12-1977

The Physical Anthropology of Chiggerville: Demography and Pathology

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THE PHYSICAL ANTHROPOLOGY OF CHIGGERVILLE: DEMOGRAPHY AND PATHOLOGY

by

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A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
December, 1977

ACKNOWLEDGEMENTS

I would like to take this opportunity to express my gratitude to the people that have helped me at various stages of this project.

First of all, special thanks are extended to Dr. Robert Sundick, who introduced me to the study of human osteology and has guided me throughout all of the stages of my research. His patience, encouragement and friendship are greatly appreciated. In addition, thanks are also due to Dr. Elizabeth Baldwin-Garland and Mr. William Cremin for offering advice on improvements of this manuscript and for their support throughout the period of my studies at Western Michigan University.

I am grateful to Dr. Eugenie Scott of the University of Kentucky for most generously offering the opportunity to work with skeletal material in the collections of the University of Kentucky Museum of Anthropology.

I also wish to express my appreciation to Professor Alan Jacobs, Chairperson of the Department of Anthropology at Western Michigan University, for his interest in this study and for his aid in attending to many of the details encountered during this project.

Sincere thanks also go to the Graduate College at Western Michigan University for a Graduate Student Research Grant that has served as partial funding for this project.

MASTERS THESIS 13-10,929

SULLIVAN, Norman Craig, 1950-
THE PHYSICAL ANTHROPOLOGY OF CHIGGERVILLE: DEMOGRAPHY AND PATHOLOGY.

Western Michigan University, M.A., 1977
Anthropology, physical

University Microfilms International, Ann Arbor, Michigan 48106

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CHAPTER I

INTRODUCTION

The Chiggerville Site is a shell mound, approximately 200 feet long and 100 feet wide with its long axis oriented in an east-west direction. The site is located on a terrace on the east side of the Green River, in Ohio County, Kentucky. By geographical proximity and archaeological comparisons with the nearby Indian Knoll Site it is clear that Chiggerville was only one part of the Indian Knoll settlement system and, by association with Indian Knoll, the Chiggerville Site was probably occupied for approximately 1500 to 2000 years, from 4160 $\pm$ 315 B.C. to 2558 $\pm$ 365 B.C. (Winters, 1974).

There are numerous similarities between the Chiggerville and Indian Knoll Sites in artifact categories. Artifacts found at the Chiggerville Site included: bone and lithic projectile points, knives, drills, thumbnail scrapers, pestles, a mortar, awls, fishhooks, atlatl hook ends and shell pendants and beads. In addition, there were 53 features, including: 1 concentration of small gastropod shells, 1 cache of a mortar and pestles, 1 cache of hickory nuts, 2 caches of large flint flakes and 48 fireplaces (Webb and Haag, 1939).

On the basis of the trait lists provided by Webb and

Haag (1939), Winters (1969;1974) suggested that the Chiggerville Site represents a "settlement" with the Indian Knoll or Carlson Annis Sites being the base camps. Winters (1974), by observing ratios of functional tool categories, was also able to show the relative importance of various activities at the Chiggerville Site. Through these ratios it becomes apparent that fabricating and processing activities as well as fishing were important aspects of site function.

The hunting of deer and the gathering of nuts and fresh water mussels was of greater importance than fishing for the Indian Knoll settlement system, taken as a whole.

The narrow-spectrum or harvesting economy of the Indian Knoll people was established and maintained by the exploitation of these 3 essential resources.

There were a total of 114 human burials and 12 dog burials at Chiggerville. These burials were distributed over the entire mound but tended to concentrate on the east and south sides. There are 3 methods of burial recognized, with fully flexed being the most common (75), followed by partially flexed (17) and extended (1) (Webb and Haag, 1939). Most of this skeletal material was poorly preserved, with the majority of burials badly fragmented and incomplete. This condition can be attributed to the effects of aboriginal activities as well as modern cultivation and the root action of trees (Webb and Haag, 1939).

This report examines aspects of the demography and pathology of the human skeletal population from the Chiggerville Site. The age and sex of the burials is first established and these analyses are presented in Chapters 2 and 3. The demographic implications of this data are then examined in Chapter 4. Finally, the results of an analysis of the pathologies present in the skeletal collection are given in Chapter 5.

The demographic analysis is basically descriptive and its purpose is threefold. First, it will serve to describe the composition of the population by making reference to the sex ratio, infant and subadult representation as well as mortality at each age interval.

Secondly, the demographic analysis, along with the analysis of the pathology, will partially reconstruct the health environment of the population. The mortality rates of infants and subadults are good indicators of crucial periods of stress, such as at the period of weaning, and will generally provide a rough measure of the adequacy of the nutritional regime and the degree of susceptibility to disease insult. The mortality rates of adults will also aid in reconstructing the health environment by identifying the age and sex groups which were subjected to the highest risk of death.

Finally, an analysis of mortality aids in the evaluation of the social-functional efficiency of the population since "the circumstances under which men die are closely related to the conditions under which they live" (Preston, et al., 1972:1). Comparisons of the mortality experience of different populations may be made with the observed variations in death rates being attributable to variations in exposure to the hazards which lead to death.

To this end, the Chiggerville mortality profile was compared to profiles constructed for 4 other prehistoric populations. These additional profiles were drawn from 2 hunting and gathering groups and 2 groups which engaged in food production.

The hunting and gathering populations are represented by a composite skeletal series from Illinois and the Indian Knoll collection. The Illinois Archaic Series consists of 101 individuals from 63 burials and 7 crematories located beneath the Hopewell interments at the Pete Klunk Mounds, in southern Illinois (Blakely, 1971; Perino, 1968). Full flexion was the most common method of burial although bundle reburials were also found. Although there were some artifact similarities between the Archaic and Hopewell components at the Klunk Mounds the former was clearly distinguished by the method of burial, a distinct grooved, tear drop plummet type and Kampsville barbed projectile points (Perino, 1968). In addition, other artifacts of the Archaic component include: various types of beads, fishhooks of shell and copper, bone awls, an antler maul and antler flaking tools. This component has been radiocarbon dated at 920 $\pm$

75 years B.C. (Perino, 1968:71).

The Indian Knoll Site is a large, Archaic shell midden located along the Green River only a few miles from Chiggerville. In addition to the artifacts found at both Indian Knoll and Chiggerville there are ceremonial artifacts (rattles, medicine bags and pipes), mauls and adzes or gouges also present at Indian Knoll (Webb, 1946). There were a total of 1,234 individuals excavated at Indian Knoll although the analysis by Johnston and Snow (1961) examined only 873 skeletons.

The food producing populations selected for comparison are the Middle Woodland component of the Pete Klunk Mounds and the Middle Mississippian burials from the Dickson Mounds. The Hopewellian group from the Klunk Mounds consists of 294 individuals drawn from the mound group which is situated on the crest of a ridge overlooking the Illinois River, in Calhoun County, Illinois (Blakely, 1971; Perino, 1968). The usual treatment of the dead consisted of extended burials both at the floor and in the fill of the constructed earthen mounds. There were numerous artifacts found in association with these burials, including: various types of Hopewell ceramic vessels, platform pipes, bone awls, stone projectile points, knives and chert hoes. Perino (1968:115) has provided a radiocarbon date of A.D. 175 $\pm$ 75 years for the Hopewellian component at the Pete Klunk Mounds.

The Middle Mississippian skeletal collection consists of 479 individuals excavated from the Dickson Mounds (Blakely and Walker, 1968; Blakely, 1971; Harn, 1971). These mounds are located on a terrace above the Illinois River, in Fulton County, Illinois. The most common method of burial was the extended position (82%), with secondary burials being less common (13%), while flexed burials are infrequent (approximately 5%). There is 1 burial which may have been cremated (Harn, 1971). There were grave goods associated with 100 of the 248 burials at this site. These artifacts include: antler tip flakers, flake knives, stone projectile points, celts, drills, scrapers, bone needles, bone awls, weaving tools, mussel-shell hoes, effigy bowls, jars, beakers and water bottles (Harn, 1971). The radiocarbon dates for the Dickson Mounds range between A.D. 920 and A.D. 1120 (Crane and Griffen, 1960 cited in Harn, 1971).

The purpose in selecting these particular populations was to provide a comparison of the Chiggerville profiles to the profiles of both food gathering and food producing populations. It was thought that these comparisons would help identify the sources of mortality reflected in the Chiggerville profiles and would aid in an evaluation of the social-functional efficiency of the Chiggerville population. It was felt necessary to compare Chiggerville only to populations that have lived within the same geographical region and therefore confronted similar environments. For this reason, only midwestern United States skeletal series were used in the analysis and comparisons of Chiggerville mortality.

It is recognized that the food producing populations may pose special problems for demographic analysis since the mound burials probably represent mostly the elite segments of the society. A possible result is that sociocultural variables may intrude and obscure the real demographic characteristics of the total population. Although this does not seem to be a problem with the Dickson Mound skeletons, the Hopewellian burials do exhibit a slight deficiency in subadults under the age of 10 years (see Figure 3). Despite this underrepresentation of subadults at the Pete Klunk Mounds, the profiles of both Pete Klunk and Dickson Mounds approximate a normal pyramidal distribution with the majority of deaths occurring early in the life cycle and a gradual attrition thereafter, so that the final age intervals contain relatively few individuals. It can be inferred then, that even if the mound burials represent only the social elite it is likely that their mortality experience at least paralleled that of the total population.

