained and was likely thrown on his back into the middle of a kiva floor.

One individual from Castle Rock (5MT1825) had evidence of an accidental injury. This adult male had a previous fracture on the right tibia prior to the skull fractures that caused his death. One individual from Yellow Jacket (5MT0005) had evidence of interpersonal violence. This adult female had a healed fracture of the right nasal bone.

Summary

Of the entire population of individuals with indications of warfare-related trauma between A.D. 600 and A.D. 1280, a large percentage (81.9%) exhibited evidence of human processing and cranial trauma (Figure 5.1). In contrast, a rather small percentage (18.1%) exhibited evidence of fractures to the radius and/or ulna or other types of insults (such as projectile points embedded in the skeletal remains or scalping).

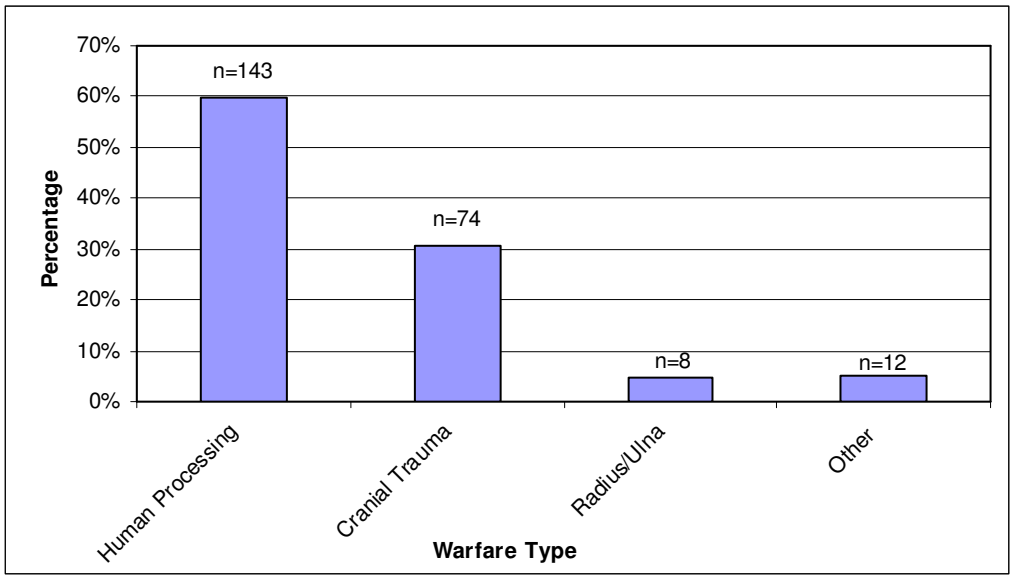


Figure 5.1. Distribution of individuals with warfare-related trauma based on percentage of occurrences. The total number of occurrences (n=240) is greater than the total number of individuals (n=193), since some individuals exhibited more than one type of warfare-related trauma.

The distribution of individuals with warfare-related trauma, grouped by age, clearly indicates that more adults were participating in, or victims of, warfare events (Figure 5.2). Surprisingly, more children than subadults exhibited evidence of warfare-related trauma. It is also important to note the percentage of individuals by age with

warfare-related trauma versus those without such trauma is significant ($\chi^2 = 32.776$, $df = 4$, $p \leq .001$, χ^2 based on frequencies).

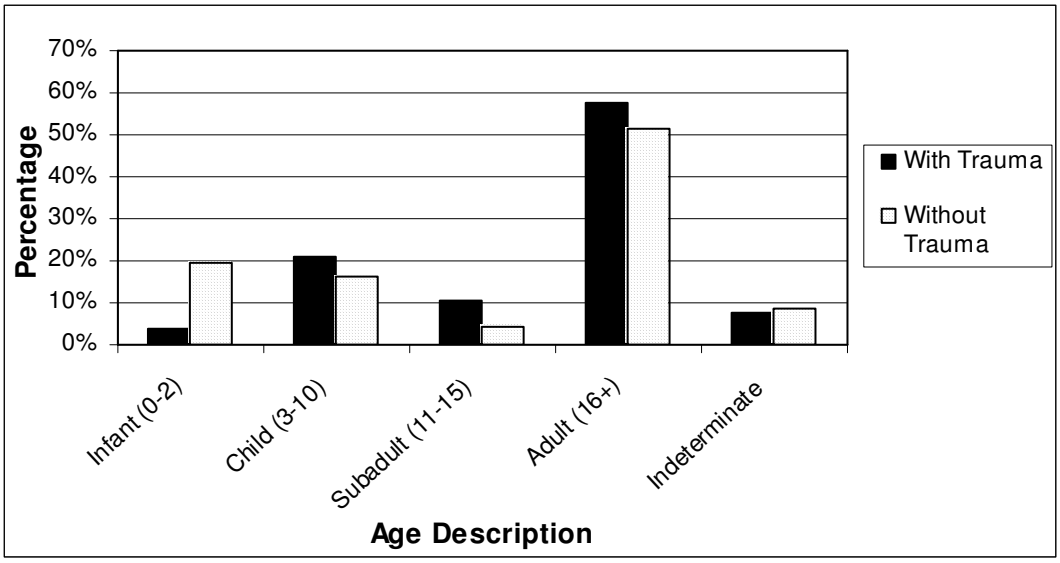


Figure 5.2. Age distribution of individuals with and without warfare-related trauma.

The distribution of adults with warfare-related trauma, grouped by sex, suggests that more males were participating in, or victims of, warfare events (Figure 5.3). However, for a large percentage of adults, sex could not be determined. Binomial confidence intervals around the observed proportions of males and females with warfare-related trauma were created (Figure 5.4). The departure from the expected .5 proportion of males is not significant. In other words, these results would not provide much support for the idea that more males were participating in, or victims of, warfare events.

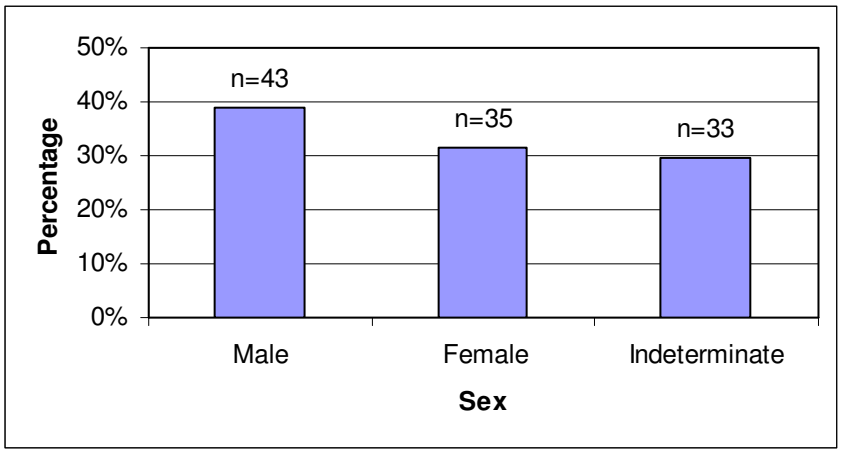


Figure 5.3. Sex distribution of adults with warfare-related trauma.

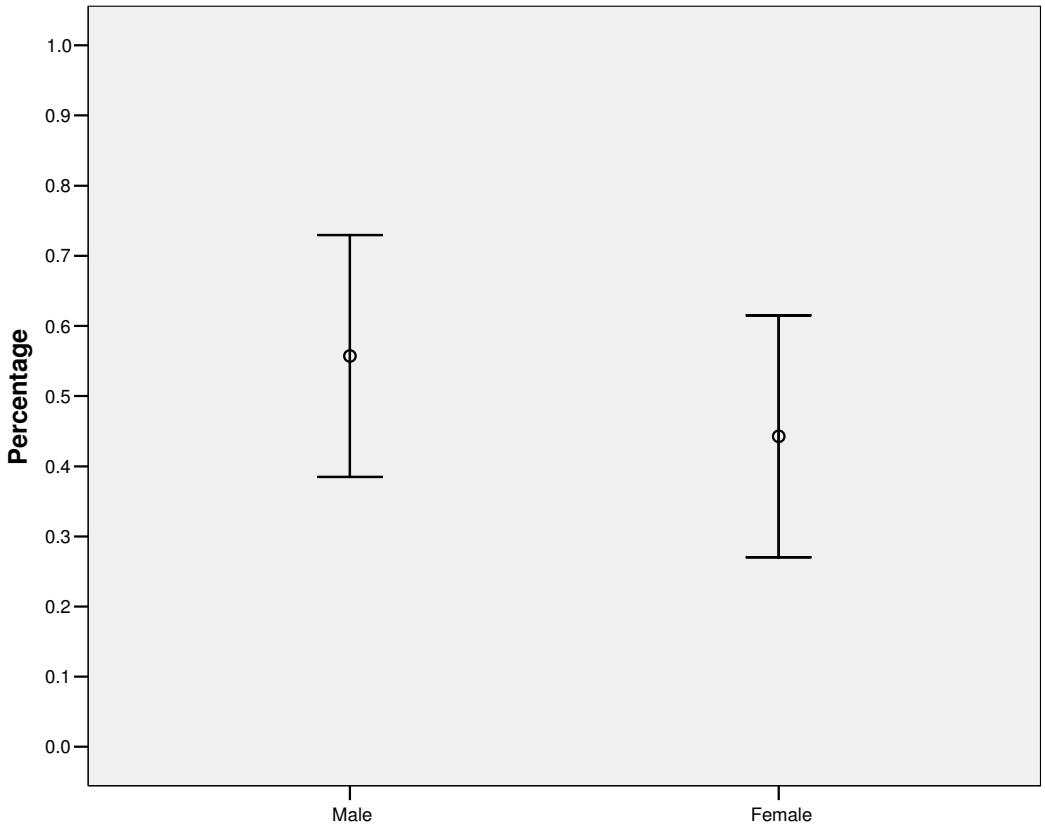


Figure 5.4. Percentage of males and females with warfare-related trauma. Vertical bars display 95% binomial confidence limits around observed percentages of males and females.

This chapter presented a detailed description of the dataset by modeling period. In the next chapter, the number of individuals with warfare-related trauma and the total number of human remains recorded according to each modeling period are used to calculate the estimate of warfare intensity (*W*) that is then used to test the Turchin-Korotayev model discussed in Chapter 3.

Chapter 6 EVALUATING THE TURCHIN-KOROTAYEV MODEL

In Chapter 3, the Turchin-Korotayev model concerning the relationship between population dynamics and warfare intensity for small-scale societies was discussed. They argue that population increase stimulates warfare, but that increased warfare in turn eventually causes population numbers to decline. In the present chapter, this model is tested using the data to estimate warfare intensity compiled in the previous chapter as well as estimates of population density (N), carrying capacity (K), and rate of population growth (r) for the Village Project study area discussed in Chapter 3.

Estimating Warfare Intensity

The dataset compiled in this thesis is of course not a complete record of all individuals who lived and died from A.D. 600 to 1280 in the central Mesa Verde region, a situation common in other types of archaeological datasets as well. Empirical Bayesian methods can help provide a more meaningful estimate of warfare intensity (W) for the entire region based on the compiled population. Since I am using the dataset to make inferences about warfare intensity within a larger population in the central Mesa Verde region, the observed proportion from the compiled population can actually be misleading.

> When proportions of a particular…category are estimated within individual collections that vary much in size, random effects of sampling error will cause the measures of variance attached to the estimates to be correspondingly uneven; most important, some of the measures of variance will be relatively *large* (Robertson 1999:137-138).

The Bayesian method of parameter estimation used to estimate warfare intensity follows techniques discussed by Robertson (1999) who was in turn inspired by Chernoff (1982), Cowgill (1968, 1974, 1994), and Cowgill et al. (1984). This method, applied

here with assistance from Scott Ortman of the Crow Canyon Archaeological Center, is useful when dealing with samples that are small and variable in size, as it obviates the need to arbitrarily aggregate or eliminate small samples. Table 6.1 displays the *n* of skeletal remains for each period and the number of individuals with warfare-related trauma (*x*), as discussed in greater detail in the previous chapter.

Table 6.1. Raw Data Used in Calculating the Warfare Index (*W*).

Period	Midpoint	x	n	x/n	a	b	μ″	Raw Warfare Index	W (Final Version)
6	663	2	11	0.1818	-0.12119	-0.40858	0.17944	0.10375	0.1038
7	763	1	10	0.1000	-0.12119	-0.40858	0.09280	-0.01622	0.0000
8	820	0	6	0.0000	-0.12119	-0.40858	-0.02215	-0.32309	0.0000
9	860	3	55	0.0545	-0.12119	-0.40858	0.05285	0.03581	0.0358
10	900	6	18	0.3333	-0.12119	-0.40858	0.33650	0.31537	0.3154
11	950	0	13	0.0000	-0.12119	-0.40858	-0.00972	-0.10708	0.0000
12	1000	5	20	0.2500	-0.12119	-0.40858	0.25058	0.22202	0.2220
13	1040	17	70	0.2429	-0.12119	-0.40858	0.24296	0.23535	0.2353
14	1080	24	45	0.5333	-0.12119	-0.40858	0.53696	0.53870	0.5387
15	1120	44	108	0.4074	-0.12119	-0.40858	0.40829	0.40655	0.4065
16	1160	30	35	0.8571	-0.12119	-0.40858	0.86680	0.88939	0.8894
17	1203	4	34	0.1176	-0.12119	-0.40858	0.11589	0.09148	0.0915
18	1243	6	75	0.0800	-0.12119	-0.40858	0.07894	0.06732	0.0673
19	1270	51	121	0.4215	-0.12119	-0.40858	0.42234	0.42102	0.4210

As is apparent in this table, the population is variably sized across all periods, with some periods – especially the first three – having small sample sizes. Because arbitrarily aggregating or eliminating small samples would be detrimental for examining the T-K model, the Bayesian techniques used here "dampen the random effects of small samples without requiring that arbitrary decisions be made as what actually constitutes a small sample" (Robertson 1999:141).

Bayes' Theorem is used to generate an improved estimate of the unknown population proportion π from the observed sample proportion p (where $p = x/n$). Measures of central tendency and dispersion are used to generate both the prior (observed) and posterior (improved) estimates of π. The mean μ' and the variance σ'^2 of the *prior* distribution (according to the proportion for each site in the dataset rather than each period) are defined by the following formulas:

$$\mu' = \frac{a}{a+b} \qquad \sigma'^2 = \frac{\mu'(1-\mu')}{a+b+1} \qquad \text{(6.1a, b)}$$

With these values specified, the values for constants a and b play a crucial role in defining a *posterior* distribution for π and can be derived as follows:

$$a = \mu'\left[\frac{\mu'(1-\mu')}{\sigma'^2} - 1\right] \qquad b = (1-\mu')\left[\frac{\mu'(1-\mu')}{\sigma'^2} - 1\right] \qquad \text{(6.2a, b)}$$

The mean μ'' and the variance σ''^2 of the *posterior* distribution for π are derived by using the constants a and b (from the previous formulas in 6.2a and 6.2b) and the n of total remains and those with warfare-related trauma (x) according to each period. The prior knowledge is equivalent to $a + b$ items. Mathematically combining this information with the observed data (x and n) takes this prior knowledge into account:

$$\mu'' = \frac{x + a}{n + a + b} \qquad \sigma''^2 = \frac{\mu''(1 - \mu'')}{n + a + b + 1} \qquad (6.3a, b)$$

It has been suggested that μ'' is not always the most probable value of the *posterior* distribution, especially concerning small sample sizes (Iversen 1984:32-33). Therefore, the peak, or the most probable value, of the posterior distribution (i.e., the raw warfare index) is calculated using the following formula:

$$f(\pi)_{\max} = \frac{(x + a - 1) \cdot (n + b + a)}{(x + a) \cdot (n + b + a - 2)} \cdot \mu'' \qquad (6.4)$$

The final version of warfare intensity (*W*) in the farthest right-hand column of Table 6.1 is calculated by rounding the raw warfare index to four decimal places and converting negative values to zero.

The outcome of this procedure, the *posterior* distribution (*W*), is different, although modestly, from the *prior* distribution (*x/n*). This is due to the Bayesian method used here which mathematically combines the observed data (*x/n*) with the prior knowledge (μ' and σ'^2). Furthermore, in some instances $W > x/n$ whereas in others $W < x/n$. This difference is influenced by the values of $x + a$ and $n - x + b$, especially when such values happen to be small. For example, when $(x + a) > (n - x + b)$, then $W > x/n$.

At first glance, the prior (*x/n*) and posterior (*W*) distributions in Table 6.1 appear to be nearly identical. Figure 6.1, however, indicates otherwise. The prior distribution (dotted blue line) suggests that a higher degree of warfare intensity occurred during the first three periods than what is suggested by the posterior distribution (solid black line). The Bayesian technique used here dampened the random effects of the small sample sizes

in the first three periods by moving the sample points slightly towards the grand mean, but more so for small samples than large.

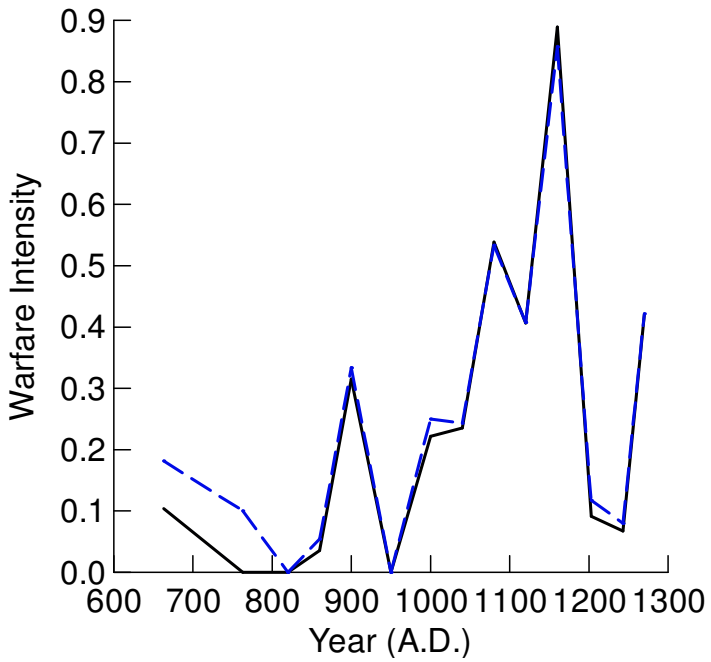
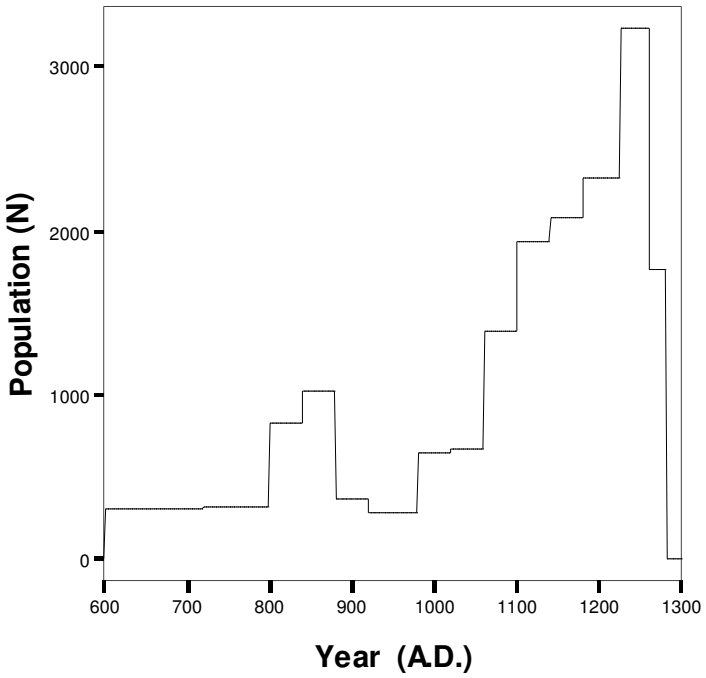


Figure 6.1. Graphic depiction of the prior distribution (*x/n*) (dotted blue line) and the posterior distribution (*W*) (solid black line) shown numerically in Table 6.1.

Evaluating the Model

The Turchin-Korotayev model discussed in Chapter 3 can be evaluated in various ways. Following Turchin and Korotayev's approach (2006), the time series data for population (*N*) and warfare intensity (*W*) is first smoothed using 40-year running means to obtain a more continuous measurement. Since smoothing can "overestimat[e] the endogeneity (i.e., signal/noise ratio) of the dynamical process" (Turchin and Korotayev 2006: 10), Figures 6.2 and 6.3 display the time series data for population (*N*) and warfare intensity (*W*) before and after smoothing.



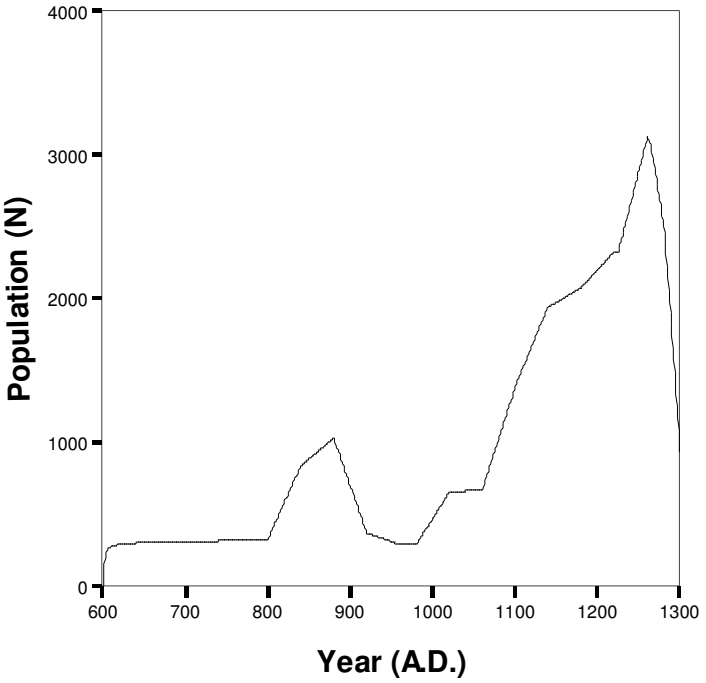
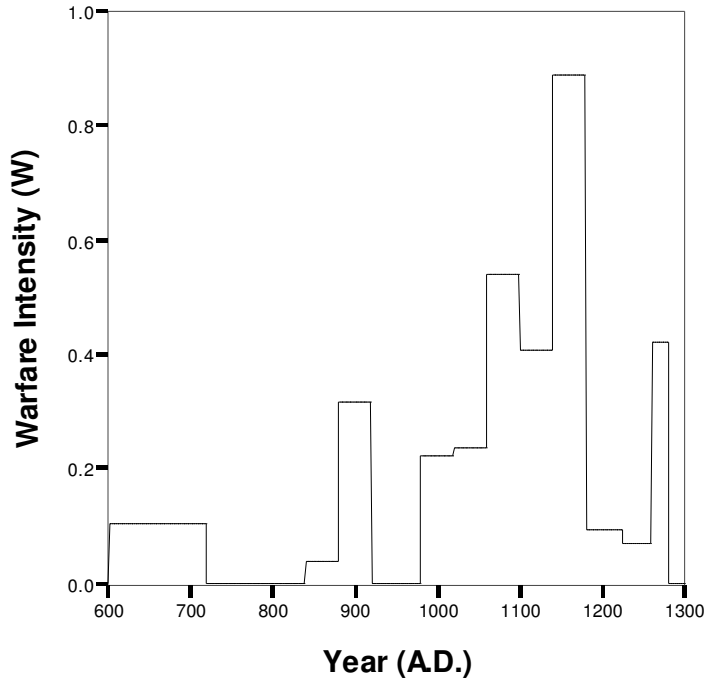


Figure 6.2. Time series data displayed for the unsmoothed (top graph) and smoothed (bottom graph) versions of population (*N*) by number of households.



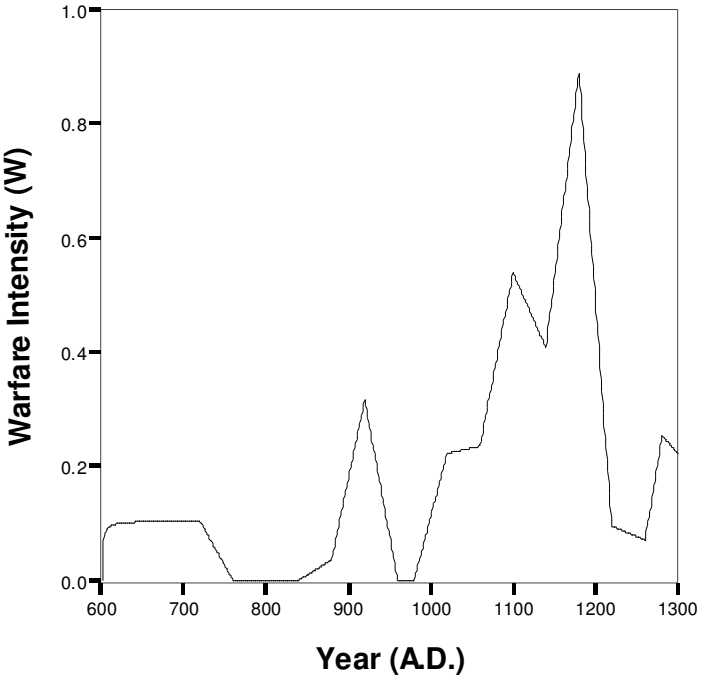


Figure 6.3. Time series data displayed for the unsmoothed (top graph) and smoothed (bottom graph) versions of warfare intensity (*W*). *W* is the proportion of individuals in each period with evidence of warfare-related injury, slightly refined using Bayesian techniques. Note that the post-1280 decrease in warfare intensity is an artifact of the smoothing process as these years were assigned a value of zero for *W* rather than a missing value.

The previous graphs for the smoothed data can be superimposed after standardizing both variables to simultaneously visualize the trajectories of population and warfare intensity through time (Figure 6.4). Remembering Figure 3.1, which displays the dynamic relationship predicted by the Turchin-Korotayev model, population growth should lead to increased warfare, and increased warfare should in turn cause population numbers to decline. Thus, the response of each variable to changes in the other should be lagged with respect to one another, although the period of lag is unknown.

Excluding the first period with its slightly higher than expected value for warfare intensity (*W*), the first cycle in Figure 6.4 shows population (*N*) peaking before warfare intensity, then population decreases as warfare intensity peaks. As warfare intensity decreases, population begins to increase again. This cycle is as the model predicts. However, the cycle from about 1000 to 1200 does not follow the model since increasing warfare intensity apparently leads to increasing population.

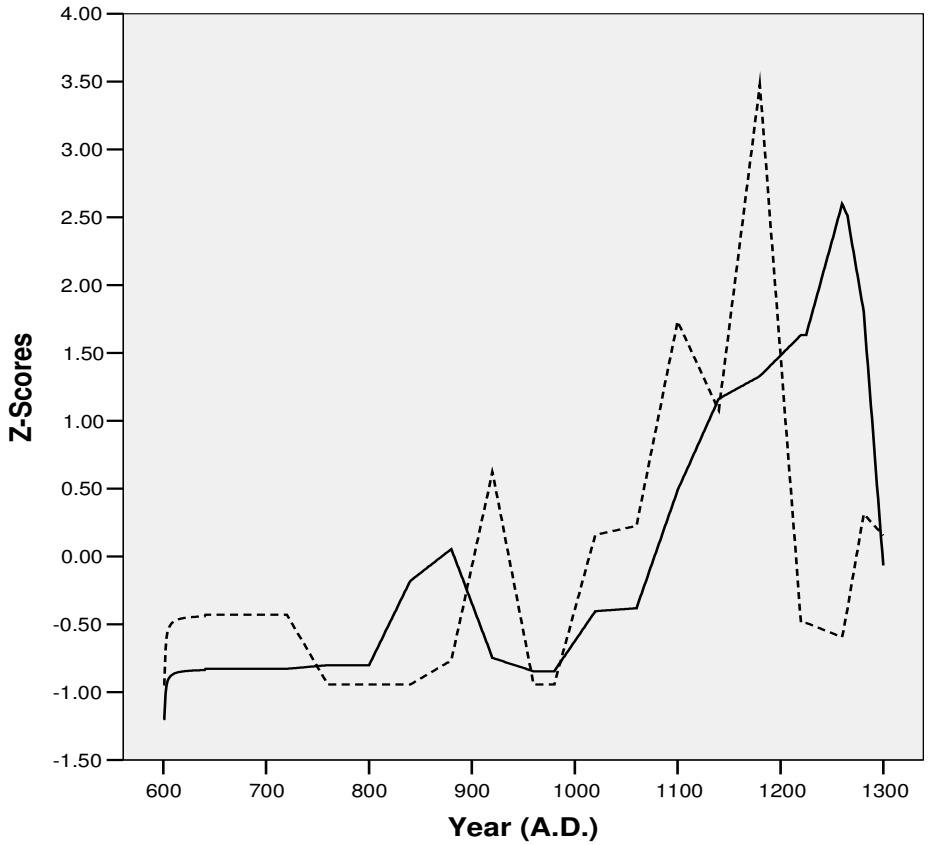


Figure 6.4. Dynamics of smoothed population (*N*) (solid line) and smoothed warfare intensity (*W*) (dotted line) converted to z-scores.

A simple but not entirely satisfactory way to evaluate the model is to regress warfare intensity (*W*) on population (*N*) for each 40-year period (after smoothing and standardizing) (Figure 6.5). This approach ignores the lags suggested by the model, although I do find a weak positive relationship between the two variables. Although there are only 14 modeling periods, the 17 data points represent the smoothed data with 40-year running means, sampled at 40-year intervals from A.D. 600 to A.D. 1280.

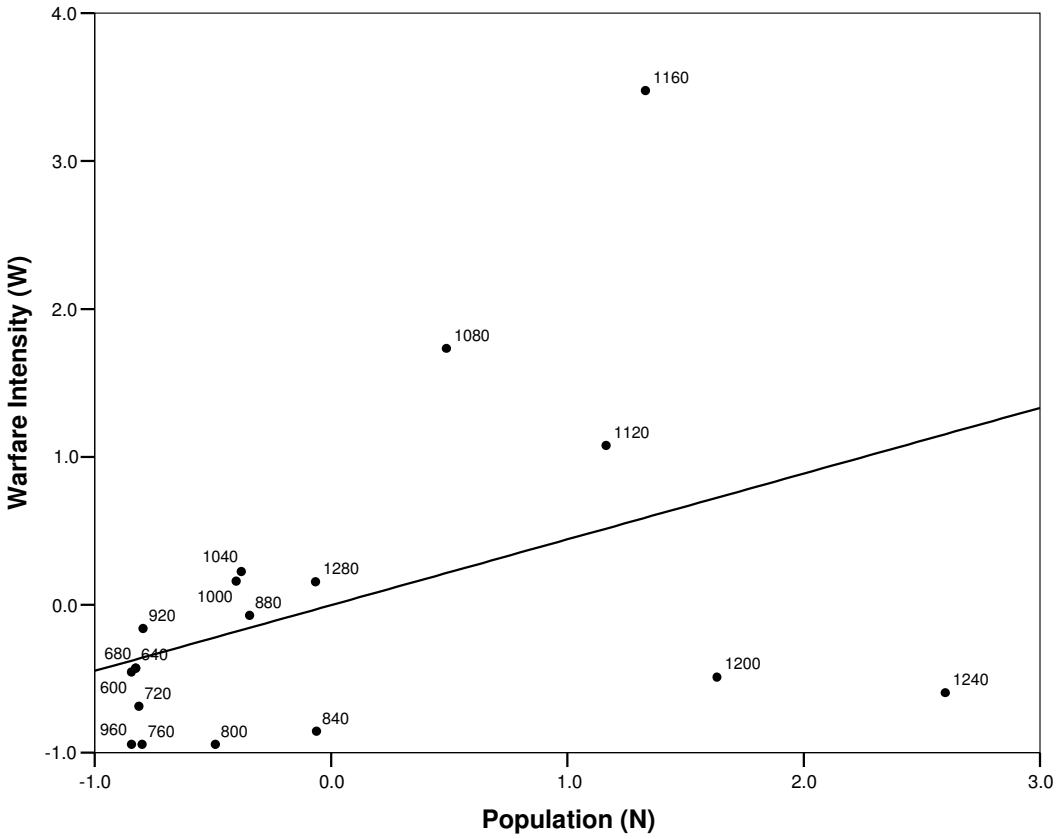


Figure 6.5. Linear regression of warfare intensity (*W*) against population (*N*) (smoothed and converted to z-scores): r^2 = .168, p = .091, F = 3.227, W = -.002 + .45N.

Another way to evaluate the model is to display the trajectory of population (*N*) and warfare intensity (*W*) in the phase space. In Chapter 3, Figure 3.2 displays the trajectory of population and warfare intensity in the phase space as predicted by the Turchin-Korotayev model. Thus, population increase should lead to an increase in warfare intensity which would in turn result in decreasing population. As is apparent in Figure 6.6, the 600s through the mid-900s and the 1200s do behave as the model predicts (although in different regions of the phase space), but the three data points between 1080 and 1160 strongly contrast with the model's predictions.

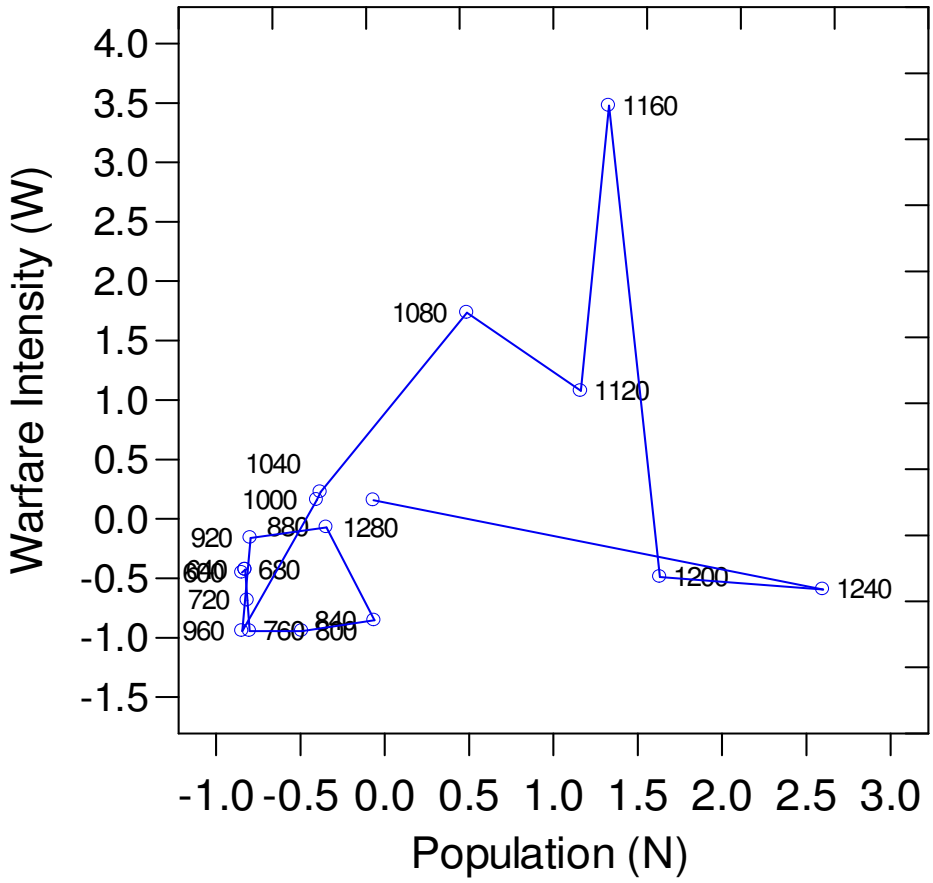


Figure 6.6. The population-warfare trajectory in the phase space (smoothed and converted to z-scores). Note that this graph is equivalent to Figure 6.5. I've merely connected the dots temporally.