CHAPTER II

SEX DETERMINATION

In this study of 114 individuals, consisting of 70 adults and 44 subadults, the 70 adults included 32 males and 30 females. No attempt to determine the sex of subadults was made since previous studies (Boucher, 1955; Imrie and Wyburn, 1958; Reynolds, 1945) require the presence of cartilage which is seldom preserved in dried skeletons and it has been noted that sex determinations cannot be made on the basis of bone alone (Bass, 1971; Sundick, 1977). It is only after puberty that secondary sex characteristics become readily apparent in the bones of the skeleton, thus the estimation of the sex of subadult skeletons remains largely a matter of guesswork despite some promising methodological advances (Bailit and Hunt, 1964; Hunt and Gleizer, 1955).

By the time adulthood is reached sexual dimorphism is well established in the skeleton. Sexual dimorphism is brought about by three factors. These are: 1)differential reproductive function which is primarily expressed in pelvic morphology; 2) genetically determined differences in bone size and body proportions; and 3) contrasts in the robusticity of bone and musculature reflected by the degree of development of muscle attachment areas on bone.

Since the female pelvis is adapted to functions of parturition the innominate is regarded as providing the most reliable indication of sex in adult skeletons, and it is suggested that sex determinations can be made with an accuracy of 90% to 95% using this bone alone (Krogman, 1962; Stewart, 1968). Generally, the female pelvis is characterized by a wide sciatic notch, the presence of a pre-auricular sulcus, the presence of a ventral arc on the _os pubis_, a wide subpubic angle and narrow medial aspect of the ischio-pubic ramus. In addition, the occurrence of parity scars on the inner surface of the _os pubis_ provides a certain diagnosis of sex. All of the above traits were used for sex determinations and are listed in Table 1 along with the variable expression seen in male and female pelves.

Table I

Pelvic Traits Used in Sexing Analysis

	Males	Females	
Ventral Arc	not frequent	frequent	(Phenice,1969)
Subpubic Concavity	not present	present	(Phenice,1969)
Medial Aspect of the _Os Pubis_	wide	narrow	(Phenice,1969)
Parity Scars	absent	may be present	(Stewart,1957)
Greater Sciatic notch	narrow to median	median to wide	(Krogman,1962)
Pre-auricular Sulcus	infrequent	frequent	(Krogman,1962)

Forty one individuals were observed for at least one of the traits listed in Table 1. Only 13 of these burials, however, were complete enough to allow the observation of one-half of these traits and only 6 individuals provided information on all 6 pelvic traits. The traits discussed by Stewart (1957) and Phenice (1969) were given the greatest emphasis in sexing observations. The remaining two were given less weight but were generally emphasized more than other cranial and post-cranial traits. If two or more of the pelvic traits could be observed for a burial a sex determination was made, but no sex determinations were made on the basis of only one of the traits.

Sex differences are also well marked in the skull and mandible and these are generally reflective of the greater degree of robusticity of the male (Brothwell, 1972; Krogman, 1962). A total of 8 characteristics of the skull and mandible were observed for sex differences. These are listed along with their expression in Table 2.

Utilizing these characteristics, it has been claimed that an experienced observer can achieve an accuracy of between 80% and 90% although this is somewhat dependent upon the completeness of the skull (Krogman, 1962; Stewart, 1968). There were a total of 60 individuals examined for one or more of the morphological traits of the skull although only 47 were preserved well enough so that at least one-half of the cranial traits could be observed.

Table 2

Cranial Traits Used in Sexing Analysis

	Male	Female	
Size of vault	Large (endocranial volume 200 cc more than female	Small	(Hrdlicka,1952; Krogman,1962)
Supra-orbital ridge	Medium to large	Small to medium	(Hrdlicka,1952; Krogman,1962)
Mastoid process	Medium to large	Small to medium	(Hrdlicka,1952; Krogman,1962)
Occipital crest	Medium to large	Small to medium	(Hrdlicka,1952; Krogman,1962)
Orbit margin	Usually blunt	Usually sharp	(Hrdlicka,1952; Krogman,1962)
Orientation of forehead	Higher, receding	Lower, rounder	(Woo,1949)
Posterior root of the zygomatic	Extends above or beyond the external auditory	Terminates anterior to the external auditory meatus	(Keen,1950)
Mandible shape	Square	Rounded	(Bass,1971)

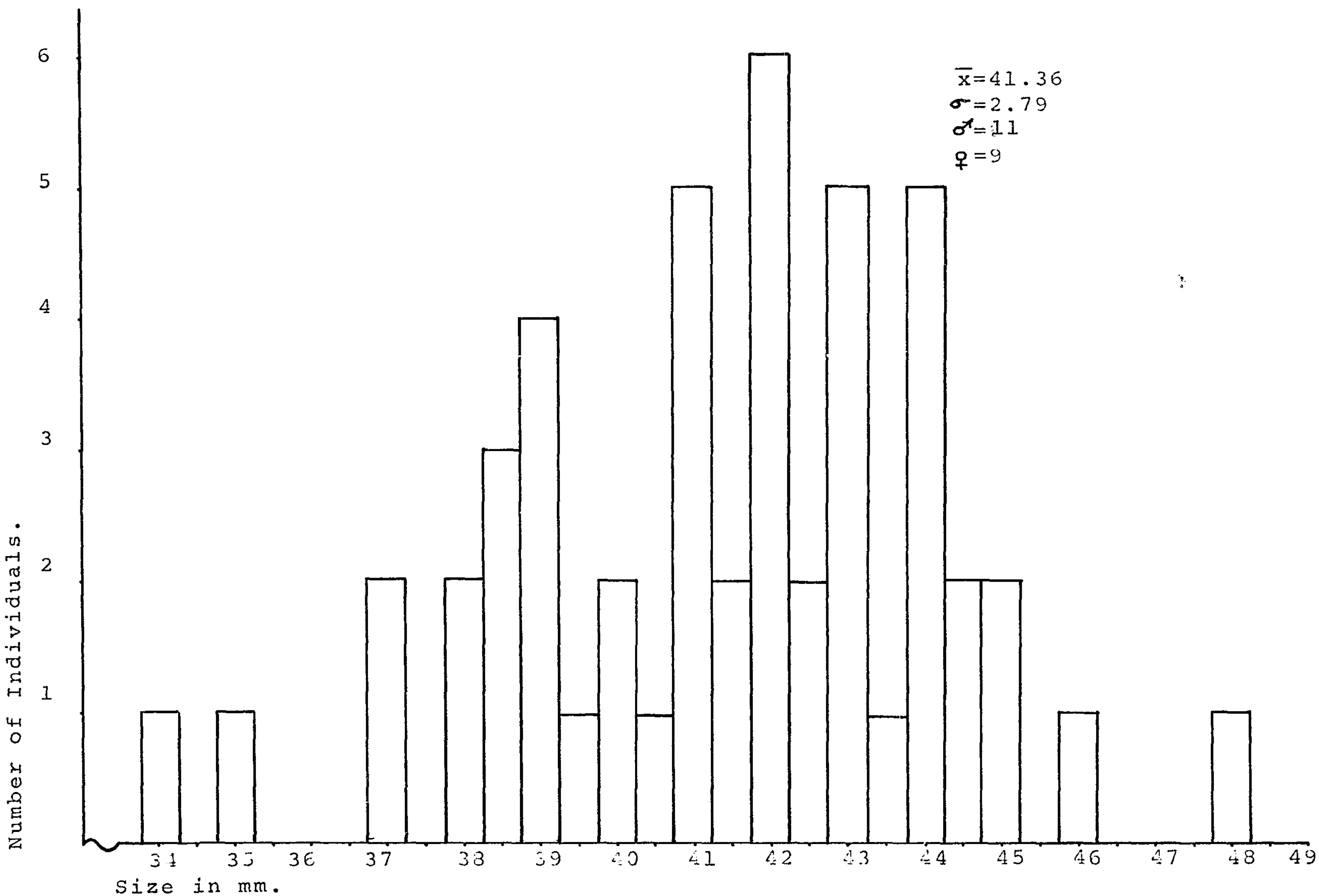
The long bones are occasionally useful for determining the sex of skeletons, with males having larger or more robust bones than females. Similarly, male long bones are characterized by pronounced tuberosities and well developed areas for muscle attachment (Krogman, 1962; Stewart, 1968). In this study, only the femur and humerus were evaluated for these characteristics and they were rated as being male, female or ambiguous in appearance. A total of 49 individuals were examined for humeral or femoral robusticity. Of these, 11 were considered to be male or female based on both bones. The remaining 38 burials were either ambiguous (21 individuals) or did not have a femur or humerus sufficiently well preserved to be observed.

Another means of establishing the sex of a skeleton is by taking the measurements of the maximum diameter of the head of the humerus and femur (Bass, 1971). The maximum diameter of the femoral head was determined for 49 of the 70 adults. Following anthropometric convention, preference was given to the left side if both femora were present but rights were used if this was the only side represented (11 right and 38 left femora were measured). It is recognized that bilateral size asymmetry can sometimes be found within individuals (Schults, 1937) but this should not seriously alter the results.

The results of this part of the analysis are presented in Figure 1 and are included in the final sex assessment presented in Table 3. For Figure 1, those individuals that exceed the mean (41.36mm) by one or more standard deviations are classified as male while those that fall below the mean by one or more standard deviations are classified as female. This method classified 9 of the 47 individuals as female and 11 as male, with 29 being ambiguous. This represents a very conservative approach to assigning sex based on this characteristic. The necessity for caution follows from the observation, made by Anderson (1963), that this measurement distributes itself as a normal curve and is, therefore, unable to securely discriminate between the sexes for those individuals that fall near the mean.

A comparison of these data from the Chiggerville series with that given by Pearson (1919), Dwight (1905) and Thieme (1957) demonstrates the need for caution, and further, for not relying upon cut off values which have been established for different populations. The use of Pearson's male-female values, derived from an analysis of seventeenth century English skeletons, would group all individuals at 43.5 mm or below into the female category. For the Chiggerville series this would include even those individuals that are almost plus one standard deviation above the mean ($\bar{x}$=41.36), with a resulting distribution of 11 males and 38 females. Similarly, Thieme's mean for males (47.17mm) from a sample of 200 dissecting room skeletons falls near the maximum value expressed for this trait at Chiggerville (48.0mm).

Figure 1. Histogram of the Maximum Diameter of Capita Femora.

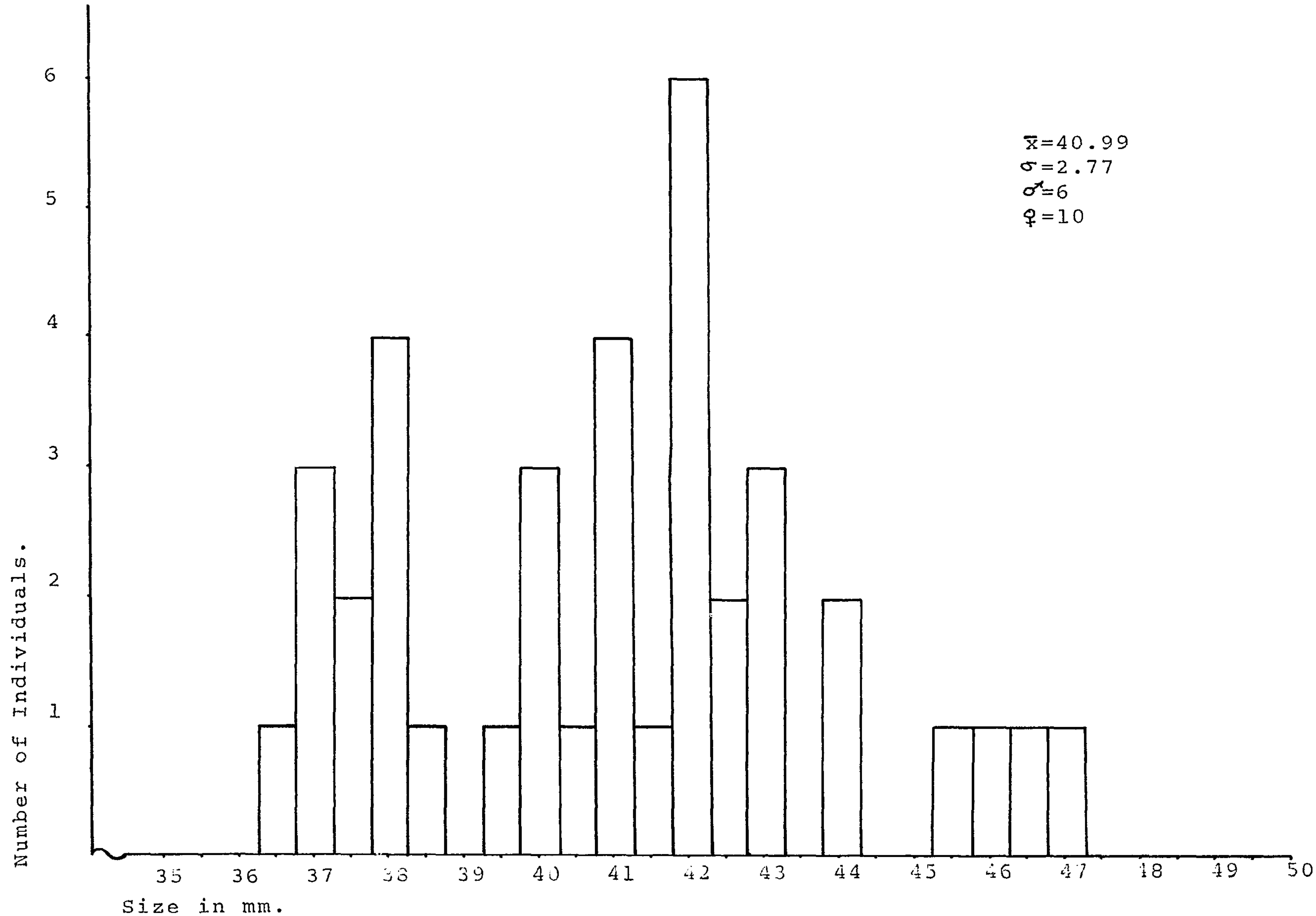


The mean for females (41.17 mm) in Thieme's study corresponds very closely with the mean for the entire Chiggerville adult group (41.36 mm).

Measurement of the maximum diameter of the head of the humerus was taken for 38 adults (14 rights and 24 lefts). The procedure for determining the cut off values and assessing sex followed that already described for the femoral head. The results of this analysis are presented in Figure 2 and included in the final sex assessment. Those burials with a maximum diameter of the head of the humerus of 44 mm or more were considered as males and those at 38 mm or less as females. This classified 10 burials as female and 6 as male, with the remainder being ambiguous.

The assessment of the 23 skeletons that were unequivocally sexed by femoral and/or humeral head diameters agrees in all instances with the consensus estimate based upon cranial and pelvic traits and long bone robusticity. In addition, there were no disagreements on those individuals that were complete enough to allow both of these observations to be made and were assigned sex on both of these traits (9 burials). There were, however, 28 burials that appeared ambiguous for either the humerus or femoral head, by falling near the extreme range but still within one standard deviation about the mean. Three of these burials, although ambiguous for one measurement, were clearly sexed by the addition of one other measurement.

Figure 2. Histogram of the Maximum Diameter of _Capitus Humerus_.



Hooton (1946:718) has suggested that "the determination of the sex from the post-cranial skeleton in adults is easy and certain in about 80% of cases, difficult but possible in another 10% of cases, and quite dubious in the remainder". Brothwell (1972) has identified two factors which contribute to this problem. First, those features which are useful for determining sex in one population may be of little value for this purpose when applied to another, unrelated population. For example, Wood-Jones (1908) found foetuses within the abdominal cavities of burials which would have otherwise been classified as male on the basis of the skeletal characters. A second problem results from the fact that sexual dimorphism is not always expressed as a definite bimodality, but that there is often a range of overlap between the sexes in skeletal morphology. In this regard, Heyns (1945) has observed that there is much less sexual dimorphism in Bantu pelves than is seen in European or Bushmen pelves.

Krogman (1962) has discussed another set of factors which create difficulties in the sexing of unknown skeletons. The first is the often fragmentary nature of skeletal remains, and a second is associated with the lack of standardization in evaluating sex differences of the skeleton. In attempting to establish standardization of sexing methods some researchers have made use of multivariate statistical analyses. This type of analysis assigns an individual skeleton to one of two classes (male or female) on the basis of a series of anthropometric variables. Multivariate sexing analyses have been performed with varying degrees of success on the cranium (Giles and Eliot, 1963; Hanihara, 1959), the mandible (Giles 1964), dentition (Ditch and Rose, 1972; Breitburg, n.d.) and the bones of the post-cranial skeleton (Pons, 1955; Thieme, 1957).

The use of multivariate sexing techniques is dependent upon being able to consistently apply a set of measurements to each skeleton of a skeletal series. Since the material from the Chiggerville Site was very fragmentary and individual burials were frequently incomplete, the application of these statistical tests was not possible. Instead, an approach was followed which relied upon the combined observations of a series of traits in the cranium and post-cranial skeleton and measurements of the head of the humerus and femur. The final sex assessment for each burial followed the suggestion of Metress (1973) and was based upon a concensus of the observed traits, although several traits, particularly those of the pelvis, were emphasized.

Summary

From a total of 70 adult burials, sex determination was possible for 62 individuals. Table 3 presents the sex assessment for each of these burials. The determinations give a total of 32 males, 30 females and 8 burials of indeterminate sex. This results in a balanced sex ratio of 1.07 males to 1.00 females.