A closer look at the 600s through the 900s indicates no linear non-lagged relationship between population (*N*) and warfare intensity (*W*) (Figure 6.7). This result is suggested by the model since population growth leads to increased warfare, but increased warfare in turn causes population to decline (Figure 6.8). Nonlinear dynamical systems theory states that one should not necessarily see a clean correlation between two variables that are non-lagged (Turchin and Korotayev 2006). In fact, one might see a weak positive, a weak negative, or even no correlation between the two variables (Figure 6.7).

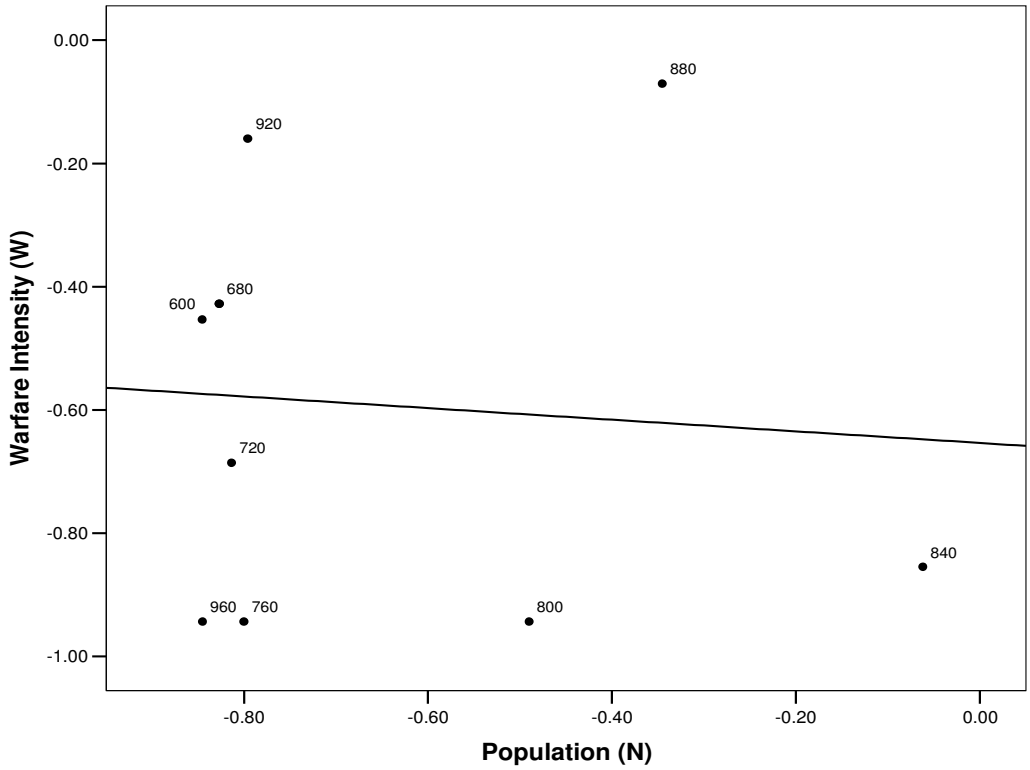


Figure 6.7. Linear regression of warfare intensity (*W*) against population (*N*) for the A.D. 600s through the 900s (smoothed and converted to z-scores): r^2 = .006, *p* = .83, *F* = .049, W = -.654 - .094N.

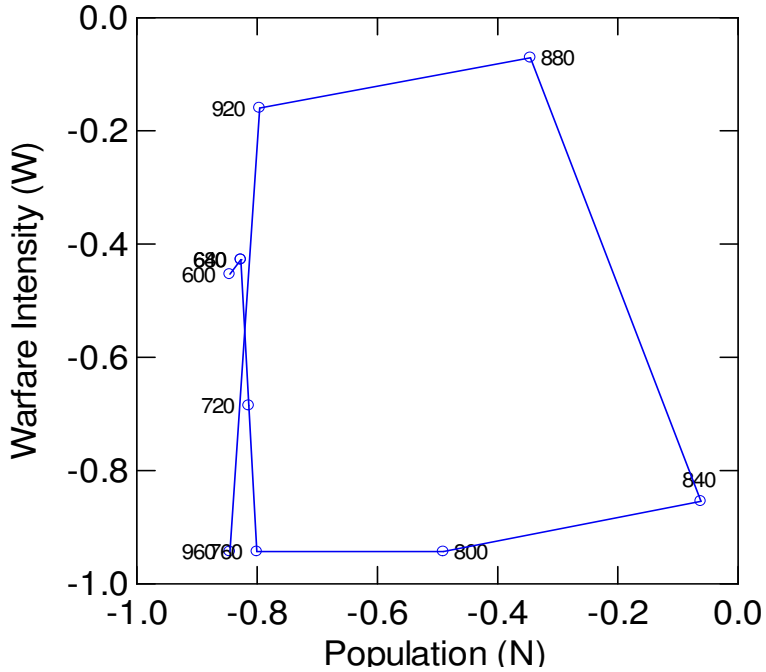


Figure 6.8. The population-warfare trajectory in the phase space (smoothed and converted to z-scores) for the A.D. 600s through the 900s. Note that this graph is equivalent to Figure 6.7. I've merely connected the dots temporally.

A more sophisticated approach to evaluating the model is to plot warfare intensity (*W*) against lagged values of population (*N*). If the lag is about 40 years in length, then a strong positive relationship should be observed between population, lagged 40 years, and warfare intensity. Figure 6.9 suggests that there is a positive, but not significant, relationship between the two variables when all periods are included. Once again, the three data points (1080-1160) are strong outliers, and the 1200s represent a consistent pattern although different from the pattern between the 600s and 900s.

Interestingly and unexpectedly, the unlagged version of this regression (Figure 6.5) fits slightly better than this lagged relationship. This may be because warfare intensity (*W*) leads rather than lags in three data points. It may also be that the true value of the lag is less than 40 years. This value is more than one human generation, and perhaps a more precise value of the lag may be closer to 25 years. It is important to note, however, that a more consistent relationship is observed from the 600s through the 900s in the lagged (Figure 6.9) versus the non-lagged relationship in Figure 6.7.

Finally, a more definitive method for evaluating the Turchin-Korotayev model is to fit the model's values of *a*, *b*, and *c* using the empirically derived values for population (*N*) (Table 3.1) and warfare intensity (*W*) (Table 6.1), and then assessing the goodness-of-fit. Equations [3.2 and 3.3] (discussed previously in Chapter 3) were not considered here because a better goodness-of-fit was obtained with equations [3.2 and 3.4]. This analysis was conducted by Stanca Ciupe, then of the Santa Fe Institute, as part of Kohler et al. (2006) and is reported here given its relevance.

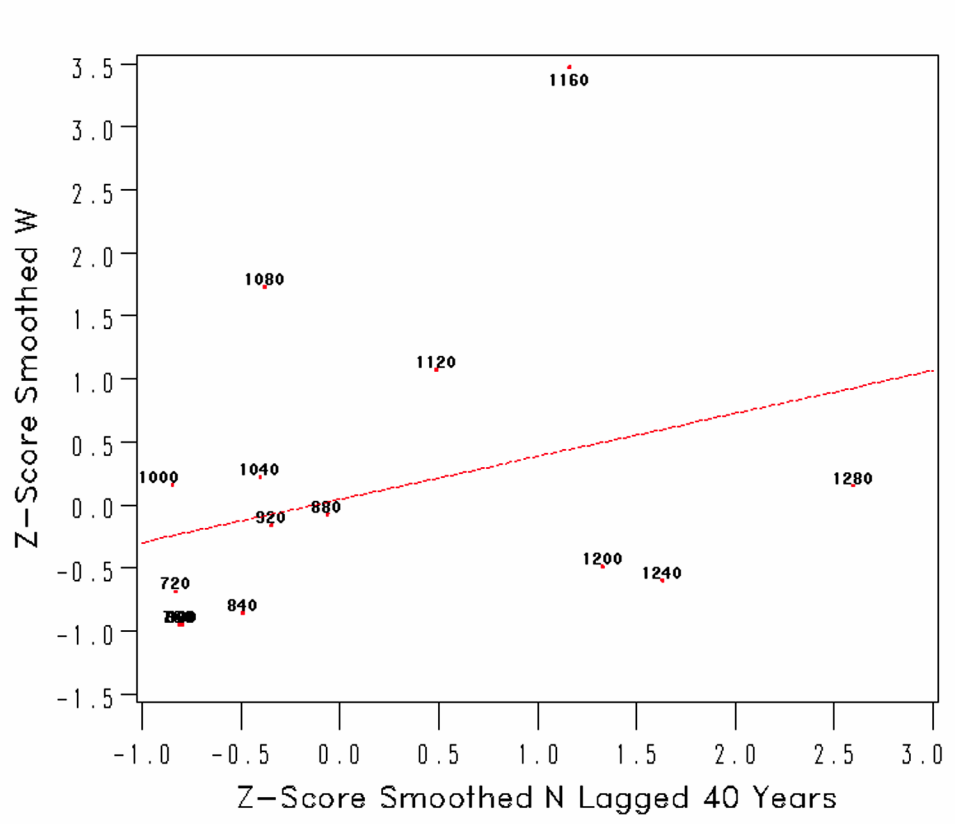


Figure 6.9. Linear regression of Warfare Intensity (*W*[t]) against Population (*N*[t-1]) (smoothed and converted to z-scores): $r^2 = .09$, $p > F = .27$.

Assuming initially that population size is $N_0 = 152$ households and warfare intensity, as in Table 6.1, is $W_0 = 0.0519$ at A.D. 600, and using the values for r and K discussed in Chapter 3, the remaining parameters a, b, and c are estimated using weighted least squares regression. This method is often used to maximize the efficiency of parameter estimation in situations when it may not be beneficial to assume that every observation should be treated equally (Guthrie et al. 2006). This approach finds values for a, b, and c that minimize the size of the residuals on the right-hand side of the function:

$$J(a,b,c)=\sum_{i=1}^{n}\omega_N(\log(N_i)-\log(N_{data_i}))^2+\sum_{i=1}^{n}\omega_W(W_i-W_{data_i})^2 \qquad (6.5)$$

The number of data points is indexed by i (i.e., the 17 time periods); N_i and W_i are population and warfare intensity, respectively, at times t_i predicted by the solution of equations [3.2 and 3.4]. The data values for population and warfare intensity at times t_i are represented by $Ndata_i$ and $Wdata_i$, respectively. Unlike regular least squares, ω_i is included as an additional weight for each term in the weighted least squares criterion which "determines how much each observation in the data set influences the final parameter estimates" (Guthrie et al. 2006:4.4.3.2). Here, ω_n and ω_w are additional weights to insure that equal influence is given to population and warfare intensity. These are defined by the following formulas:

$$\omega_N=\frac{1}{\sigma_N^2}=\frac{1}{\frac{\sum_{i=1}^{n}(N_{data_i}-\overline{N_{data}})^2}{n-1}} \qquad \omega_W=\frac{1}{\sigma_W^2}=\frac{1}{\frac{\sum_{i=1}^{n}(W_{data_i}-\overline{W_{data}})^2}{n-1}} \qquad (6.6a, b)$$

and $\overline{N_{data}}$ and $\overline{W_{data}}$ are the average values of the measured populations N and W.

Because the data contain large populations from A.D. 1080-1280 versus small populations from A.D. 640-1040 (see Figure 6.2), population sizes were measured here in logarithms. Equal weight was given to the warfare intensity and population data in the minimization algorithm. This analysis used the Nelder-Mead nonlinear iterative routine in Matlab (fminsearch).

The top-left graph in Figure 6.10 displays warfare intensity in its possible range from 0.0 – 1.0 (blue circles), against the initial best-fit model for equations [3.2 and 3.4]. Since warfare intensity was defined as a proportion (see Table 6.1), the values were

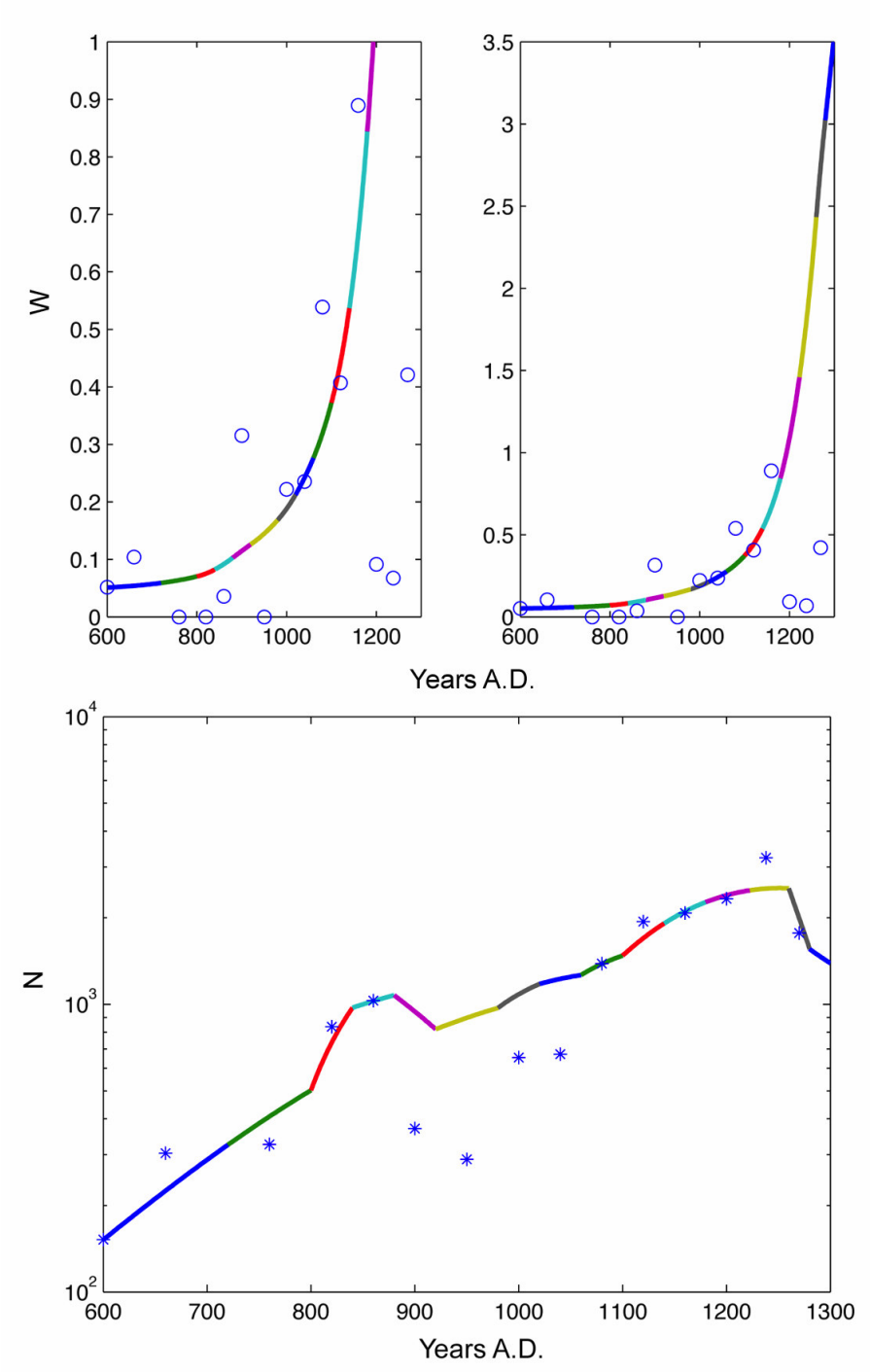


Figure 6.10. Top-left graph: Time-series data of warfare intensity (*W*) (blue circles), in its possible range, from 0.0 – 1.0, against the initial best-fit model for equations [3.2 and 3.4] (colored line). Top-right graph: Time-series data of the actual estimated values of warfare intensity (*W*) (blue circles) against the final best-fit model for equations [3.2 and 3.4] (colored line). Bottom graph: Time-series data of population (*N*) (blue asterisks), on a logged scale, against the final best-fit model for equations [3.2 and 3.4] (colored line). The final best-fit values for parameters *a*, *b*, and *c* are $a = 0.00011$, $b = 0.003$, and $c = 0.006$ when using *r* between 0.007 and 0.014. The final goodness-of-fit is 2.98 as measured by the residual ($ESS_{\log(N)} + ESS_W$).

initially constrained to be positive and bound by 1.0. However, this made the fit for population to be highly underestimated during the second cycle. To compensate for this problem and reach a higher population during the second cycle, the final estimated values for warfare intensity were unconstrained by 1.0. The top-right graph displays the actual estimated values for warfare intensity (unconstrained), which exceed 1.0 in the 1200s. The bottom graph displays the time-series data for population (N) (blue asterisks) on a log scale against the final best-fit model for equations [3.2 and 3.4] (colored line). The final best-fit values for parameters a, b, and c are $a = 0.00011$, $b = 0.003$, and $c = 0.006$ when using r between 0.007 and 0.014. The final goodness-of-fit is 2.98 as measured by the residual ($ESS_{\log(N)} + ESS_W$).

What is important to note in Figure 6.10 is that the best-fit values for warfare intensity (W) (colored lines) exceed the data observed in the 1200s as well as the possible range from 0.0 to 1.0 (blue circles). This is important because the somewhat high population (N) and very high warfare intensity (W) in the 1000s and 1100s and the very high population and moderate or low warfare intensity in the 1200s cannot both be accommodated by the model.

Summary

The main argument concerning the Turchin-Korotayev model is that population and internal warfare are dynamic variables; thus, they change with time and they can affect each other. Turchin and Korotayev (2006) used a new approach to modeling the relationship between these two variables using ideas developed within nonlinear dynamics. Although Turchin and Korotayev did not empirically test their model-derived predictions on non-state societies, analyzing the dataset used in this thesis has

demonstrated that a dynamic relationship between population and warfare is apparent in the central Mesa Verde region, at least in certain time periods between A.D. 600 and 1280.

The Turchin-Korotayev model represented by equations [3.2 and 3.4] is supported during the first population cycle, from A.D. 600 through the early 1000s, when exogenous factors appear to have been weak enough not to influence the dynamic relationship between warfare intensity and population. The lack of a significant relationship, overall, may be due to the high degree of endogeneity required by the model. This is difficult to obtain in a non-closed, pre-state system. Regardless, it is important to note that dynamical feedbacks appear to be detected in this archaeological record.

The second population cycle, especially the two centuries from about 1000 to 1200, do not fall within the model's predictions, and this is likely due to exogenous factors at play that had a significant impact in the study area. In this cycle, increases in warfare intensity actually precede increases in population.

Finally, in the 1200s the predicted relationship between warfare intensity and population reappears; however, warfare intensity is much lower than expected based on the population sizes. The general relationship through time between warfare intensity and population is apparent in all of the methods used here to evaluate the Turchin-Korotayev model.

Although it is important that the first population cycle from A.D. 600 through the 900s, as well as the 1200s, supported the Turchin-Korotayev model, it is equally important that the second cycle did not. Both the link between population and warfare

intensity in the first cycle (and in the 1200s) and its disconnection in the second cycle require further explanation in regards to the local culture history of the central Mesa Verde region. This is the subject of the following chapter.

CHAPTER 7 SUMMARY AND CONCLUSIONS

This thesis has demonstrated that population size and warfare in the central Mesa Verde region have a complicated and changing relationship. Population size effects may explain some, but certainly not all instances of warfare through time in this region. In this chapter, I give a more detailed discussion of the specific temporal periods from A.D. 600 to 1280 in terms of the relationship between population size and warfare intensity.

The Basketmaker III Period

The portion of the Basketmaker III period (A.D. 600-700) included in this thesis suggests a slightly higher-than-expected level of warfare. Kuckelman et al. (2000) have stated that there are no known instances of violent deaths which date from the Basketmaker III period. In their analysis, however, they focused primarily on incidents of human modification and disarticulation. Partially or fully stockaded habitations have been inferred as indirect evidence of warfare in the central Mesa Verde region at this time (Knobby Knee Stockade [Fuller and Morris 1991], Payne Site [Rohn 1974], Gilliland Site [Rohn 1975], Rabbit Site [Phillips and Chenault 2004], Dancing Man Hamlet [Desruisseaux et al. 2004], and Dead Dog Hamlet [Chenault 2004a]).

> It appears that these stockades were made of about 450-600 posts set into the ground at intervals between 10 to 30 cm. The posts range between 6 and 20cm in diameter and were set into the ground in postholes or trenches, which were sometimes up to 30cm deep…The stockades typically encircle at least two pit structures with associated pitrooms as well as the site's midden, so they are substantial (Wilshusen 1999a:180).

When one considers the difficulty entailed in cutting a tree down with a stone ax to erect such posts, this is an enormous labor investment.

Archaeologists have often considered defense as the primary function of stockaded hamlets (Kuckelman et al. 2000; Rohn 1975; Wilcox and Haas 1994). Cross-cultural information concerning stockades has also supported this argument (Chenault and Motsinger 2004). Other possible functions that are present cross-culturally include "protection from wild animals, privacy, protection from the elements, and definition of space" (Chenault and Motsinger 2004:7-4). Chenault and Motsinger (2004) suggest that "defense against human aggression" was the primary purpose for their initial construction, with protection from the elements, privacy, and definition of space being secondary functions. Thus, it is likely that the slightly higher-than-expected value for warfare presented here may be an accurate reflection of conflict during this time period.

The First Cycle of Population and Warfare

The first cycle of population and warfare includes the entire Pueblo I period and the first part of the Pueblo II period. The relationships between population and warfare in this cycle are as predicted by the Turchin and Korotayev model. Population peaks before warfare intensity, then decreases as warfare intensity peaks. As warfare decreases, population begins to increase again.

This first cycle falls within a period recognized as having "rapid demographic and organizational change" (Wilshusen 1999b:200). It has also been suggested that population changes during this time were outside the reasonable mortality and natural increase rates for societies of similar size and social organization (Wilshusen and Ortman

1999). Migration in as well as out of the region have been considered important in understanding these population changes (Wilshusen 1999b:234; Wilshusen and Ortman 1999).

It has been suggested that the influx of people into the Mesa Verde-Mancos and Dolores drainage units during this cycle likely represents the mixing and interaction of up to three different cultural groups differentiated by ceramic traditions, public architecture, and site layout (Wilshusen 1999b:236-237; Wilshusen and Ortman 1999). Wilshusen and Ortman (1999) have argued that at least two culturally (and perhaps ethnically) distinct groups can be seen along the east and west sides of the Dolores River in Southwest Colorado.

Large aggregated sites first appeared near Alkali Ridge in Southeast Utah in the late eighth century. The most extensive episode of aggregation culminated in Southwest Colorado in the mid-A.D. 800s (Wilshusen and Ortman 1999:374). At their population peaks, many of these villages were comparable in mean habitation site size to the late Pueblo III period settlements (LeBlanc 1999:146; Wilshusen 1999b; Wilshusen and Ortman 1999). Explaining why aggregation occurred at this time has been difficult. While some researchers interpret the need to aggregate as a defensive (and offensive [Kuckelman 2002]) measure during various times in the American Southwest (Haas 1986, 1989; Hunter-Anderson 1979; Kohler 1989; LeBlanc 1999:283; Rice 2001; Solometo 2004, 2006; Wilcox and Haas 1994), the results of the Turchin-Korotayev model for the first population cycle in this region suggest otherwise. According to the data presented here – and as predicted by the model – warfare was at a low level when

aggregated sites first appeared (also noted by Orcutt et al. [1990:211]). Warfare then increased sharply beginning in the late 800s and local population began to decline.

Wilshusen (1999b:233) and Wilshusen and Ortman (1999) have suggested that the decline in population is the result of large-scale emigration to northwestern New Mexico along the San Juan River which may have contributed to the nascent Chaco system. Why was this level of emigration occurring? Some have argued that the abandonment of the aggregated villages was due to the series of drought years in the early 880s (Schlanger and Wilshusen 1993; Varien et al. 1996; Wilshusen 1999b:231). According to their analyses, the people of the central Mesa Verde region became locked into a system in which high-risk, unsustainable methods of farming in combination with climatic fluctuations and population pressure resulted in village abandonment and emigration. Considering the fit of the Turchin-Korotayev model, however, we might add that high warfare intensity will also have a "negative effect on demographic rates (birth, mortality, and emigration)" (2006:6). Most researchers concerned with population dynamics in the central Mesa Verde region have not fully considered the importance of the presence of warfare during this period's population decline (see LeBlanc [1999:145-146] for a notable exception – although LeBlanc refers to rather ambiguous data from burned sites and structures and unburied bodies). It is likely that the combination of population pressure, unfavorable climate, and desire to escape warfare resulted in depopulation of the region at this time.

Wilshusen and Ortman (1999) suggest that inhabitants on the east and west sides of the Dolores River were culturally or ethnically distinct groups. They argue that this can be seen in architectural, settlement history, and ceramic differences. According to

the skeletal data recorded for this thesis, however, inhabitants on the Dolores River may have not been as socially distant as Wilshusen and Ortman suggest. The skeletal data used in this thesis suggests that raiding was a more common occurrence during this time than human modification and disarticulation or village-level massacres. Raiding tactics are usually representative of groups who are not socially distant. In other words, these culturally distinct Puebloan groups are not so socially distant as to have engaged in extremely violent behavior rather than raiding.

Furthermore, if the inhabitants of the east side of the river were facing assimilation pressures from the dominant western groups, as Wilshusen and Ortman (1999:389) suggest, one might expect more evidence of violence on adolescents from the east side if assimilation was being met with resistance. Cross-cultural research on band-to-tribal-level groups has indicated that during an ideological conflict adolescents (age 12-20) are more likely to face physical risk because of their resistance to conformity (Bradley 2002a). Wilshusen and Ortman (1999) note "that both great kivas and glaze-painted pottery fell out of use in less-populous east-side communities" and they further argue that this is consistent with minority populations that "have difficulty maintaining their traditions in the absence of a strong ideology of cultural purity" (1999:389). For the sites used in this thesis, however, no adolescents from the east side of the Dolores River indicated evidence of violence. In fact, the one adolescent with evidence of violence near the river was located at Golondrinas Oriental (5MT5108) on the west side. Interestingly, the single example of extremely violent behavior dating in Period 10 (A.D. 880-920) is death of four individuals (one adult male, one adult female, and two adolescents) at

Cottonwood Wash (42SA12209) in Southeast Utah, a good distance from the Dolores River.

The Anomalous Second Cycle

The second cycle of warfare, from about A.D. 1000 to 1200, does not follow the Turchin-Korotayev model. During this time, warfare intensity appears to lead to increasing population. To understand why the model failed during this time span, we must look outside the central Mesa Verde region to the Chacoan system to the south. Although scholars (e.g., Kantner 1999a, 1999b; Kuckelman et al. 2000; Lekson 2002; Lipe 2006; Turner and Turner 1999) differ as to what sort of influence the Chacoan system had on the inhabitants of the central Mesa Verde region, most are in agreement that various violent behaviors occurred within this time. Whether such incidents should be classified as cannibalism (Turner and Turner 1999) or we should follow Kuckelman et al.'s (2000) definition of extreme processing (EP) (Kantner 1999a; Lekson 2002) is still debatable.

Lipe (2006) and Kuckelman et al. (2000) have asserted that the time-space distribution of Chaco-style Great Houses in the central Mesa Verde region is the best indication of Chacoan influence. They further suggest that most of the skeletal evidence of human modification and disarticulation occurred outside the period of Great House construction and many fall well outside this period. Some of the best documented and well-dated examples from the central Mesa Verde region fall in a narrow time range between A.D. 1130 and 1160, after Great House construction had largely stopped. By the 1140s at the latest, the Chacoan system appears to have fallen apart. It is highly likely, as

Lipe (2006) and Kuckelman et al. (2000) suggest, that such instances of violence were correlated with the collapse of the Chacoan system, possibly through score settling and/or due to crop failure from the long drought in the mid-1100s.

Two elements that are missing from such theories, however, are an explanation for the instances of extreme violence that pre-date Great House construction in the central Mesa Verde region and an explanation for violent behavior that is not represented by human modification and disarticulation. Construction of Great Houses occurred in this region from about A.D. 1075 to 1135 (Lipe 2006:292) and may have begun even later than A.D. 1075, shortening the period of Great House construction. Some direct evidence of warfare, which includes human modification, defensive wounds, and cranial trauma, occurred prior to Great House construction, but also appears to be unrelated to population size in the way predicted by Turchin and Korotayev.

If I were to move the four sites that I placed in Period 15 (1100-1140) to Period 16 (1140-1180) following Lipe's (2006:313) and Kuckelman et al.'s (2000) dates of occupation, this would actually slightly decrease the intensity of warfare in Period 16 but not entirely eliminate evidence of warfare in Period 15. The proportion of human remains with warfare-related trauma in Period 15 would decrease from 0.4074 for the value of (x/n) shown in Table 6.1 to 0.1064 and the value of (x/n) in Period 16 would actually decrease slightly from 0.8571 to 0.7188. The four sites that I placed in Period 15 instead of Period 16 consist of Mancos (5MTUMR2346), Marshview Hamlet (5MT2235), 5MV0499, and 5MT0003. The reasoning behind placing these sites in Period 15 was discussed in greater detail in Chapter 5.

One way to resolve the anomaly of the second cyle is to suggest that architectural indicators may not be the earliest evidence of Chacoan influence, but that "we need to look for external influences before they become obvious as Chacoan-style architecture" (Kohler et al. 2006:14). Rising levels of violence and stockaded sites prior to A.D. 1075 may indicate resistance on the part of the local inhabitants to the first successful Chacoan expansion in the ca. 1080s. Partly or completely enclosed stockaded sites in the mid-1000s, predating the construction of Great Houses in this region, include Dobbins stockade (Kuckelman 1988), Dripping Springs stockade (Harriman and Morris 1991), Ewing Site (Hill 1985), and Two Raven House (Hayes 1998). Although this is mere speculation because stockades can have multiple functions besides defense, these sites (and possibly more that remain undetected) could be representative of such resistance, especially as they seem to accompany contemporaneous increases in violence documented osteologically.

Stockaded sites were also present during the period of Great House construction (Mustoe Site [Gould 1982], Yellow Jacket [Lange et al. 1986], Casa Bisecada [Morris 1988], and Roundtree Pueblo [Morris 1991]). The direct evidence suggests that warfare was present during this time as well and at a much greater frequency than prior to Great House construction.

As noted above, extremely violent behavior is often representative of groups who are socially distant. Furthermore, it is interesting to note that such behavior as human modification and disarticulation does not solely include adults, but subadults, children, and infants are represented as well. If such behavior were merely a raiding tactic, individuals who were not considered an immediate threat (i.e., women and children)

would have likely been taken captive and assimilated into the conquering group. In the eleventh century, Chaco Canyon had a female-biased sex ratio even though central Mesa Verde region sites at this time did not have a significantly male-biased sex ratio (Kohler and Turner 2006). In other words, it does not appear that the inhabitants of Chaco were raiding for women from the central Mesa Verde region.

The Final Cycle of Population and Warfare

The final cycle of population and warfare in the 1200s falls within the model's prediction. Population peaks before warfare intensity then decreases as warfare intensity increases. During the early A.D. 1200s (1200-1225), communities in the central Mesa Verde region consisted of "dispersed small habitations, but some communities had nuclei of multiple residential roomblocks, each containing several contiguous Prudden units" (Lipe 2006:304) and civic architecture was rare. After about A.D. 1225, aggregated community centers developed along with a rapid shift to canyon rims and cliff dwellings. These communities typically contained "civic architecture, including a D-shaped, multi-walled building, an informal plaza, a tower complex, and occasionally a Great Kiva" (Lipe 2006:307).

The shift to canyon-oriented aggregated settlements has been attributed to an increase in warfare (Kuckelman et al. 2000; Lambert 2002; LeBlanc 1999; Lipe 2006; Lipe and Varien 1999; Wilcox and Haas 1994). The osteological index of warfare intensity generated here, though, suggests that the inhabitants of the central Mesa Verde region moved to aggregated villages prior to the intensification of warfare. Perhaps, as Tainter and Tainter (1991) suggested, initially, aggregated settlements may have been

visible symbols of community strength designed to be impressive to those both inside and outside the community. The one example of direct evidence most often used to infer warfare consists of the village-wide massacre at Castle Rock Pueblo, which occurred in the late 1200s. The direct evidence of warfare in the early-to-mid 1200s is rather limited. However, it is plausible that the threat of warfare instigated the mid-thirteenth century aggregation, which apparently was, for a time at least, successful in preventing the use of strategies that would have resulted in elevated levels of the warfare index.

In comparison to the first cycle, however, warfare as measured by this index is much lower for the entire thirteenth century than is anticipated by the model, given the high populations. This could be attributed to any number of factors. Perhaps, as Kohler et al. (2006) suggest, confederacies among communities were able to promote integration and conflict resolution better than the community-level organization that was likely present during the first population cycle.

Other factors, however, may explain the apparent low level of warfare towards the end of the thirteenth century. First, few large sites that date to the second half of the thirteenth century have been systematically excavated and reported in detail (Lipe and Varien 1999). Nordenskiold (1973) and other early researchers reported finding human remains that were not formally buried, but such descriptions were too vague to be considered for this thesis. The few sites that have been reported, such as Long House (Cattanach 1980) and Mug House (Rohn 1971), do not appear at first glance to have patterns of violence consistent with those reported for Sand Canyon and Castle Rock pueblos. It is important to note, however, that evidence of violence at Long House was documented by Nordenskiold (1973:29): "[T]here are indications to suggest that they

[the inhabitants] eventually succumbed to their enemies. Human bones – ribs, vertebrae, etc. – are strewn in numbers here and there among the ruins." Cattanach (1980:141) considered the evidence for violence at Long House to be inconclusive. In contrast, however, Turner and Turner (1999:67) believe "that a systematic reexamination of the Long House skeletal remains along taphonomic lines would be useful." It is also possible this difference in patterns of violence is due to the lack of Late Pueblo III projects in which there is a significant midden testing component; a location where many people in the region tended to be buried.