Table 3

Sex Determinations of Adult Burials

Burial No.	Male	Female	Indeterminate	Burial No.	Male	Female	Indeterminate
1	X			41		X	
4		X		42	X		
5	X			43		X	
6	X			44		X	
9	X			45		X	
10		X		47			X
11	X			48			X
12	X			49			X
14		X		50	X		
15	X			51		X	
16	X			53		X	
20	X			54	X		
21		X		55	X		
24	X			58		X	
25		X		59			X
27		X		61	X		
28		X		65		X	
29		X		66	X		
30		X		73	X		
32	X			76		X	
34		X		77	X		
35	X			78		X	
38		X		81	X		
39		X		82			X
40		X		83		X	

Table 3 (Continued)

Burial No.	Male	Female	Indeterminate	Burial No.	Male	Female	Indeterminate
89	X			107		X	
92	X			108		X	
93	X			109	X		
94		X		112		X	
96			X	114	X		
97		X		116	X		
98	X			119	X		
101		X		122			X
103			X	123	X		
104	X			125	X		

CHAPTER III

AGE DETERMINATION

It is generally maintained that until adulthood is reached at 20 years, skeletons can be aged with an acceptable degree of accuracy by a consideration of the skeletal and dental events associated with growth and development (Genoves, 1969; Krogman, 1962). After the age of 20 years most dental and skeletal growth has ceased and aging techniques, for adults, are consequently based upon degenerative processes. The processes of adult skeletal age change do not occur with the consistency of growth events and it is therefore more difficult to assign chronological ages to adult skeletons than to subadult specimens.

Techniques for the determination of age-at-death of subadults are based upon the sequence of epiphyseal union (Krogman, 1939; McKern and Stewart, 1957), length of long bones (Johnston, 1962; Sundick, 1972) and dental calcification and eruption. Garn, Lewis and Polacheck (1959) and Lewis and Garn (1960) have shown that chronological age can be determined more accurately by assessing dental development than by observing skeletal growth. The latter two studies have also demonstrated that tooth formation and calcification are more closely correlated with age than tooth eruption.

There are several standards of dental development and eruption which can be used for age correlations, including those provided by Moorrees, Fanning and Hunt (1963 a and b), Schour and Massler (1941) and Sundick (1972 b). Merchant (1973) and Ubelaker (1974) have noted that the Moorrees, Fanning and Hunt standards are the most suitable for age determinations of subadult skeletons from archaeological context. This is because these standards were established for a large group of teeth (13) and they give the mean age and variation for each tooth. Wyckoff (1977) has applied the Moorrees, Fanning and Hunt standards for the age determinations of the Chiggerville subadults and these data have been incorporated into Table 5 and parts of Figures 3 through 6 (in Chapter 4).

Adult age determination presents special difficulties, but there are a number of available techniques and it is best to estimate age by using as many methods as possible. In this study, three different criteria were employed and these included: remodeling of the pubic symphysis, dental attrition and cancellar regression. The age estimates given by each method were derived independently from one another. The adult burials, based upon one or more of these methods, were assigned an age within a 10 year interval. This is felt necessary since these methods, like most other adult aging techniques possess too much non-age related variability to permit the use of a smaller interval.

Todd (1920) first noted that the regularity of remodeling on the pubic symphyseal face provided a useful indication of age. He was able to define 10 stages of metamorphosis beginning at age 18 years and ending at 50+ years. Each stage was defined by a type description and aging was done by comparing the specimen to the best match of the 10 stages. In a second study Todd (1921) found that there was little discernable racial variability in the age at which these stages were reached.

The reliability of Todd's method was questioned by Hanihara (1952) and Brooks (1955) when they noted that the variability of each was not adequately stressed and that there was often a considerable disparity in the ages assigned to a specimen by different observers. McKern and Stewart (1957) proposed a modification for aging the male pubic symphysis after their analysis of a group of Korean War dead. This constitutes the method of aging the pubic symphysis used in this study. The pubic symphyseal face is divided into 3 components (dorsal demi-face, ventral demi-face and symphyseal rim). Each of these components is further subdivided into 5 developmental stages. To determine the age of a specimen a comparison is made to each of the stages for the 3 components. A stage number is then assigned for each component. These numbers, when compared to a table, provide a probable age and an age range for the individual.

Gilbert (1971) established female standards for aging the pubic symphysis since it was noted that use of the male standards consistently underages female pubes which are 40 years or older (Gilbert, 1973). The method follows that already described for males and is presented in some detail in Gilbert and McKern (1973). The Gilbert stage definitions were employed for females in this study.

There were a total of only 13 pubic symphyses representing the 70 adults of the Chiggerville population. Of these 13, only 9 were complete enough to allow making age estimates. The probable ages given for these individuals ranged from 19 to 55 years. Based upon probable age and age range, 6 individuals were put into the 20-29 year interval, 1 in the 30-39 year interval and 2 were considered to have been from 50 to 59 years of age at death. The age and probable age interval of all these burials is presented in Table 4.

Schranz (1958) observed that in the proximal end of the humerus there is a regular pattern of resorption of cancellar bone and consequent expansion of the medullary cavity. He further claims that by determining the amount of cancellar regression in longitudinally sectioned humeri ages can be established within 2 to 4 year age intervals for individuals in their 20s and 10 year age classes can be used for individuals in middle age. If a roentgenogram is used, instead of a sectioned bone, the age estimate is said to be less accurate since the arrangement and density of cancellar bone is not as easily observed (Schranz, 1958;

Kerly, 1970).

The following sets forth the criteria for assigning ages on the basis of cancellar regression in the proximal end of the humerus. From 20 to 29 years the medullary cavity varies from being well below to a position just slightly below the collum chirurgicum (surgical neck). The trabeculae are in a transition from a radial to an ogival arrangement. Between 30 to 39 years the medullary cavity may approach the collum chirurgicum and the trabecular bone exhibits a partially ogival structure. By the age of 40 to 49 years, the medullary cavity has reached the surgical neck. Lacunae begin to appear between the cone of the medullary cavity and the epiphyseal line. After 50 years the apex of the medullary cavity has reached or surpassed the epiphyseal line and large lacunae appear in the tuberculum majus (greater tubercle).

In this study it was thought that the sectioning of intact humeri would have been counterproductive in terms of results achieved against the amount of destruction of bone, and roentgenograms were used instead. X-rays were taken of 14 humeri and the ages derived, following the criteria outlined above, are given for each individual in Table 4. The ages assigned to the 14 individuals are as follows: 7 individuals from 20 to 29 years, 4 between 30 to 39 years, 2 between 40 to 49 years and 1 at 50 to 59 years.

Miles (1963) has described a method by which the attrition of the molars can be used to provide an estimate of the age-at-death of adult skeletons. The rate of tooth wear occurs, for individual teeth, more or less regularly. Additionally, the amount of wear which takes place in known periods of time can be discerned by noting the degree of enamel and dentin attrition at the ages of 12 and 18 years, which are the respective times of eruption of the second and third molars. Once the rate of attrition is known this can then be projected forward to provide an estimate of how much wear would occur at different ages.

When the rates of wear become known the functional age of a tooth can be assigned. This refers to the length of time a tooth has been a functioning unit (Miles, 1963). For example, a first molar with a functional age of 12 years would indicate a chronological age of approximately 18 years for the individual. The functional age of a molar is determined by the length of time it has operated and by its position in the molar series. Murphy (1959) has noted that there is a gradient of wear, as a result of which the first molar wears more rapidly than the second and the second more rapidly than the third. Miles (1963) has attempted to quantify this by expressing the wear gradient in the ratio of 6:6.5:7. This means that it takes 6.5 and 7 years for the second and third molar, respectively, to reach the state of wear seen in the first molar at 6 functional years.

Therefore, if an individual had third molars which displayed 12 years of first molar wear the functional age of the third molar would be 14 years and the individual would have been between 30 and 39 years of age at death.

There are several possible sources which could introduce error into the use of attrition rates as an aging method. The time of molar eruption can vary between and within populations and a difference in the amount of time a tooth has functioned can cause variability in the functional age of teeth and consequently produce inaccuracy in the estimate of chronological age. In addition, cultural practices have been identified as contributing factors to observed differences in the rates and amount of wear (Pederson, 1949; Goldstein, 1932). Presumably, because of these and other factors of variability Stewart (1962) has criticized the use of dental attrition in the original analysis of the Indian Knoll collection (Snow, 1948) and the reanalysis of that collection (Johnston and Snow, 1961). Stewart (1962: 143) has suggested that "it is valid to use dental attrition as an aid in distinguishing a young adult from an old adult; but when it comes to distinguishing a 30 year old adult individual from a 40 year old individual attrition is no more reliable than suture closure".

In spite of these problems attrition was employed in assigning ages to the Chiggerville adults. Because of the fragmentary and incomplete nature of the remains it was the only technique that could be consistently applied to most of the adults. 59 individuals were assigned ages based upon the amount of attrition. The results of this analysis are presented for individual burials in Table 4. These 59 burials were distributed throughout the age intervals as follows: 17 individuals between 20 to 29 years, 17 between 30 to 39 years, 18 from 40 to 49 years and 7 between the ages of 50 to 59 years.

Summary

A total of 59 age determinations were made on the 70 adult burials from the Chiggerville series. Of these 59, 40 individuals were aged using only dental attrition, 14 by dental attrition and cancellar regression, 5 by dental attrition and morphological changes on the pubic symphysis and only 4 burials were sufficiently complete to allow the use of all three aging methods. A comparison of age determinations can be made on those burials for which more than one technique was employed. For the 19 burials on which age was independently assigned by two or more methods there is disagreement on only 1 burial. Burial number 30 was assigned to the 30-39 year interval on the basis of dental attrition and the 40-49 year interval by cancellar regression. The final age assigned to this burial was 40-49 years since it is generally accepted that cancellar regression allows better age determination than dental attrition.

There was however, concurrence on the assigned age intervals for the remaining 18 burials and it would seem that dental attrition, despite its inherent variability, is capable of yielding reasonable age estimates for 10 year age classes.