Secondly, Kohler and Turner (2006) have suggested that inhabitants of the Totah region to the south raided for women in the central Mesa Verde region during the A.D. 1200s. Since these "missing women" have no possibility of contributing to the index for warfare developed here, as they did in earlier periods (see Figure 7.1 and Figure 7.2), the lower value I calculate for this index in the 1200s may also underestimate the true scope of conflict. It is difficult to quantitatively support the hypothesis that a low value for warfare on adult female skeletal remains would appear in the 1200s, because of the high percentage of adults who could not be determined by sex. This is largely due to the adults who were victims of human modification and disarticulation. Indirect evidence that supports the inference of a hostile relationship between the Totah region and the central Mesa Verde region at this time includes the creation of a "no-man's land" north of Aztec (Lipe 2006; Lipe and Varien 1999).

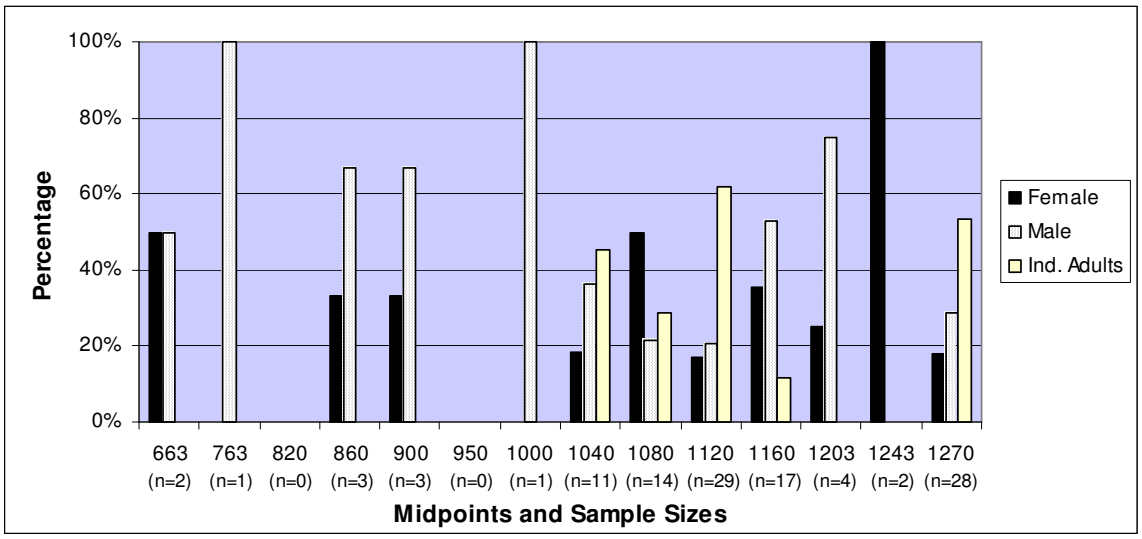


Figure 7.1. Sex distribution of adults with evidence of warfare-related trauma.

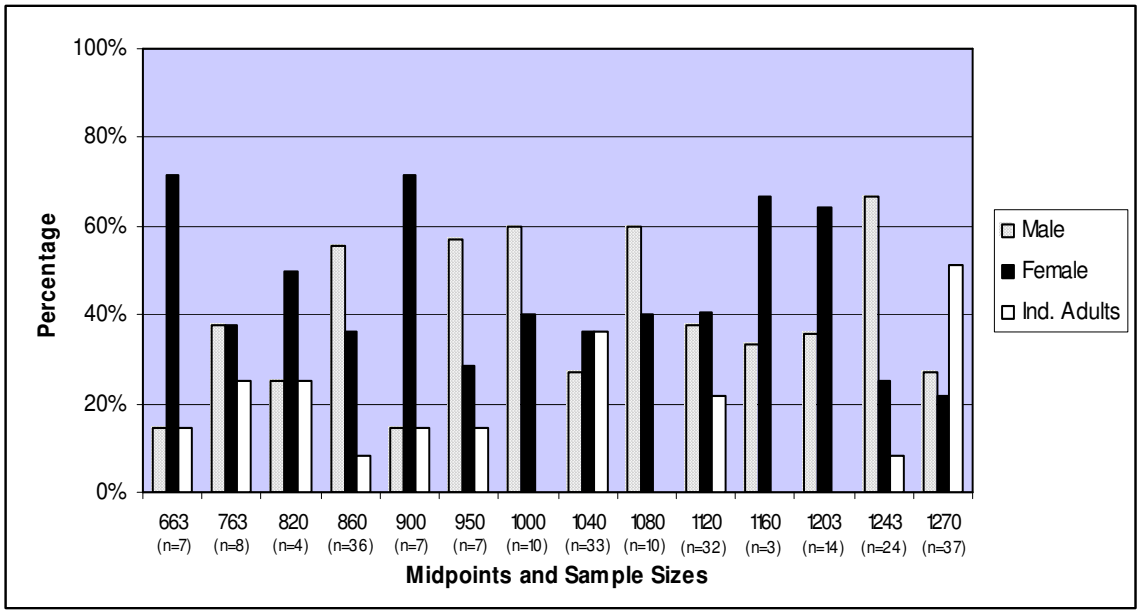


Figure 7.2. Sex distribution of adults without evidence of warfare-related trauma.

Finally, when calculating the warfare index for the Turchin-Korotayev model, I interpreted the different types of violence and warfare tactics equally. Evidence for raiding, human modification and disarticulation, and village-level massacres were all treated in a similar fashion. Such diverse types of warfare could affect groups differently at a psychological level, which would in turn affect population decline differently in regards to emigration as well as birth and death rates. Furthermore, village-level massacres (such as Castle Rock Pueblo) would be devastating, especially to a social unit that is already decimated by raids (Keeley 1996:68). Therefore, the low level of warfare evidenced in the A.D. 1200s, unanticipated by the model, is likely due to a combination of (1) the small number of large sites systematically excavated, especially in the first half of the 1200s, (2) losing women to raiders from the Totah region, and (3) underestimating the impact of village-level massacres when calculating the warfare index.

The suggestion has been made elsewhere using these same data (Kohler et al. 2006) that the apparent low level of warfare in the 1200s may be due to confederacies among communities promoting integration and conflict resolution. This may be accurate for the early 1200s but not necessarily for the late 1200s. Bradley (2002a) has suggested that the violent deaths of some inhabitants of Sand Canyon Pueblo were the result of ideological conflict in the form of intervillage or intravillage disintegration, as most communities began to follow the Katsina phenomenon. She defines an ideological conflict as a "type of civil warfare in which one group within a society initiates a violent response to eradicate an opposing faction and/or its beliefs" (Bradley 2002a:190). Cross-cultural information has indicated that in such a conflict, mortality rates due to warfare in

the infant and childhood categories will be rather low, with death rates for adolescents sharply higher.

Figures 7.3 and 7.4 display the distribution of adolescents (ages 11 through 15) as well as infants and children, respectively, with and without evidence of warfare-related trauma throughout the periods analyzed in this thesis. Comparison of these graphs suggests that Bradley's hypothesis may be accurate for the entire central Mesa Verde region during the late 1200s, when there is a marked increase in the percentage of adolescents with warfare-related trauma in addition to a slight decline for infants and children. However, this pattern may also be indicative of children being taken as captives and assimilated into the conquering group, especially since the 1200s was also a time when women may have been captured by inhabitants of the Totah region.

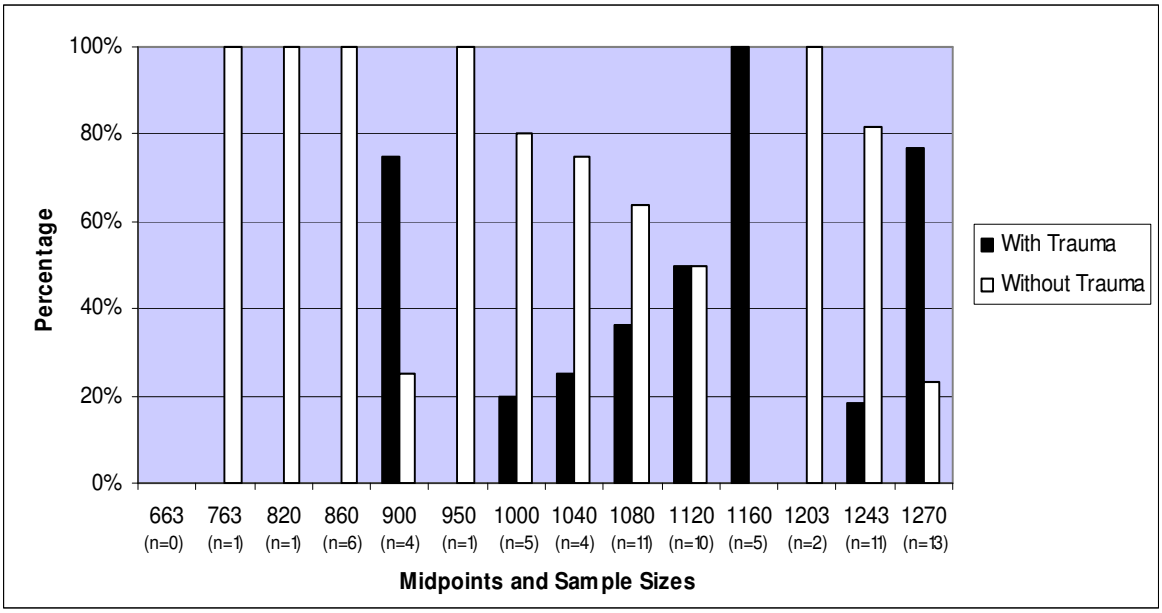


Figure 7.3 Distribution of adolescents with and without evidence of warfare-related trauma.

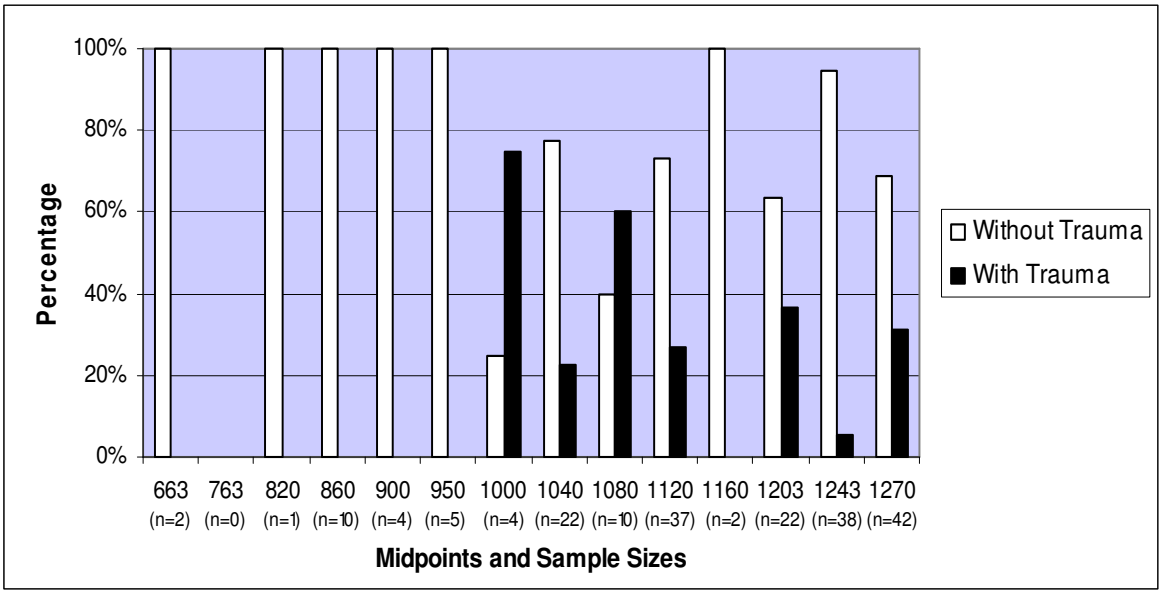


Figure 7.4. Distribution of infants and children with and without evidence of warfare-related trauma.

Further Research

Further research can be conducted on this database by modifying the index of warfare intensity to include indirect evidence of warfare such as stockaded settlements. The direct evidence of warfare on skeletal remains could be further refined by distinguishing between raiding, human modification and disarticulation, and village-level massacres. A total of 162 (84 percent) of the 193 warfare-related deaths resulted from village or hamlet massacres with 138 (85 percent) of the 162 having evidence of human modification and disarticulation. An overwhelming majority of the victims of human modification and disarticulation occurred in the anomalous second cycle of population and warfare. Raiding and feuding did not completely cease during this cycle, however, as Lekson (2002:619) suggests.

Raiding during the first cycle may have influenced groups' decision-making in regards to food storage, such as concealing food against raiders and increasing the quantity of food stored. The type of warfare occurring in the second cycle, which included women and children as victims, could have greatly reduced a society's ability to reproduce and carry on specialized knowledge to the next generation.

Village-level massacres, such as that at Castle Rock in the late 1200s, must have had a profound psychological effect on surrounding neighbors just as news of the victims of human modification and disarticulation must have psychologically terrorized people in the anomalous second cycle (Lekson 2002:620). But to suggest that warfare in the late 1200s was at unprecedented levels in comparison to the "peaceful" (LeBlanc 1999; Lekson 2002), yet terrorizing and brutal, events of the second cycle may be inaccurate. Currently, there is much osteological evidence of endemic warfare for the late 1200s in the central Mesa Verde region. Thus, accurately distinguishing the nature of warfare in the central Mesa Verde region is important for our understanding of warfare in tribal groups as well as warfare in the greater American Southwest.

The database could also be expanded by including more sites within the central Mesa Verde region, especially in Southeastern Utah, which would increase the chances of observing intraregional variability. For example, one would like to be able to determine if Chacoan Great Houses exhibited more or less evidence of warfare in comparison to stockaded settlements, make a similar comparison on stockaded versus unstockaded settlements during the Basketmaker III period, and a more detailed comparison of sites along the Dolores River during the Pueblo I period.

Creating a similar database for northern New Mexico and refining Kramer's (2002) database to correlate with the time periods used here would also be beneficial. This would be especially important for the A.D. 1200s since it appears the Totah region and the central Mesa Verde region were coupled through conflict during that time. Furthermore, LeBlanc (2006) has hypothesized (without quantitative data) that warfare in northern New Mexico would be the only reason for people immigrating to the central Mesa Verde region during the Pueblo I period. With a similar database for northern New Mexico, one might be able to determine if warfare was actually prevalent in that region prior to people immigrating to the Dolores River at this time.

This study has contributed to understanding the dynamic relationship between population and warfare in the prehistoric central Mesa Verde region. It has also brought to light the need for new interpretations concerning population aggregation that weigh the changing roles through time of density-dependent effects, various kinds of warfare, and changing local and regional sociopolitical organization.

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APPENDIX: HUMAN REMAINS USED IN DATASET

Table A.1. 5MT1825, Castle Rock[a], No.1[b]

Burial / Individual # (n=41)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	19	Indeterminate	35-50	Present	Absent	Absent	Several perimortem fractures on skull
	19	Indeterminate	0-9 mos	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	1-4	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	1-4	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	1-4	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Several perimortem fractures on skull
	19	Female	40	Present	Absent	Absent	Perimortem and antemortem fractures on skull
	19	Indeterminate	1-4	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Female	40	Present	Absent	Absent	Antemortem fractures on skull
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	5-9	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	10-14	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	15-19	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Female	Adult	Present	Absent	Absent	Possible cannibalism, blows to the mouth
	19	Indeterminate	15-19	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Male	20-34	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Female	Adult	Present	Absent	Absent	Possible cannibalism, blows to the mouth
	19	Indeterminate	20-34	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	20-34	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	20-34	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Male	35-50	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism

Table A.1. 5MT1825, Castle Rock, No.1 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	19	Indeterminate	50+	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Subadult	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Subadult	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Male	Adult	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	Unknown	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
	19	Indeterminate	35-50	Present	Absent	Absent	Disarticulated, fragmentary, possible cannibalism
HRO12	19	Male	40-44	Present	Present	Absent	Found in sprawled position, previous fracture on right tibia, skull was shattered by multiple lethal fractures
HRO9	19	Male	35-50	Present	Absent	Absent	Found in sprawled position, antemortem depression fracture on back of skull, two small depression fractures on frontal bone, face removal, one blow to the mouth, left leg was removed to 100m
HRO10	19	Indeterminate	8	Present	Absent	Absent	Found in sprawled position, perimortem fractures of left femur, left fibula, and both tibiae, multiple healed depression fractures on skull
Totals				**41**	**1**	**0**	

[a]From: Crow Canyon Archaeological Center 2001, 2004; Kuckelman et al. 2002
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.2. 5MT0003[a], No. 2[b]

Burial / Individual # (n=34)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
3.3-01	13	Indeterminate	0-2	Absent	Absent	Absent	
3.3-13a	13	Female	20-30	Absent	Absent	Absent	
3.3-13b	13	Indeterminate	3-4	Absent	Absent	Absent	
PM-3.1-01a	13	Male	Adult	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malvile (1989) argue cannibalism
PM-3.1-01b	13	Male	Adult	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01c	13	Female	Adult	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01d	13	Indeterminate	Unknown	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01e	13	Indeterminate	Unknown	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01f	13	Indeterminate	Unknown	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01g	13	Indeterminate	1-2	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01h	13	Indeterminate	2	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01i	13	Indeterminate	4-5	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.1-01j	13	Indeterminate	8-10	Present	Absent	Absent	Highly fragmented and disarticulated, Turner and Turner (1999) and Malville (1989) argue cannibalism
PM-3.2-02a	13	Indeterminate	20-50	Present	Absent	Absent	Yunker (2001) argues perimortem damage, associated with PM-3.2-02b
PM-3.2-02b	13	Indeterminate	4-12	Present	Absent	Absent	Yunker (2001) argues perimortem damage, associated with PM-3.2-02a
PM-3.2-05	13	Male	20-49	Present	Absent	Absent	Yunker (2001) argues perimortem damage
PM-3.3-04	13	Indeterminate	20-30	Present	Absent	Absent	Yunker (2001) argues perimortem damage
PM-3.3-05	13	Male	20-49	Present	Absent	Absent	Yunker (2001) argues perimortem damage
3.3-22	15	Indeterminate	0-3	Absent	Absent	Absent	
PM-3.3-02	15	Female	20-49	Present	Absent	Absent	Yunker (2001) argues perimortem damage, found mixed with dog bones and trash in fill of masonry room