Table 4

Age Determinations of Adult Burials

Burial No.	Dental Attrition	Cancellar Regression	Pubic Symphysis	Age Determination
1	50-59 yr			50-59 yr
4	30-39 yr			30-39 yr
5	30-39 yr	30-39 yr		30-39 yr
6	40-49 yr			40-49 yr
9	30-39 yr	30-39 yr		30-39 yr
10	30-39 yr			30-39 yr
11	40-49	40-49 yr		40-49 yr
12	30-39 yr			30-39 yr
14	40-49 yr			40-49 yr
15	20-29 yr	20-29 yr		20-29 yr
16	20-29 yr			20-29 yr
20	40-49 yr			40-49 yr
21	40-49 yr			40-49 yr
24	40-49 yr			40-49 yr
25	30-39 yr			30-39 yr
27	20-29 yr	20-29 yr	19 (13-24)	20-29 yr
29	30-39 yr			30-39 yr
30	30-39 yr	40-49 yr		40-49 yr
32	20-29 yr			20-29 yr
34	50-59 yr		55 (52-59)	50-59 yr
38	40-49 yr			40-49 yr
39	30-39 yr			30-39 yr
40	20-29 yr	20-29 yr	26 (22-29)	20-29 yr
41	40-49 yr			40-49 yr
42	30-39 yr	30-39 yr		30-39 yr

Table 4 (Continued)

Burial No.	Dental Attrition	Cancellar Regression	Pubic Symphysis	Age Determination
43	30-39 yr			30-39 yr
44	20-29 yr		29 (25-36)	20-29 yr
45	50-59 yr			50-59 yr
51	20-29 yr		20 (16-25)	20-29 yr
53	40-49 yr			40-49 yr
54	40-49 yr			40-49 yr
55	40-49 yr			40-49 yr
58	30-39 yr			30-39 yr
59	40-49 yr			40-49 yr
61	20-29 yr	20-29 yr		20-29 yr
65	20-29 yr			20-29 yr
66	30-39 yr	30-39 yr	29 (23-39)	30-39 yr
73	20-29 yr	20-29 yr	24 (22-28)	20-29 yr
76	30-39 yr			30-39 yr
77	50-59 yr	50-59 yr		50-59 yr
78	50-59 yr		55 (52-59)	50-59 yr
81	50-59 yr			50-59 yr
83	20-29 yr			20-29 yr
89	20-29 yr			20-29 yr
92	20-29 yr	20-29 yr		20-29 yr
93	20-29 yr	20-29 yr		20-29 yr
94	20-29 yr		20 (16-25)	20-29 yr
97	40-49 yr			40-49 yr
101	40-49 yr			40-49 yr
103	40-49 yr			40-49 yr
107	40-49 yr			40-49 yr
108	40-49 yr			40-49 yr

Table 4 (Continued)

Burial No.	Dental Attrition	Cancellar Regression	Pubic Symphysis	Age Determination
109	50-59 yr			50-59 yr
112	20-29 yr			20-29 yr
114	30-39 yr			30-39 yr
116	20-29 yr			20-29 yr
122	30-39 yr			30-39 yr
123	40-49 yr			40-49 yr
125	30-39 yr			30-39 yr

CHAPTER IV

PALEODEMOGRAPHY

Brothwell (1971:111) has defined paleodemography "as the study of the demography of past populations, and especially of prehistoric and protohistoric communities". Further, he has observed that the data of paleodemography are usually derived from a study of the physical remains of earlier peoples although archaeological and "documentary" data can also be important sources of information (Turner and Lofgren, 1966; Ammerman, Cavalli-Sforza and Wagener, 1976; Dethlefsen, 1969).

Paleodemographers, like their counterparts working with contemporary groups, are interested in the vital processes (i.e. growth rates and mortality) which determine the biological structure of human societies. However, analysts of prehistoric populations face several difficulties which are not encountered by other demographers (Petersen, 1975). Brothwell (1971) and Weiss (1976) have noted that paleodemographic analysis is, first of all, confronted with the uncertainty associated with the determination of the age-at-death distribution and sex ratio of past human groups. This is partly a result of the problems of aging and sexing skeletons (discussed in the second and third chapters), but is often exacerbated by underrepresentation of infants and juveniles and variance of burial practices with different age and sex groups. In addition, there is seldom direct information on the size of the group, natality and family and social structure.

Despite these drawbacks there has been a long term interest in demographic topics in archaeology and human osteology (reviews of this literature are given in Cook, 1972; Baker and Sanders, 1972). Anthropologists are now beginning to go beyond simple description and are developing the methodology for making increasingly sophisticated statements about paleodemographic events (Moore, Swedlund and Armelagos 1975; Weiss 1973,1975). Although there are problems in applying the analytic methods of demography to prehistoric societies (Angel 1969; Howell 1976), some researchers have demonstrated the usefulness of these methods for studying the life processes of past populations (Bennett 1973; Ubelaker 1974). In addition, with an awareness of the systemic relationship between population and ecology, there has been a growing concern for analyzing the underlying causes of demographic phenomena (Angel 1968,1969,1972) and testing some of the long held assumptions about the interaction of demographic and cultural variables (Zubrow 1976).

Sex Ratio

Cavalli-Sforza and Bodmer (1971) point out that the sex ratios of modern populations do not always correspond to the expected 1:1 ratio. Males appear to be slightly favored at conception but experience slightly higher attrition than females in later developmental stages. The result is that a 1:1 ratio of adult males to females comes close enough to biological reality to accept it as a theoretical expectation.

Weiss (1972) has surveyed the published data in osteological reports and found that there are frequent deviations from the expected sex ratio. He notes that there appears to be a systematic bias, probably resulting from sexing techniques, of about 12% too many males. This can also be seen in the graph presented by Brothwell (1971:120). Whether or not it is ultimately possible to avoid this bias by employing multivariate sexing techniques remains a point of dispute. Since "inspectional" methods were used in this study, Weiss' observation was viewed as a caveat to be cautious in the determination of sex.

The ratio of adult males to females was 1.07:1. This conforms very closely to the expected 1:1 ratio. A chi-square test (x^2=.0322 at .01) confirms the fact that this ratio does not differ significantly from biological expectations.

Infant Representation

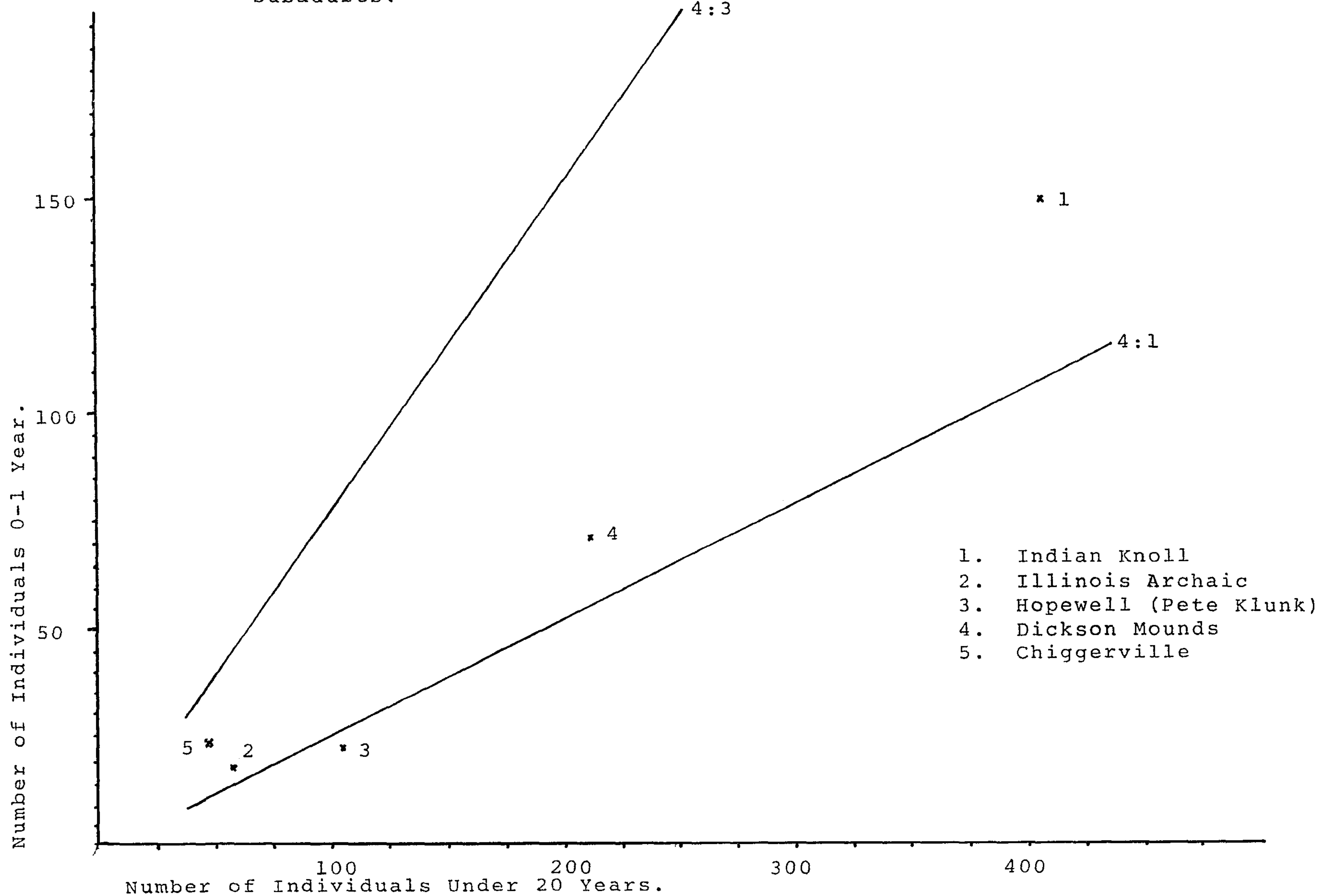
The occurrence of infant underrepresentation in skeletal samples is often cited as a significant problem in paleodemographic studies (Angel 1969; Genoves 1969). Vallois

(1960) states that the fragility of their skeletons and hostile conditions of the burial environment usually are the cause of this census error. Another factor which must be considered is the possibility of differential burial practices for different age groups. The ethnographic and archaeological literature contain numerous references to the practice of burying infants away from the usual cemetery area.

Brothwell (1971:115) has proposed a rough method for determining whether a skeletal assemblage approximates a "normal" population in the frequency of infants. He has plotted the number of children 1 year or younger against the total frequency of individuals under 20 years of age for 6 modern and 11 ancient populations. He found that the normal range appears to lie in the area bounded by ratios of 4:3 and 4:1. That is, a normal distribution is between 4 subadults to 3 infants and 4 subadults to 1 infant.

Figure 3 represents this graphically for the Chiggerville Site and 4 selected midwestern United States skeletal series. Chiggerville can be seen to be situated securely in the middle range of these values. Similarly, the Indian Knoll group, the Illinois Archaic series and the Illinois Middle Mississippian skeletons from Dickson Mounds, fall well within the normal range. The Illinois Hopewell group from the Pete Klunk Mounds appears to have fewer than the expected number of infants. Blakely (1971:47) notes this

Figure 3. Frequency of Infants Under 1 Year Plotted Against All Other Subadults.



and suggests that the individuals interred in the mounds may have represented a social elite and that children of this elite experienced better care with the consequence being a lower attrition of infants from this segment of the population.

Mortality

Mortality profiles provide a graphic demonstration of fluctuations in the relative percentages of individuals dying within all age groups. As such, mortality provides a measure of the relative stress during each age interval, with the apices of the profiles, representing higher frequencies of death.

Interpretation of the profiles is largely speculative since, as Weiss (1973:78) has pointed out, we have little understanding of the causes of mortality in past populations. However, there is probably an interaction of several factors which produce the mortality structure, including exposure to infectious disease, subsistence patterns and the nature of intersocietal contacts.

In Figures 4 and 5, the mortality profile of the Chiggerville group is presented along with four other profiles, two of hunting and gathering and two from agricultural populations. The data used to construct these profiles are given in Table 5.

The curve for Chiggerville shows that most deaths

Table 5

Frequency and Percentage of Death (Sexes Combined)
for 5 Skeletal Populations

Chiggerville n=105			
Age Interval	f	F	%
0-9	40	40	38
10-19	4	46	4
20-29	17	63	16
30-39	16	79	15
40-49	19	98	18
50-59	7	105	7
Illinois Archaic Series n=101 (Blakely, 1971)			
Age Interval	f	F	%
0-9	49	49	48
10-19	11	60	11
20-29	7	67	7
30-39	11	78	11
40-49	12	90	12
50-59	6	96	6
60-69	5	101	5
Indian Knoll n=873 (Johnston and Snow, 1961)			
Age Interval	f	F	%
0-9	308	308	35
10-19	112	420	13
20-29	203	623	23

n=Sample size; f=Age class frequency; F=Cumulative frequency

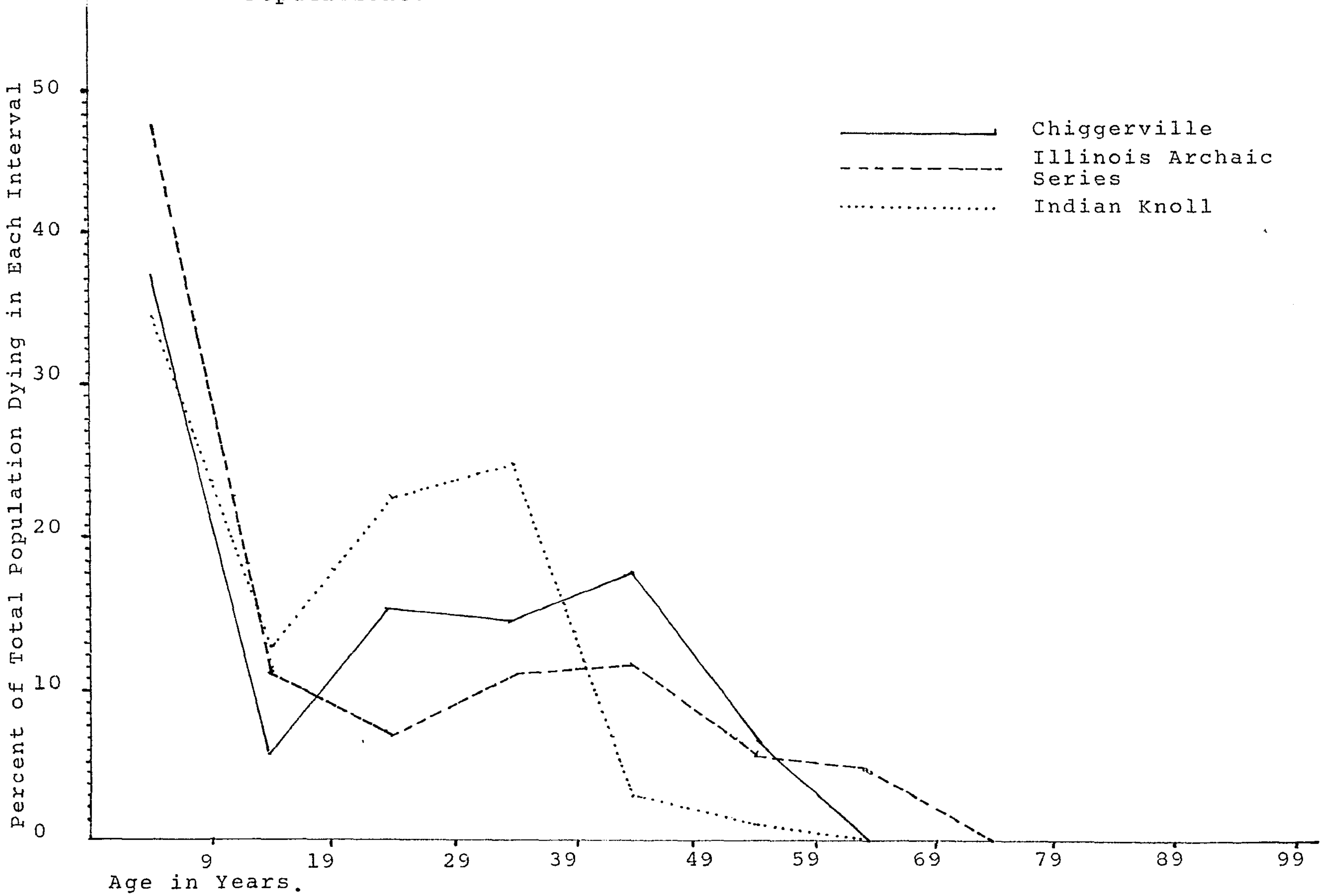
Table 5 (Continued)

Indian Knoll (Continued)			
Age Interval	f	F	%
30-39	221	844	25
40-49	28	872	3
50-50	1	873	1
Illinois Hopewell n=294 (Blakely, 1971)			
Age Interval	f	F	%
0-9	82	82	28
10-19	24	106	8
20-29	39	154	13
30-39	41	186	14
40-49	55	241	19
50-59	24	265	8
60-69	20	285	7
70-79	9	294	3
Illinois Middle Mississippian n=479 (Blakely, 1971)			
Age Interval	f	F	%
0-9	169	169	35
10-19	46	215	9
20-29	74	289	15
30-39	76	365	16
40-49	70	435	14
50-59	25	460	6
60-69	17	477	4
70-79	2	479	1

occurred during the first 10 years of life. The years of childhood and adolescence (10-19 years) are characterized by a marked decrease in the number of deaths. During early adulthood (20-29 years) there is an increase in the death frequency, while mature adults (30-39 years) experience a slightly lower frequency of death. This was probably an age period when females experienced less stress due to decreased childbearing while males were probably playing a lesser role in high risk activities associated with subsistence pursuits and intersocietal conflicts. It can also be suggested that attrition from old age had little impact on the people of this age class except near the end of the interval. The frequency of mortality increases for old adults (40-49 years), with the major cause of death probably being due to old age-related factors. Aged individuals (50-59 years) exhibit a lower frequency than the previous age classes simply because most of the population died prior to reaching this age class. Only 7% of the people in the Chiggerville series survived beyond their fiftieth year.