Table A.2. 5MT0003, No. 2 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
3.3-03	15	Male	20-45	Absent	Absent	Absent	
3.3-04	15	Female	40-45	Absent	Absent	Absent	
3.2-09	15	Indeterminate	0-6	Absent	Absent	Absent	
3.3-07a	15	Indeterminate	15-18	Present	Absent	Absent	Intertwined with 3.3-07b, Turner and Turner (1999) and Malville (1989) argue perimortem damage
3.3-07b	15	Female	20-30	Present	Absent	Absent	Intertwined with 3.3-07a, Turner and Turner (1999) and Malville (1989) argue perimortem damage
3.3-08	15	Indeterminate	1-3	Absent	Absent	Absent	
3.3-12	15	Indeterminate	20-34	Absent	Absent	Absent	
3.3-09a	15	Female	20-25	Absent	Absent	Absent	
3.3-05	15	Indeterminate	5-7	Absent	Present	Absent	Traumatic lesion on central aspect of occipital
3.3-10a	15	Indeterminate	1-2	Absent	Absent	Absent	
3.3-10b	15	Male	45-49	Absent	Absent	Absent	
3.3-10c	15	Indeterminate	16-18	Absent	Absent	Absent	
3.3-14	15	Indeterminate	1-2	Absent	Absent	Absent	
3.3-09b	15	Indeterminate	0-1	Absent	Absent	Absent	
Totals				18	1	0	

[a]From: Malville 1989; Swedlund 1969; Turner and Turner 1999; Yunker 2001
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.3. 5MT0765, Sand Canyon[a], No. 3[b]

Burial/ Individual # (n=33)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
HRO2	19	Male	40-45	Present	Absent	Absent	Sprawled on floor, small healed depression fracture on left parietal, large lethal depression fracture on left frontal bone

Table A.3. 5MT0765, Sand Canyon, No. 3 (continued)

Burial/ Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
HRO11	19	Indeterminate	15	Present	Absent	Absent	Base of skull exhibited perimortem crushing, two small depression fractures on left parietal
HRO19	19	Indeterminate	12-15	Present	Absent	Absent	Found face down on floor, large depression fracture on occiput, multiple perimortem skull fractures, numerous cutmarks near distal end of left humerus, anvil abrasions on left clavicle, spiral fractures on right tibia, evidence of scalping
HRO20	19	Male	18-20	Present	Absent	Absent	At least three perimortem depression fractures on back of skull, perimortem anvil abrasions on pelvis, one healed depression fracture on frontal bone
HRO22	19	Indeterminate	8	Present	Absent	Absent	Found in hearth, lethal fracture on back of skull, evidence of scalping
HRO24	19	Male	35-39	Present	Absent	Absent	Possible decapitation, pelvis and all leg bones were fractured spirally
HRO12	19	Indeterminate	15	Present	Absent	Absent	Perimortem fracturing on frontal bones
HRO10	19	Female	20-30	Present	Absent	Absent	Facial bones with perimortem trauma of possible face removal
HRO8	19	Indeterminate	0-1	Absent	Absent	Absent	
HRO9	19	Indeterminate	0-1	Absent	Absent	Absent	
HRO15	19	Indeterminate	1-2	Absent	Absent	Absent	
HRO26	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO27	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO21	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO13	19	Indeterminate	Child	Absent	Absent	Absent	
HRO16	19	Indeterminate	2-3	Absent	Absent	Absent	
HRO17	19	Indeterminate	2-6	Absent	Absent	Absent	
HRO30	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO31	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO18	19	Indeterminate	15	Absent	Absent	Absent	
HRO6	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO1	19	Indeterminate	1-2	Absent	Absent	Absent	
	19	Indeterminate	Unknown	Absent	Absent	Absent	

Table A.3. 5MT0765, Sand Canyon, No. 3 (continued)

Burial/ Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
HRO5	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO4	19	Indeterminate	Child	Absent	Absent	Absent	
HRO32	19	Indeterminate	2-3	Absent	Absent	Absent	
HRO25	19	Indeterminate	Infant	Absent	Absent	Absent	
HRO28	19	Indeterminate	Subadult	Absent	Absent	Absent	
HRO7	19	Indeterminate	1	Absent	Absent	Absent	
HRO3	19	Female	Adult	Absent	Absent	Absent	
HRO23	19	Female	Adult	Absent	Absent	Absent	
HRO14	19	Indeterminate	Unknown	Absent	Absent	Absent	
HRO29	19	Indeterminate	Unknown	Absent	Absent	Absent	
Totals				**8**	**0**	**0**	

[a]From: Crow Canyon Archaeological Center 2003, 2004; Kuckelman et al 2002
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.4. 5MT11842, Woods Canyon[a], No. 4[b]

Burial / Individual # (n=11)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	18	Indeterminate	4-8	Absent	Absent	Absent	
2	18	Indeterminate	11-12	Absent	Absent	Absent	
3	18	Female	29-31	Absent	Absent	Absent	
4	18	Indeterminate	20-35	Absent	Present	Absent	Well-healed fracture of left fifth metatarsal
5	18	Indeterminate	4-6	Absent	Absent	Absent	
6	18	Female	20-35	Absent	Absent	Absent	

Table A.4. 5MT11842, Woods Canyon, No. 4 (continued)

Burial / Individual #	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
7	18	Indeterminate	20	Absent	Absent	Absent	
8	18	Indeterminate	1-2	Absent	Absent	Absent	
9	18	Indeterminate	7-9	Absent	Absent	Absent	
10	18	Indeterminate	15-19	Absent	Absent	Absent	Possible green-stick fracture of right ulna, but not enough evidence to be conclusive
11	18	Indeterminate	10-13	Absent	Absent	Absent	
Totals				**0**	**1**	**0**	

[a]From: Bradley 2002b; Churchill 2002
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.5. 5MT2235, Marshview Hamlet[a], No. 5[b]

Burial / Individual # (n=6)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
13-6	15	Indeterminate	1-2	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.
13-5	15	Indeterminate	3-12	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.
13-1	15	Indeterminate	Adult	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.

Table A.5. 5MT2235, Marshview Hamlet, No. 5 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
13-2	15	Indeterminate	Adult	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.
13-3	15	Indeterminate	Adult	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.
13-4	15	Indeterminate	Adult	Present	Absent	Absent	Fragmentary remains. Turner (1988) argues that it is not postoccupational, that they were dumped in pithouse, not interred. Random scatter of elements on floor and in fill of PS main chamber.
Totals				**6**	**0**	**0**	

[a]From: Stodder 1987; Turner 1988; Turner and Turner 1999; Wilshusen 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.6. 5MT11338, G and G Hamlet[a], No. 6[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Male	20-30	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Katzenberg 1999; Kuckelman 1999a; Varien 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.7. 5MT3930, Roy's Ruin[a], No. 7[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Indeterminate	5-9	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Katzenberg 1999; Varien 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.8. 5MT3951, Troy's Tower[a], No. 8[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Female	25-30	Present	Absent	Absent	Depression fracture above right orbit
Totals				**1**	**0**	**0**	

[a]From: Katzenberg 1999; Varien 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.9. 5MT10246[a], Lester's Site, No. 9[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	19	Indeterminate	3-5	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Katzenberg 1999; Kuckelman 1999b; Varien 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.10. 5MT10459, Lookout House[a], No. 10[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	19	Male	50+	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Katzenberg 1999; Kuckelman 1999c; Varien 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.11. 5MV1200, Long House[a], No. 11[b]

Burial / Individual # (n=39)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
40	19	Male	28-30	Present	Absent	Absent	Positioned on back, head appeared to have been twisted off while some skin or ligaments remained, possibly thrown onto back in middle of kiva floor
1	19	Female	Adult	Absent	Absent	Absent	
2	19	Indeterminate	3-4	Absent	Absent	Absent	
3	19	Female	20-25	Absent	Absent	Absent	
4	19	Male	30	Absent	Absent	Absent	
5	19	Male	40	Absent	Absent	Absent	
6	19	Indeterminate	15	Absent	Absent	Absent	
7	19	Female	40	Absent	Absent	Absent	
8	19	Male	45	Absent	Absent	Absent	
9	19	Indeterminate	8-10	Absent	Absent	Absent	
10	19	Indeterminate	Adult	Absent	Absent	Absent	
12	19	Male	Adult	Absent	Absent	Absent	
13	19	Indeterminate	1-2	Absent	Absent	Absent	
14	19	Indeterminate	Unknown	Absent	Absent	Absent	

Table A.11. 5MV1200, Long House, No. 11 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
15	19	Female	Adult	Absent	Absent	Absent	
16	19	Male	Adult	Absent	Absent	Absent	
17	19	Indeterminate	Child	Absent	Absent	Absent	
18	19	Female	30	Absent	Absent	Absent	
19	19	Indeterminate	0-1	Absent	Absent	Absent	
20	19	Indeterminate	Adult	Absent	Absent	Absent	
21	19	Indeterminate	Infant	Absent	Absent	Absent	
22	19	Indeterminate	Infant	Absent	Absent	Absent	
23	19	Indeterminate	7-8	Absent	Absent	Absent	
24	19	Male	Adult	Absent	Absent	Absent	
25	19	Indeterminate	1	Absent	Absent	Absent	
26	19	Indeterminate	Unknown	Absent	Absent	Absent	
27	19	Indeterminate	Unknown	Absent	Absent	Absent	
28	19	Female	Adult	Absent	Absent	Absent	
29	19	Indeterminate	10	Absent	Absent	Absent	
30	19	Indeterminate	3-4	Absent	Absent	Absent	
31	19	Indeterminate	0-1	Absent	Absent	Absent	
32	19	Indeterminate	1	Absent	Absent	Absent	
33	19	Indeterminate	Infant	Absent	Absent	Absent	
34	19	Indeterminate	Unknown	Absent	Absent	Absent	
35	19	Male	Adult	Absent	Absent	Absent	
36	19	Indeterminate	10-12	Absent	Absent	Absent	
37	19	Indeterminate	Infant	Absent	Absent	Absent	
38	19	Male	27-35	Absent	Absent	Absent	

Table A.11. 5MV1200, Long House, No. 11 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
39	19	Indeterminate	1-2	Absent	Absent	Absent	
Totals				**1**	**0**	**0**	

[a]From: Cattanach 1980
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.12. Grinnell[a], No. 12[b]

Burial / Individual # (n=7)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	16	Indeterminate	8-10	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Indeterminate	8-10	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Indeterminate	19	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Female	20s	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Indeterminate	20s	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Male	Adult	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
	16	Male	Adult	Present	Absent	Absent	Disarticulated, highly fragmented, and possible cannibalism.
Totals				**7**	**0**	**0**	

[a]From: Luebben 1983; Luebben and Nickens 1982; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.13. 5MTUMR2346, Mancos[a], No. 13[b]

Burial / Individual # (n=29)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
50	15	Female	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
3	15	Male	Adult	Present	Absent	Absent	Possible cannibalism
5	15	Female	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
3	15	Male	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
	15	Indeterminate	Adult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Subadult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Subadult	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
8	15	Indeterminate	Subadult	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
6	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism

Table A.13. 5MTUMR2346, Mancos, No. 13 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
6	15	Indeterminate	Child	Present	Absent	Absent	Possible cannibalism
Totals				**29**	**0**	**0**	

[a]From: Turner and Turner 1999; White 1992
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.14. 5MV0499[a], No. 14[b]

Burial / Individual # (n=10)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	15	Male	Adult	Present	Absent	Absent	Bone awl was present in chest cavity. Appeared to have been stabbed.
2	15	Indeterminate	Infant	Absent	Absent	Absent	
3	15	Indeterminate	Infant	Absent	Absent	Absent	
4	15	Indeterminate	Child	Absent	Absent	Absent	
5	15	Indeterminate	Infant	Absent	Absent	Absent	
6	15	Indeterminate	Unknown	Absent	Absent	Absent	
7	15	Indeterminate	Unknown	Absent	Absent	Absent	
8	15	Indeterminate	Child	Absent	Absent	Absent	
9	15	Indeterminate	Child	Absent	Absent	Absent	
10	15	Indeterminate	Unknown	Absent	Absent	Absent	
Totals				**1**	**0**	**0**	

[a]From: Lister 1964; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.15. 5MV1229, Mug House[a], No. 15[b]

Burial/ Individual # (n=46)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
M1	18	Male	Adult	Absent	Absent	Absent	
M2	18	Male	Adult	Absent	Absent	Absent	
M3	18	Female	20-22	Absent	Absent	Absent	
M4	18	Indeterminate	2	Absent	Absent	Present	Three unhealed rib fractures, probably abuse
M5	18	Female	26-32	Absent	Absent	Absent	
M6	18	Male	30-36	Absent	Present	Absent	Broken finger
M7	18	Male	Adult	Absent	Absent	Absent	
M8	18	Indeterminate	2-3	Absent	Absent	Absent	
M9	18	Indeterminate	1-1 1/2	Absent	Absent	Absent	
M10	18	Indeterminate	2-4	Absent	Absent	Absent	
M11	18	Indeterminate	1	Absent	Absent	Absent	
M12	18	Male	10-12	Absent	Absent	Absent	
M13	18	Indeterminate	Fetus	Absent	Absent	Absent	
M14	18	Indeterminate	1 1/2 - 2	Absent	Absent	Absent	
M15	18	Female	40-46	Absent	Absent	Absent	
M16	18	Male	30-50	Absent	Absent	Absent	
M17	18	Indeterminate	Adult	Absent	Absent	Absent	
M18	18	Male	25-29	Absent	Absent	Absent	
M19	18	Indeterminate	2-3	Absent	Absent	Absent	
M20	18	Indeterminate	1/4-1/2	Absent	Absent	Absent	
M21	18	Female	20-22	Absent	Absent	Absent	
M22	18	Male	32-40	Absent	Absent	Absent	
M23	18	Indeterminate	0-1/4	Absent	Absent	Absent	
M24	18	Indeterminate	3/4	Absent	Absent	Absent	
M25	18	Male	32-40	Absent	Absent	Absent	
M26	18	Indeterminate	1 1/2-3	Absent	Absent	Absent	
M27	18	Male	22-26	Absent	Absent	Absent	
M28	18	Indeterminate	0-1/4	Absent	Absent	Absent	

Table A.15. 5MV1229, Mug House, No. 15 (continued)

Burial/ Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
M29	18	Indeterminate	12-16	Absent	Absent	Absent	
M30	18	Male	40-46	Absent	Present	Absent	Healing collarbone and healed rib
M31	18	Male	40-50	Absent	Absent	Absent	
M32	18	Indeterminate	1 1/2-2	Absent	Absent	Absent	
M33	18	Indeterminate	2-4	Absent	Absent	Absent	
M34	18	Indeterminate	8-9	Absent	Absent	Absent	
M35	18	Indeterminate	2-3	Absent	Absent	Absent	
M36	18	Indeterminate	Infant	Absent	Absent	Absent	
M37	18	Indeterminate	5-6	Absent	Absent	Absent	
M38	18	Indeterminate	Infant	Absent	Absent	Absent	
M39	18	Indeterminate	1 1/4-1 3/4	Absent	Absent	Absent	
M40	18	Indeterminate	2-4	Absent	Absent	Absent	
M41	18	Indeterminate	2 1/2-3 1/2	Absent	Absent	Absent	
M42	18	Indeterminate	1 1/2-2	Absent	Absent	Absent	
M43	18	Male	30-35	Absent	Absent	Absent	
M44	18	Indeterminate	3-4	Absent	Absent	Absent	
M45	18	Indeterminate	3-4	Absent	Absent	Absent	
M46	18	Male	30-35	Absent	Absent	Absent	
Totals				**0**	**2**	**1**	

[a]From: Miles 1975; Rohn 1971
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.16. 5MT3868, Duckfoot[a], No. 16[b]

Burial / Individual # (n=14)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	9	Male	30-39	Present	Absent	Absent	Healed, depressed fracture 3cm above right browridge
2	9	Male	30-39	Absent	Absent	Absent	
3	9	Female	30-39	Present	Absent	Absent	well-healed depressed fracture of L occipital squama
4	9	Male	30-39	Absent	Present	Absent	healed fracture of L fourth rib
5	9	Indeterminate	5-6	Absent	Absent	Absent	
6	9	Male	40-49	Absent	Present	Absent	old shin bruise, foot fracture and torn insertion of hip adductor
7	9	Indeterminate	6-7	Absent	Absent	Absent	
8	9	Male	50+	Absent	Absent	Absent	
9	9	Indeterminate	10-11	Absent	Absent	Absent	
10	9	Female	18-20	Absent	Absent	Absent	
11	9	Indeterminate	3-4	Absent	Absent	Absent	
12	9	Female	50+	Absent	Absent	Absent	
13	9	Indeterminate	12-15	Absent	Absent	Absent	
14	9	Indeterminate	5-6	Absent	Absent	Absent	
Totals				**2**	**2**	**0**	

[a]From: Hoffman 1993; Lightfoot 1993
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.17. 5MT0023, Grass Mesa Village[a], No. 17[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
9	9	Male	Adult	Absent	Absent	Absent	