Figure 4 shows the mortality profiles of Chiggerville and two other Archaic Indian populations. There are few similarities between the Chiggerville and the Indian Knoll profiles after the first 10 years of life. Thereafter, it appears as though the Indian Knoll people suffered from considerably higher mortality during the early and mature adult stages than did the people at Chiggerville. This

Figure 4. Mortality Profiles of 3 Midwestern, United States Archaic Indian Populations.



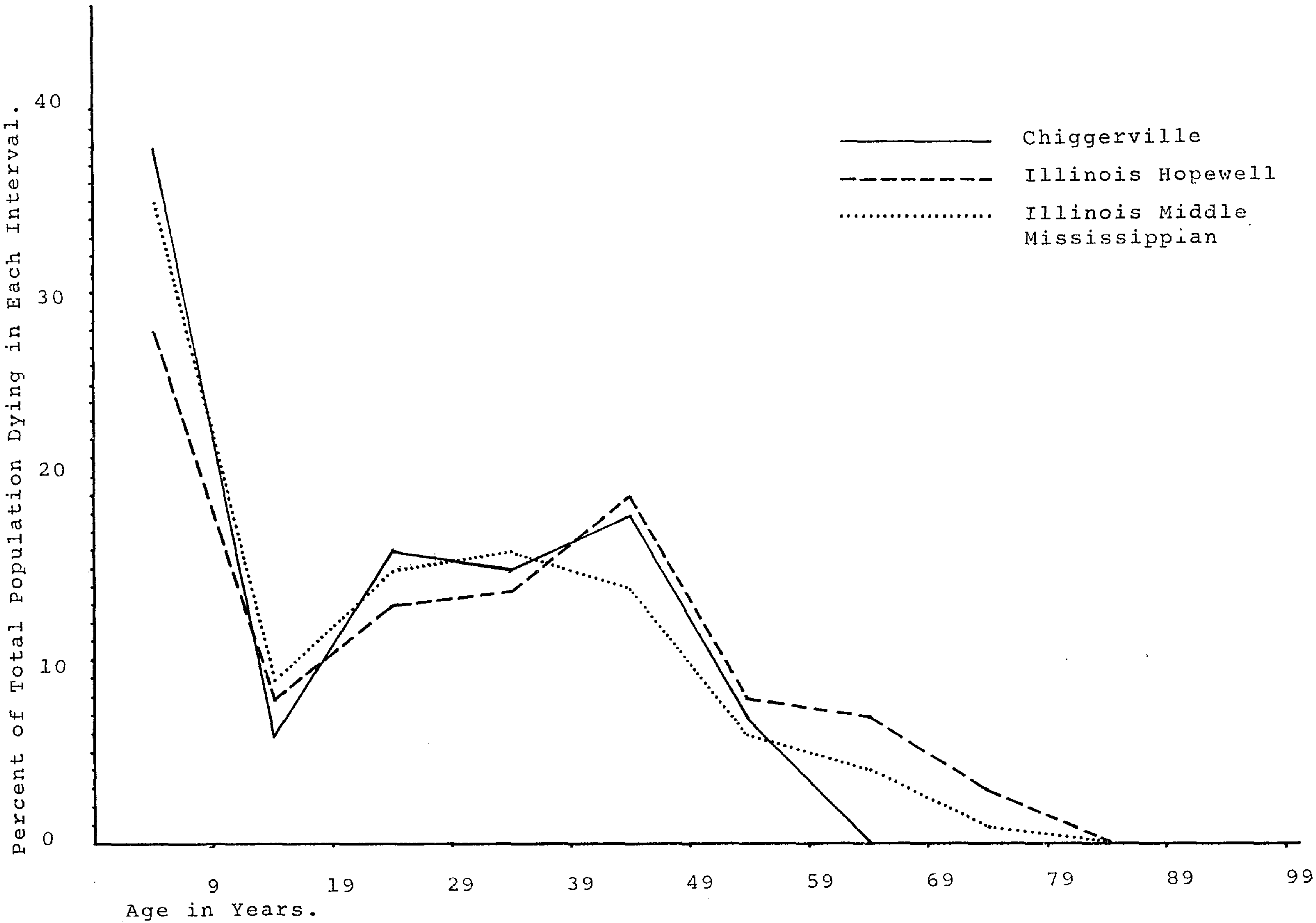
difference is reflected in the average ages for the two skeletal series. The average age at death for the Indian Knoll burials is 18.56 years while that for Chiggerville is 24.57 years. These observations are difficult to explain since it is clear from the archaeological evidence and geographical propinquity of the two sites that the same group of people are represented in both burial populations. It would seem that the disparities of the mortality data between these sites may lend additional credence to Stewart's (1962) comments regarding the problems associated with the demographic analysis of the Indian Knoll skeletons.

There are also marked dissimilarities between the Chiggerville and the Illinois Archaic profiles. The composite Illinois Archaic series experience a higher mortality rate during the first two decades of life. After this, the Chiggerville profile shows a higher mortality until the final age interval with the greatest disparity occurring between 20-29 years. In addition, the Illinois series is characterized by a slightly longer lifespan which is reflected by the 5% of the population that lived beyond the age of 60 and in the average age-at-death of 27 years.

It is unlikely that there were enough significant differences in disease patterns between Chiggerville and the Illinois Archaic series to cause the observed disparities between the profiles. The possible causes which remain, then, are either a more frequent occurrence of trauma at Chiggerville or the intrusion of sampling effects. The latter would include differential recovery of burials or the effects of the settlement patterns if there exist different patterns of mortality at individual sites within a settlement system (if the function of sites differ, this may cause a corresponding difference in mortality). Since neither of these possible causes can be evaluated we are left only with hostility in intersocietal contacts as a contributing factor. Blakely (1971) does not cite any evidence of this in the Illinois Archaic burials. Neither is there direct evidence of death due to conflict in the Chiggerville burials but it may be inferred that this contributed to the attrition of adults at Chiggerville because of the evidence of the results of hostile activities in the Indian Knoll burials (Webb, 1946). It is possible then that more frequent hostile contacts with neighboring groups is the source of the higher mortality of Chiggerville adults when compared to the Illinois Archaic series adults.

Figure 5 shows a comparison of the mortality profiles between the Chiggerville series and two agricultural populations. There are a number of similarities between the three profiles with the major difference being that none of the Chiggerville people lived beyond 59 years while 5% of the Middle Mississippian group and 10% of the Hopewell

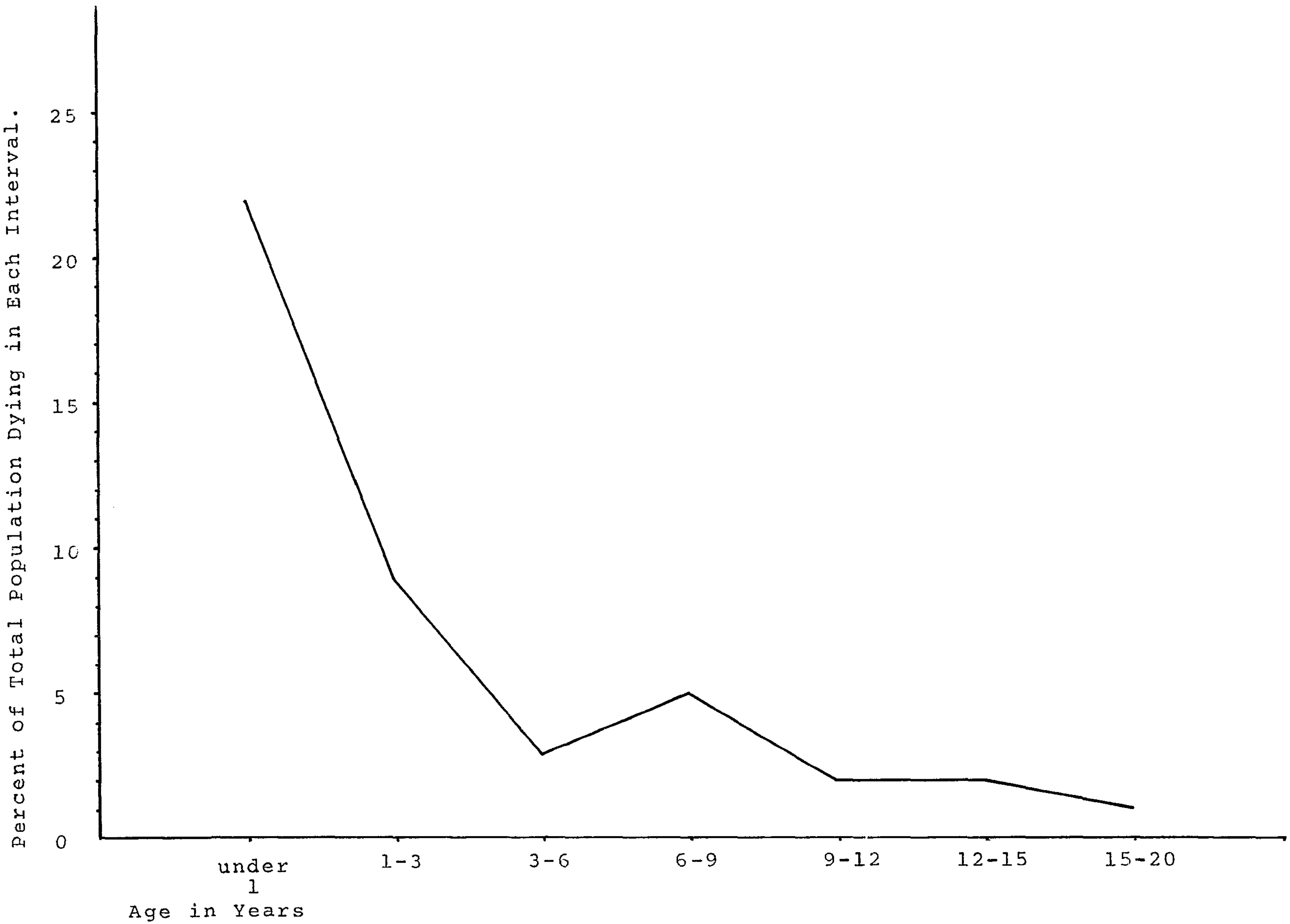
Figure 5. Mortality Profiles of the Chiggerville Site, an Illinois Hopewell Group and an Illinois Middle Mississippian Population.