Table A.17. 5MT0023, Grass Mesa Village, No. 17 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
8-1	10	Indeterminate	Adult	Absent	Absent	Absent	
8-2	10	Indeterminate	3-6	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Lightfoot et al. 1988; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.18. 5MT10207[a], No. 18[b]

Burial / Individual # (n=14)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	16	Male	30	Absent	Present	Absent	old healed break of lower R rib
	16	Male	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Male	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Male	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Female	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Female	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism

Table A.18. 5MT10207, No. 18 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	16	Female	Adult	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	7-12	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	7-12	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	7-12	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	13-18	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	Unknown	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	Infant	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
	16	Indeterminate	3-6	Present	Absent	Absent	Disarticulation, anvil/hammer abrasions, burning, cut marks, gnawing, etc. Argued as possible cannibalism
Totals				13	1	0	

[a]From: Dice 1993a; Dice 1993b; Errickson 1993; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.19. 5MT7723[a], No. 19[b]

Burial / Individual # (n=4)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Indeterminate	9-10	Absent	Absent	Absent	
3	14	Male	19-21	Absent	Absent	Absent	
5	14	Female	18-20	Absent	Absent	Absent	
	14	Indeterminate	Unknown	Present	Absent	Absent	Turner and Turner (1999) argue that it does meet the minimal requirements for possible cannibalism
Totals				**1**	**0**	**0**	

[a]From: Dice 1993a; Dice 1993b; Errickson 1993; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.20. 5MT2336, Kin Tl'iish[a], No. 20[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
29	10	Female	20-25	Absent	Absent	Absent	
30	10	Female	24-28	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Dohm and Gould 1986; Stodder 1987; Wiener 1986
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.21. 5MT4545, Tres Bobos Hamlet[a], No. 21[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
4	7	Male	29-39	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brisbin and Varien 1986; Flander 1986a; Stodder 1987;
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.22. 5MT2858, Apricot Hamlet[a], No. 22[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	7	Indeterminate	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Flander 1986b; Montgomery 1986
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.23. 5MT2182, Rio Vista Village[a], No. 23[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
19	9	Male	20-25	Absent	Absent	Absent	
33	9	Male	42-45	Present	Present	Absent	Fracture at sternal end of clavicle and healed fractures of L radius and ulna.
Totals				**1**	**1**	**0**	

[a]From: Stodder 1987; Wilshusen 1986b
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.24. 5MT2519, Herren House[a], No. 24[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Female	17-20	Absent	Absent	Absent	
2a	14	Indeterminate	15-17	Absent	Absent	Absent	
2b	14	Male	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Morris 1991; Ogilvie and Hilton 1991
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.25. 5MT2525, Knobby Knee Stockade[a], No. 25[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Female	20-30	Absent	Absent	Absent	
2	17	Female	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Morris 1991; Ogilvie and Hilton 1991
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.26. 5MT2544, Roundtree Pueblo[a], No. 26[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
2	14	Male	40	Absent	Absent	Absent	
1	17	Indeterminate	1-2	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Morris 1991; Ogilvie and Hilton 1991
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.27. 5MV1554[a], No. 27[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	6	Female	21-24	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Birkedal 1976
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.28. 5M2433, Aulston Pueblo[a], No 28[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Female	52-59	Present	Absent	Absent	Healed fracture of R ulna.
Totals				**1**	**0**	**0**	

[a]From: Morris 1986; Nickens 1986
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.29. 5MT8827, Dobbins Stockade[a], No. 29[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	13	Indeterminate	1-2	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Akins 1988; Kuckelman 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.30. 5MT8651[a], No. 30[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
33.01	18	Indeterminate	7-11	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.31. 5MT9942[a], No. 31[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
148-1	15	Female	38-48	Absent	Absent	Absent	Died naturally or was killed while lying down. But not enough evidence to interpret as violent
246-1	15	Female	18-21	Absent	Absent	Absent	
246-1.01	15	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.32. 5MT10010[a], No 32[b]

Burial / Individual # (n=11)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
7-1.01	16	Indeterminate	2-4	Absent	Absent	Absent	
7-1	16	Female	43-63	Absent	Absent	Absent	
6	16	Indeterminate	3-5	Absent	Absent	Absent	
40	16	Male	39-49	Present	Present	Absent	Healed depression fracture on L side of frontal bone near coronal suture; well-healed fracture in body of L middle rib
3a	16	Indeterminate	8-14	Present	Absent	Absent	Assoc. w/ 3b, 3c, 3d, and 3e; perimortem fracturing on the alveolar margin and occipital bone; several perimortem fractures and tool-induced marks
3b	16	Male	31-41	Present	Absent	Absent	Assoc. w/ 3a, 3c, 3d, and 3e; perimortem fracture at glabella; perimortem fracture on posterior R parietal
3c	16	Male	-40	Present	Absent	Absent	Assoc w/ 3a, 3b, 3d, and 3e; perimortem fractures in the glabellar region and along the L temporal line at the coronal suture
3d	16	Male	-40	Present	Absent	Absent	Assoc w/ 3a, 3b, 3c, and 3e; several perimortem fractures on vault bones and on ascending ramus of R mandible
3e	16	Female	Adult	Present	Absent	Absent	Assoc w/ 3a, 3b, 3c, and 3d; highly fragmented
13a	16	Indeterminate	6-10	Present	Absent	Absent	Assoc w/ 13b; perimortem trauma throughout cranial skeleton; perimortem fracturing in vertebrae, R clavicle, both scapulae, L humerus, both ulnae, both femora, L tibia, R fibula, both metacarpals and metatarsals
13b	16	Indeterminate	11-17	Present	Absent	Absent	2 healed depression fractures on R frontal & R posterior parietal bone; perimortem fracturing on both parietals above temporal bones, temporal bones, R occipital bones, vertebrae, ribs, clavicles, R scapula, humeri, R radius, R ulna, femora, tibiae, etc.
Totals				**8**	**1**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.33. Site 1-1937, Ackmen[a], No. 33[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	11	Indeterminate	6	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Martin 1938
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.34. 5MT9943[a], No. 34[b]

Burial / Individual # (n=12)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
4	15	Female	38-48	Present	Present	Present	Small lesion on left parietal may have been trauma related, well-healed fracture on R nasal bone, 11th R rib had well-healed fracture
11	15	Female	17-23	Present	Absent	Absent	Well-healed parry fracture on L ulna
74	15	Indeterminate	18+	Absent	Absent	Absent	
82	15	Male	39-49	Absent	Absent	Absent	
87	15	Male	41-51	Present	Present	Absent	Lesion on R parietal may have been from trauma, well-healed fracture on R frontal bone, healing and healed rib fractures on 3 R ribs, bump near sternal end of L clavicle, well-healed fracture of distal L ulna
93	15	Indeterminate	3-5	Absent	Present	Absent	Well-healed fracture on R side of frontal bone
140	15	Female	26-36	Absent	Absent	Absent	
7.72	18	Female	35-45	Present	Present	Absent	Found on back on floor of pitstructure w/ arms and legs splayed out and w/ possible cranial injury on the L parietal; well-healed traumatic injuries on several foot bones
71	18	Female	27-37	Present	Absent	Absent	Old greenstick fracture on right ulna

Table A.34. 5MT9943, No. 34 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
96-1.01	18	Indeterminate	7-11	Present	Absent	Absent	Assoc w/ 96-1.02 and 96-1.03; perimortem fracturing includes one above L orbit and on L zygomatic; depression fracture on frontal bone
96-1.02	18	Indeterminate	11-15	Present	Absent	Absent	Assoc w/ 96-1.01 and 96-1.03; ellipsoidal depression fracture of L posterior vault
96-1.03	18	Indeterminate	2-4	Present	Absent	Absent	Assoc w/ 96-1.02 and 96-1.01; green fracture on L parietal; depression fracture on R occipital
Totals				**8**	**4**	**1**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.35. 5MT2181, Hamlet de la Olla[a], No. 35[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
24	8	Indeterminate	15-19	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Etzkorn 1986; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.36. 5MT2192, Pheasant View Hamlet[a], No. 36[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
12	9	Indeterminate	4-6	Absent	Absent	Absent	
11	9	Male	27-35	Absent	Present	Absent	Degenerative trauma probably from bad fall that dislocated pelvis and twist fracture in lower back.
Totals				**0**	**1**	**0**	

[a]From: Stodder 1987; Yarnell 1982
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.37. 5MT2236, Horsefly Hamlet[a], No. 37[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
6	7	Indeterminate	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Kane and Chenault 1982
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.38. 5MT2378, Poco Tiempo[a], No. 38[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
48	7	Male	35-40	Absent	Absent	Absent	
49	7	Male	40-45	Absent	Present	Absent	Traumatic fracture of L first rib resulted in misalignment of rib portions after healing.
Totals				**0**	**1**	**0**	

[a]From: Brisbin 1986; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.39. 5MT2848, Rusty Ridge Hamlet[a], No. 39[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
10	7	Female	19-29	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Flander 1986c; Hewitt 1986; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.40. 5MT2853, Deer Hunter Hamlet[a], No. 40[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
7	8	Indeterminate	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Hewitt 1986; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.41. 5MT4671, Periman Hamlet[a], No. 41[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
18	8	Indeterminate	2-3	Absent	Absent	Absent	
15	8	Female	20-25	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Yarnell 1983
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.42. 5MT5108, Golondrinas Oriental[a], No. 42[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
46-2	10	Male	23-27	Present	Absent	Absent	Associated with Burial 46-1. Grasping throat. Also exhibits small (1 x 1.5 cm) oval-shaped depression fracture on left posterior aspect of frontal bone near coronal suture (healed wound: blow to head)
45	10	Female	35-40	Absent	Absent	Absent	
46-1	10	Female	16-19	Present	Absent	Absent	Associated with 46-2. Grasping throat and pelvis and legs on hearth.
Totals				**2**	**0**	**0**	

[a]From: Stodder 1987; Kuckelman 1984a
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.43. 5MT2320, House Creek Village[a], No. 43[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
47	8	Female	24-26	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Robinson and Brisbin 1986; Stodder 1987
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.44. 5MT4475, McPhee Village[a], No. 44[b]

Burial / Individual # (n=8)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
35-2	9	Male	35-40	Absent	Absent	Absent	
35-1	9	Female	35-40	Absent	Absent	Absent	
2-1	10	Indeterminate	4-6	Absent	Absent	Absent	
1	10	Male	Adult	Absent	Absent	Absent	
2-2	10	Female	Adult	Absent	Absent	Absent	
36	10	Female	20-25	Absent	Absent	Absent	
3	11	Indeterminate	1-2	Absent	Absent	Absent	
34	11	Male	30-35	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Kane and Robinson 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.45. 5MT4477, Masa Negra[a], No. 45[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
16	10	Female	16-22	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Kuckelman 1984b
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.46. 5MT4480, Rabbitbrush Pueblo[a], No. 46[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
32	9	Indeterminate	11-14	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Kuckelman and Harriman 1984
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.47. 5MT4684, Chindi Hamlet[a], No. 47[b]

Burial / Individual # (n=5)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
23	6	Indeterminate	5-8	Absent	Absent	Absent	
21	6	Female	19-24	Absent	Absent	Absent	
20	7	Male	16-20	Absent	Absent	Absent	
17	7	Female	27-35	Absent	Absent	Absent	
22	7	Female	22-26	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Tucker 1983
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.48. 5MT4725, Tres Chapulines Pueblo[a], No. 48[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
26	9	Male	23-27	Absent	Absent	Absent	
28	9	Female	30-45	Absent	Absent	Absent	
27	9	Indeterminate	15-19	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Chenault 1983
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.49. 5MT5106, Weasel Pueblo[a], No. 49[b]

Burial / Individual # (n=4)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
38-3	9	Female	22-25	Absent	Present	Absent	Paralysis of R hip and leg
38-4	9	Female	24-28	Absent	Present	Absent	Healed fracture of sternum
38-1	9	Male	27-33	Absent	Absent	Absent	
38-2	9	Male	21-24	Absent	Present	Absent	Hyperextension of knee.
Totals				**0**	**3**	**0**	

[a]From: Stodder 1987; Morris 1984
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.50. 5MT5107, Pueblo de las Golondrinas[a], No. 50[b]

Burial / Individual # (n=8)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
42-1	9	Indeterminate	4-8	Absent	Absent	Absent	
40-1	9	Male	Adult	Absent	Present	Absent	Greenstick fracture resulting from bending stress to back of leg present in R tibia.
42-2	9	Male	35-40	Absent	Absent	Absent	
39	9	Female	22-25	Absent	Absent	Absent	
40-2	9	Female	16-18	Absent	Absent	Absent	
41	9	Female	16-20	Absent	Absent	Absent	
43	9	Female	Adult	Absent	Absent	Absent	
44	9	Female	20-30	Absent	Absent	Absent	
Totals				**0**	**1**	**0**	

[a]From: Stodder 1987; Kane and Robinson 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.51. 5MT5985, Standing Pipe Hamlet[a], No. 51[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
37	9	Indeterminate	20-23	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Stodder 1987; Nelson 1985
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.52. 5MT9168, Rabbit Site[a], No. 52[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
3.004	14	Female	30-35	Absent	Present	Absent	Possible trauma on vertebral column and strained left ankle.
Totals				**0**	**1**	**0**	

[a]From: Phillips and Chenault 2004; Underwood 2004a
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.53. 5MT9343, Dancing Man Hamlet[a], No. 53[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	6	Indeterminate	25-30	Absent	Absent	Absent	
	6	Male	30-40	Present	Present	Absent	Depressed, healed cranial fracture, round, 18mm in diameter and 5mm deep, posterior and superior to the foramen magnum on the occipital bone; ligament pull.
Totals				**1**	**1**	**0**	

[a]From: Desruisseaux et al 2004; Underwood 2004b
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.54. 5MT7522, Hummingbird Pueblo[a], No. 54[b]

Burial / Individual # (n=8)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	9	Female	20-29	Absent	Absent	Absent	
42.02	9	Female	27-34	Absent	Absent	Absent	
42.03	9	Female	28-34	Absent	Present	Absent	Healing fracture of the right scapula near spine.
42.05	9	Female	45-49	Absent	Present	Absent	Torn ligaments and broken toe in right lower limb
75.01	9	Male	30-34	Absent	Absent	Absent	
	13	Female	25-30	Absent	Absent	Absent	
21.02	13	Female	18-22	Absent	Absent	Absent	
	13	Female	23-28	Absent	Absent	Absent	
Totals				**0**	**2**	**0**	

[a]From: Chenault 2004b; Karhu 2004
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.55. 5MT11884, Conejos Camp[a], No. 55[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Female	15-17	Absent	Absent	Absent	
2	14	Male	35-40	Absent	Absent	Absent	Possible depressed cranial fracture but not enough analysis to be conclusive
Totals				**0**	**0**	**0**	

[a]From: Mabry 2004; Underwood 2004c
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.56. 42SA3724[a], No. 56[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	12	Male	20-30	Present	Absent	Absent	Depression fracture on left parietal and possible cannibalism and healed fractures on right radius and ulna.
Totals				**1**	**0**	**0**	

[a]From: Fetterman and Honeycutt 1990; Fink 1989
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.57. 42SA12209, Cottonwood Wash[a], No. 57[b]

Burial / Individual # (n=4)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
27.1	10	Indeterminate	12	Present	Absent	Absent	Cranial fractures and possible cannibalism
27.2	10	Indeterminate	13	Present	Absent	Absent	Cranial fractures and possible cannibalism
27.3	10	Male	Adult	Present	Absent	Absent	Cranial fractures and possible cannibalism
27.4	10	Female	Adult	Present	Absent	Absent	Cranial fractures and possible cannibalism
Totals				**4**	**0**	**0**	

[a]From: Fetterman et al 1988; White 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.58. 5MT8651[a], No. 58[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
39.01	14	Male	36-46	Present	Absent	Absent	Well-healed fracture of L radius
10	15	Female	33-43	Absent	Present	Absent	Traumatic injury on rib with well-healed fracture on sternal end.
Totals				**1**	**1**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.59. 5MT9541[a], No. 59[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
43	18	Female	16-22	Present	Absent	Absent	Large, round, depression fracture area on posterior L parietal bone
Totals				**1**	**0**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.60. 5MT9924[a] No. 60[b]

Burial / Individual # (n=11)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
7	15	Male	27-37	Absent	Absent	Absent	
9	15	Female	40-50	Absent	Absent	Absent	
14	15	Male	40-50	Absent	Absent	Absent	
19	15	Male	50+	Absent	Present	Absent	Well-healed fractures of two L ribs
21	15	Indeterminate	11-15	Absent	Absent	Absent	
22	15	Female	42-52	Absent	Absent	Present	Well-healed fracture of nasal bone
24	15	Female	40-60	Absent	Present	Absent	Old wrist injury
26	15	Indeterminate	4-6	Absent	Absent	Absent	
30	15	Indeterminate	1-3	Absent	Absent	Absent	
42	15	Male	41-51	Absent	Absent	Absent	
BT2	15	Male	30-48	Present	Absent	Absent	Two healed depression fractures on posterior R parietal bone. Possible perimortem fracture on R parietal
Totals				**1**	**2**	**1**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.61. 5MT9933[a] No. 61[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
10	18	Male	22-30	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Billman 2003; Lambert 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.62. 5MT7704[a], No. 62[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	16	Female	25-30	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Dice 1993a; Dice 1993b; Errickson 1993
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.63. 5MT8943[a], No. 63[b]

Burial / Individual # (n=7)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Indeterminate	3-4	Absent	Absent	Absent	
3	14	Female	Adult	Present	Absent	Absent	Healed fracture on L ulna
4	14	Female	20-25	Absent	Absent	Absent	
5	14	Female	20	Absent	Absent	Absent	
6	14	Male	25-30	Absent	Absent	Absent	
7	14	Female	+40	Present	Present	Absent	Well-healed fracture of R radius and dislocation of R ulna
8	14	Female	25-30	Absent	Absent	Absent	
Totals				**2**	**1**	**0**	

[a]From: Dice 1993b; Errickson 1993
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.64. 5MV1676[a], No. 64[b]

Burial / Individual # (n=7)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	9	Female	Adult	Absent	Absent	Absent	
2	9	Male	30-35	Absent	Absent	Absent	
3	9	Indeterminate	Unknown	Absent	Absent	Absent	
5	9	Male	30-35	Absent	Absent	Absent	
6	9	Male	40+	Absent	Absent	Absent	
8	9	Male	35-40	Absent	Absent	Absent	
9	9	Male	20-30	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Hayes and Lancaster 1975
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.65. 5MV1452, Badger House[a], No. 65[b]

Burial / Individual # (n=26)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
31	10	Indeterminate	2-3	Absent	Absent	Absent	
32	10	Indeterminate	1-2	Absent	Absent	Absent	
6	11	Indeterminate	2-3	Absent	Absent	Absent	
8	11	Male	40-50	Absent	Absent	Absent	
9	11	Indeterminate	Unknown	Absent	Absent	Absent	
13	11	Female	40-56	Absent	Absent	Absent	
14	11	Male	40-56	Absent	Absent	Absent	
24	11	Male	30	Absent	Absent	Absent	
25	11	Indeterminate	12-14	Absent	Absent	Absent	
28	11	Indeterminate	2-3	Absent	Absent	Absent	

Table A.65. 5MV1452, Badger House, No. 65 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
29	11	Female	25	Absent	Present	Absent	Healed rib fracture
30	11	Indeterminate	1-2	Absent	Absent	Absent	
1	12	Male	Adult	Absent	Absent	Absent	
7	12	Male	Adult	Absent	Absent	Absent	
2	13	Male	30-40	Absent	Absent	Absent	
3	13	Female	25-31	Absent	Absent	Absent	
10	13	Indeterminate	5-6	Absent	Absent	Absent	
11	13	Male	37	Absent	Present	Absent	Old fracture of sternum
16	13	Indeterminate	3-4	Absent	Absent	Absent	
19	13	Indeterminate	2-4	Absent	Absent	Absent	
21	13	Female	39-45	Absent	Present	Absent	Healed distal end of radius (broken wrist)
22	13	Indeterminate	2-3	Absent	Absent	Absent	
27	13	Male	25-31	Absent	Absent	Absent	
12	17	Male	24-30	Absent	Present	Absent	Healed fracture of collarbone
33	17	Indeterminate	9	Absent	Absent	Absent	Child was lowered from top of ventilator shaft with some force. Not enough evidence for warfare/interpersonal violence
15	19	Male	20-24	Absent	Absent	Absent	
Totals				**0**	**4**	**0**	

[a]From: Hayes and Lancaster 1975
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.66. 5MV1595, Big Juniper House[a], No. 66[b]

Burial / Individual # (n=20)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	15	Indeterminate	Child	Absent	Absent	Absent	
2	15	Indeterminate	Child	Absent	Absent	Absent	
3	15	Female	Subadult	Absent	Absent	Absent	
4	15	Female	Adult	Absent	Absent	Absent	
5	15	Male	30-35	Absent	Absent	Absent	
8	15	Male	30-35	Absent	Present	Absent	Healed fracture of L clavicle in midportion of shaft. Assoc. w/ 2 other individuals but were too fragmentary to include in analysis.
9	15	Male	35-40	Absent	Absent	Absent	
11	15	Male	35-40	Absent	Absent	Absent	
12	15	Indeterminate	Infant	Absent	Absent	Absent	
13	15	Indeterminate	Infant	Absent	Absent	Absent	
14	15	Indeterminate	Child	Absent	Absent	Absent	
15	15	Female	Adult	Absent	Absent	Absent	
17	15	Male	30-35	Absent	Absent	Absent	
18	15	Indeterminate	Infant	Absent	Absent	Absent	
19	15	Indeterminate	Child	Absent	Absent	Absent	
20	15	Indeterminate	Adult	Absent	Absent	Absent	
21	15	Indeterminate	Unknown	Absent	Absent	Absent	
22	15	Female	Adult	Absent	Absent	Absent	
23	15	Indeterminate	Child	Absent	Absent	Absent	
24	15	Female	40+	Absent	Absent	Absent	
Totals				**0**	**1**	**0**	

[a]From: Swannack 1969
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.67. 5MT0001, Porter-Stevenson[a], No. 67[b]

Burial / Individual # (n=19)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1S-01	6	Female	18-25	Absent	Absent	Absent	
1S-02	6	Male	40-49	Absent	Absent	Absent	
1S-05	6	Female	40-45	Absent	Absent	Absent	
1S-06	6	Female	30-40	Present	Absent	Absent	Healed fracture of L ulna
1S-07	6	Female	39-45	Absent	Absent	Absent	
1S-04	6	Indeterminate	8-10	Absent	Absent	Absent	
PM-1P2-01a	12	Male	17-18	Present	Absent	Absent	Assoc. w/ Burials 13, 14, and 15. Lesion in central aspect of occipital. Highly fragmented and disarticulated. Turner and Turner (1999) and Malville (1989) argue possible cannibalism. Scalp marks on crania.
PM-1P2-01b	12	Indeterminate	10	Present	Absent	Absent	Assoc. w/ Burials 12, 14, and 15. Highly fragmented and disarticulated. Turner and Turner (1999) and Malville (1989) argue possible cannibalism.
PM-1P2-01c	12	Indeterminate	4-5	Present	Absent	Absent	Assoc. w/ Burials 12, 13, and 15. Highly fragmented and disarticulated. Turner and Turner (1999) and Malville (1989)argue possible cannibalism. Scalp marks on crania.
PM-1P2-01d	12	Indeterminate	8-9	Present	Absent	Absent	Assoc. w/ Burials 12, 13, and 14. Highly fragmented and disarticulated. Turner and Turner (1999) and Malville (1989) argue possible cannibalism. Scalp marks on crania.
1P2-01	14	Indeterminate	1-2	Absent	Absent	Absent	
1P1-08	14	Indeterminate	10-12	Absent	Absent	Absent	
1P1-11	14	Male	40-45	Absent	Absent	Absent	
1P1-13	14	Indeterminate	6	Absent	Absent	Absent	
1P1-12	14	Female	36-40	Absent	Present	Absent	Trauma to R humerus and scapula
1P1-06	15	Indeterminate	18-24	Absent	Absent	Absent	
1P1-05	17	Indeterminate	8-10	Absent	Present	Absent	Traumatic fracture on occiput.
1P1-09	17	Indeterminate	1-2	Absent	Absent	Absent	

Table A.67. 5MT0001, Porter-Stevenson, No. 67 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1P1-02	17	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**5**	**2**	**0**	

[a]From: Malville 1989; Swedlund 1969; Turner and Turner 1999; Yunker 2001
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.68. 5MT0005, Yellow Jacket[a], No. 68[b]

Burial / Individual # (n=5)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	19	Female	15-20	Present	Absent	Present	Healed fracture of R nasal bone. Healed depression fracture above R orbit. Cut marks and multiple smaller striations on R zygomatic of cranium.
2	19	Indeterminate	Unknown	Absent	Absent	Absent	
3	19	Indeterminate	Unknown	Absent	Absent	Absent	
4	19	Indeterminate	Infant	Absent	Absent	Absent	
5	19	Indeterminate	Unknown	Absent	Absent	Absent	
Totals				**1**	**0**	**1**	

[a]From: Bradley 2003; Kuckelman 2003
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.69. 5MT10967[a], No. 69[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	15	Male	30-35	Present	Absent	Absent	Possibly from the Fremont culture. Massive head trauma on L frontal bone and above L mastoid
Totals				**1**	**0**	**0**	

[a]From: Nickens and Mabry 2000
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.70. 5MV0866[a], No. 70[b]

Burial / Individual # (n=13)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Indeterminate	Infant	Absent	Absent	Absent	
2	13	Indeterminate	Infant	Absent	Absent	Absent	
3	13	Indeterminate	Unknown	Absent	Absent	Absent	
4	13	Indeterminate	Unknown	Absent	Absent	Absent	
5	13	Indeterminate	Unknown	Absent	Absent	Absent	
6	13	Indeterminate	Unknown	Absent	Absent	Absent	
7	13	Indeterminate	Infant	Absent	Absent	Absent	
8	13	Indeterminate	Unknown	Absent	Absent	Absent	
9	13	Indeterminate	Unknown	Absent	Absent	Absent	
10	13	Indeterminate	Unknown	Absent	Absent	Absent	
11	13	Indeterminate	Unknown	Absent	Absent	Absent	
13	13	Indeterminate	Unknown	Absent	Absent	Absent	
14	13	Indeterminate	Unknown	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Lister 1966
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.71. Site 05, Alkali Ridge[a], No. 71[b]

Burial / Individual # (n=12)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Female	50	Absent	Absent	Absent	
922	13	Male	18	Present	Absent	Absent	Fracture on frontal and orbital
923	13	Indeterminate	14-15	Absent	Absent	Absent	
4	13	Indeterminate	Infant	Absent	Absent	Absent	
924	13	Indeterminate	Infant	Absent	Absent	Absent	
925	13	Male	45-75	Absent	Absent	Absent	
7	13	Female	25-30	Absent	Absent	Absent	
8	13	Indeterminate	5	Absent	Absent	Absent	
928	13	Male	36-40	Absent	Absent	Absent	
929	13	Male	50	Absent	Absent	Absent	
930	13	Female	56-75	Absent	Absent	Absent	
931	13	Male	40-44	Absent	Absent	Absent	
Totals				**1**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.72. Site 13, Alkali Ridge[a], No. 72[b]

Burial / Individual # (n=7)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
932	7	Male	50	Present	Absent	Absent	Cutmarks on the skull according to Turner and Turner (1999)
U2-1	13	Indeterminate	Unknown	Absent	Absent	Absent	
U1-1	15	Indeterminate	Child	Absent	Absent	Absent	
938	15	Indeterminate	Child	Absent	Absent	Absent	

Table A.72. Site 13, Alkali Ridge, No. 72 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
935	15	Indeterminate	12-14	Absent	Absent	Absent	
933	17	Male	40-44	Present	Absent	Absent	Part of projectile point found broken off in one of the dorsal vertebrae. Evidence of strong blow to the L side of head and Turner and Turner (1999) suggest scalping.
934	17	Male	Adult	Present	Absent	Absent	Associated with 933. Sprawled on floor. Turner and Turner (1999) suggest violence
Totals				**3**	**0**	**0**	

[a]From: Brew 1946; Brues 1946; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.73. 42SA1, Alkali Ridge[a], No. 73[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.74. Site 03, Alkali Ridge[a], No. 74[b]

Burial / Individual # (n=4)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Indeterminate	15-17	Absent	Absent	Absent	
2	13	Indeterminate	5-7	Absent	Absent	Absent	
3	13	Female	21-35	Absent	Absent	Absent	
4	13	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.75. Site 07, Alkali Ridge[a], No. 75[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
916	13	Indeterminate	Child	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.76. Site 08, Alkali Ridge[a], No. 76[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
917	13	Male	50-55	Absent	Absent	Absent	
918	13	Female	21-35	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.77. Site 12, Alkali Ridge[a], No. 77[b]

Burial / Individual # (n=3)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
919	13	Female	36-55	Absent	Absent	Absent	
2	13	Indeterminate	Adult	Absent	Absent	Absent	
920	13	Female	21	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Brew 1946; Brues 1946
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.78. 5MT2831[a], No. 78[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	8	Male	35-39	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Reed et al. 1985
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.79. 5MT2826[a], No. 79[b]

Burial / Individual # (n=5)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	9	Indeterminate	0-1	Absent	Absent	Absent	
2	9	Indeterminate	2-4	Absent	Absent	Absent	
3	9	Indeterminate	2-3	Absent	Absent	Absent	
4	9	Indeterminate	Unknown	Absent	Absent	Absent	
5	9	Male	Adult	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Reed et al. 1985
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.80. 5MV0875[a], No. 80[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Indeterminate	Unknown	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Lister 1965
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.81. 5MT6970, Wallace Ruin[a], No. 81[b]

Burial / Individual # (n=10)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	18	Indeterminate	Infant	Absent	Absent	Absent	
2	18	Indeterminate	Infant	Absent	Absent	Absent	
3	18	Male	16-20	Absent	Absent	Absent	
4	18	Male	Adult	Absent	Absent	Absent	
5	18	Female	11-15	Absent	Absent	Absent	
6	18	Indeterminate	8-9	Absent	Absent	Absent	
8	18	Indeterminate	Infant	Absent	Absent	Absent	
9	18	Indeterminate	4-8	Absent	Absent	Absent	
10	18	Female	16-20	Absent	Absent	Absent	
11	18	Male	23-27	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Bradley 1988
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.82. 5DL975[a], No. 82[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Male	30-40	Present	Absent	Absent	Scalped. Cranium had two depressed fractures w/ radiating fracture lines.
Totals				**1**	**0**	**0**	

[a]From: France 1988; O'Neil 1984
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.83. 5MT10206[a], No. 83[b]

Burial / Individual # (n=2)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	16	Female	Adult	Present	Absent	Absent	Disarticulation, cutting, burning, etc. Dice (1993b) and Turner and Turner (1999) argue possible cannibalism.
	16	Indeterminate	Subadult	Present	Absent	Absent	Disarticulation, cutting, burning, etc. Dice (1993b) and Turner and Turner (1999) argue possible cannibalism.
Totals				**2**	**0**	**0**	

[a]From: Dice 1993b; Turner and Turner 1999
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.84. 5MV1645, Two Raven House[a], No. 84[b]

Burial / Individual # (n=13)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	12	Female	18-20	Absent	Absent	Absent	
2	12	Female	20s	Absent	Absent	Absent	
3	12	Male	18-20	Absent	Absent	Absent	
4	12	Female	40-50	Absent	Absent	Absent	
5	12	Male	25-30	Absent	Absent	Absent	
6	12	Male	18-20	Absent	Present	Absent	Healed fracture of tibia.
7	12	Female	20-25	Absent	Absent	Absent	
8	12	Male	20-25	Absent	Absent	Absent	
9	12	Male	30-35	Absent	Absent	Absent	
10	12	Male	40-50	Absent	Absent	Absent	
11	12	Female	30-35	Absent	Absent	Absent	
12	12	Female	18-20	Absent	Absent	Absent	
13	12	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**0**	**1**	**0**	

[a]From: Hayes 1998; Miles 1975
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.85. 42SA18434, Rattlesnake Ruin[a], No. 85[b]

Burial / Individual # (n=20)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	14	Indeterminate	45+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
2	14	Male	25+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.

Table A.85. 42SA18434, Rattlesnake Ruin, No. 85 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
3	14	Male	25+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
4	14	Female	35-45	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
5	14	Female	40+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
6	14	Female	20-35	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
7	14	Female	25+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
8	14	Female	20+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
9	14	Indeterminate	30+	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
10	14	Indeterminate	Unknown	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
11	14	Male	12-18	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
12	14	Female	13-17	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
13	14	Indeterminate	12-18	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
14	14	Indeterminate	10-12	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
15	14	Indeterminate	7-11	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
16	14	Indeterminate	5-9	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
17	14	Indeterminate	4-6	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
18	14	Indeterminate	3-5	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
19	14	Indeterminate	1-3	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.
20	14	Indeterminate	0-2	Present	Absent	Absent	Scalping, perimortem damage, blows to the head, fracturing, cut marks, possible cannibalism, etc.

Table A.85. 42SA18434, Rattlesnake Ruin, No. 85 (continued)

Burial / Individual #	Period	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
Totals				20	0	0	

[a]From: Baker 1990
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.86. 42SA6396[a], No. 86[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	13	Male	35-39	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Cassells 1985; Davis 1985
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.87. 42SA7660, Happy Salamander Site[a], No. 87[b]

Burial / Individual # (n=1)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
	17	Indeterminate	3-7	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: Barnett 1998; Greubel 1998
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.

Table A.88. 5MV0034, Soda Canyon Pueblo[a], No. 88[b]

Burial / Individual # (n=19)	Period[c]	Sex	Age	Warfare	Accidental Injuries	Interpersonal Violence	Comments
1	17	Indeterminate	Infant	Absent	Absent	Absent	
2	17	Indeterminate	Infant	Absent	Absent	Absent	
4	17	Female	Adult	Absent	Absent	Absent	
5	17	Female	Adult	Absent	Absent	Absent	
6	17	Female	Adult	Absent	Absent	Absent	
7	17	Female	Adult	Absent	Absent	Absent	
8	17	Indeterminate	Child	Absent	Absent	Absent	
9	17	Indeterminate	Infant	Absent	Absent	Absent	
10	17	Female	Adult	Absent	Absent	Absent	
14	17	Indeterminate	Infant	Absent	Absent	Absent	
15	17	Male	Adult	Absent	Absent	Absent	
16	17	Indeterminate	Subadult	Absent	Absent	Absent	
17	17	Female	Adult	Absent	Absent	Absent	
18	17	Male	Adult	Absent	Absent	Absent	
19	17	Female	Adult	Absent	Absent	Absent	
23	17	Male	Adult	Absent	Absent	Absent	
24	17	Male	Adult	Absent	Absent	Absent	
25	17	Indeterminate	Subadult	Absent	Absent	Absent	
26	17	Indeterminate	Infant	Absent	Absent	Absent	
Totals				**0**	**0**	**0**	

[a]From: O'Bryan 1950
[b]Number is keyed to the map in Figure 4.1.
[c]Periods are keyed to dates in Table 3.1.