people did. The similarities in the profiles are reflected in the average age at death which, again, was 25 years at Chiggerville, 30 years for the Middle Woodland Hopewell burials and 24 years for the Middle Mississippian population. The profiles reflect a slightly higher mortality rate at Chiggerville during the first three decades of life. Between 30 to 39 years the Chiggerville and the Middle Mississippian groups suffered an identical mortality rate and from 40 to 49 years the mortality rate of the Mississippian burials decreased while there was an increase for both Chiggerville and the Hopewell populations. Between 50 to 59 years the mortality experience at Chiggerville and for the Hopewell people is identical while it is slightly less for the Mississippian people.

The mortality profile of the Chiggerville Site can be better understood if it is broken down into its constituent parts. Figure 6 displays mortality from birth to 20 years, while Figure 7 breaks down the composite adult rates into sex specific rates of mortality. Adults are here defined, somewhat arbitrarily as being at 20 years of age or older or about the time when virtually all dental and skeletal growth has ceased. The first year of life is a high risk period and deaths in this age group comprise one-half of all subadult mortality. The age group of 1 to 3 years is also one of relatively high risk but mortality is considerably less frequent than during the previous period. Child-

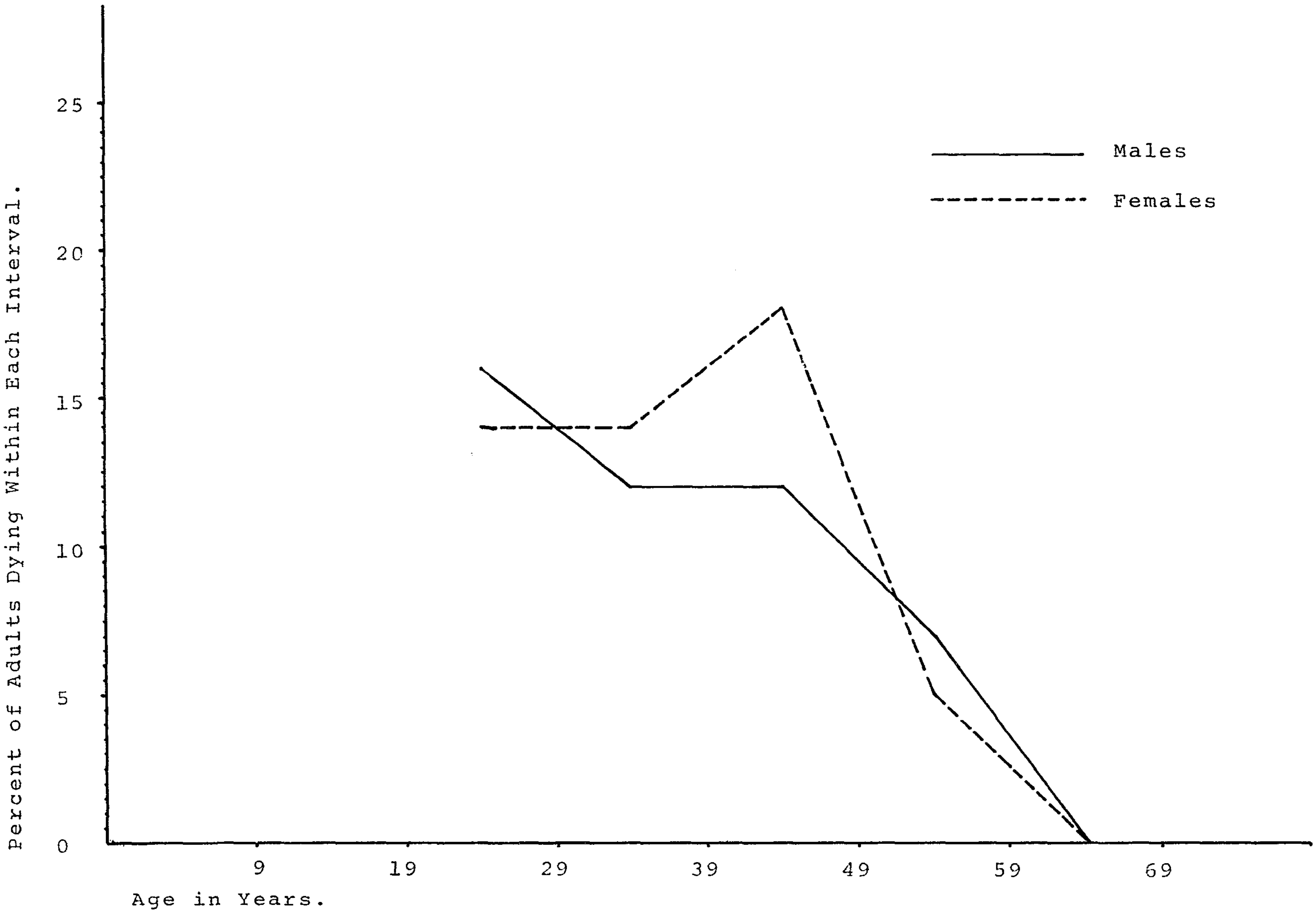
Figure 6. Mortality Profile of Subadults from the Chiggerville Site.



hood diseases are the probable cause of mortality for children of this age. It is unlikely that nutritional inadequacy is implicated here since this would show up most drastically during the weaning period which may be anywhere between 1 and 3 to 4 years. If nutritional deficiency was a factor of mortality it should be manifest in the 3 to 6 year interval as well as the 1 to 3 year interval but the 3 to 6 year age class exhibits a very low mortality rate. In addition, there was no evidence of gross nutritional distress (i.e. cribra orbitalia or enamel hypoplasia) found during the analysis of bone pathology (see Chapter 5). There is a low risk of mortality from 3 years until adulthood is reached. The years from 10 to 20 were, apparently, the most stress free in the entire lifecycle. Presumably, this was an age when the individual was subjected neither to the stress of early childhood (i.e. nutritional inadequacy or disease) nor to the dangers of occupations associated with adult status.

Figure 7 presents the separate profiles for adult males and females from Chiggerville. Interestly, males experience a slightly higher mortality rate than females for the years between 20 to 29. This phenomenon is also observed, for the same age group, in the Illinois Archaic burials where males and females have approximately equal death rates (Blakely, 1971) and in the Archaic burials from the Gray Site in which male deaths, for this age interval, exceed female deaths

Figure 7. Mortality Profiles of Adult Males and Females from the Chiggerville Site.



(So and Wade, 1975). This is an unexpected result since in anthropological populations the normal occurrance would be that females would suffer a higher attrition than males due to the hazards associated with parturition. Two possible causes must be considered. First, sampling or inaccurate sex determination of the individuals in this age interval could produce this feature. Assuming accuracy in sex reporting for these sites, it is probable that males experienced a higher mortality due to trauma incurred during intersocietal conflicts and the performance of subsistence tasks. In the next decade, females have a higher mortality rate than males, presumably, this occurs because females are still at risk of conceiving and giving birth while males, on the other hand, may have begun to play a diminished role in stress activities. The disparity between death frequencies for old adults (40-49 years) is more difficult to explain, but it may only be a reflection of the larger number of adult males that could not be assigned an age-at-death. Most of the mortality in this age class was probably a result of old age-related causes and it is difficult to understand why females would experience higher mortality than males.

Summary

The Chiggerville series has been "described" by making reference to the sex ratio, infant and subadult representation and mortality rates throughout the life cycle.

Comparisons were made between the Chiggerville profile and the mortality profiles from 4 other prehistoric skeletal series. The mortality rates of the Chiggerville people differed in several respects from the 2 Archaic groups. Chiggerville had a slightly higher subadult mortality than Indian Knoll while it was considerably lower than that observed for the Illinois Archaic Series. Adults, at Chiggerville, apparently experienced a lower mortality rate than the Indian Knoll adults while, at the same time, experiencing a slightly higher attrition than the Illinois Archaic burials.

The profiles from Chiggerville and 2 food producing groups were also compared and these were found to be similar throughout most of the life cycle. Chiggerville subadults, under 10 years, suffered a higher mortality than subadults from the Dickson Mounds and the Pete Klunk mounds although subadult mortality may not have been fully expressed at the latter site. Adult mortality was similar at all 3 sites except that the life span of the Chiggerville people appears to have been somewhat shorter than that of either the Pete Klunk or Dickson Mounds peoples.

CHAPTER V

PALEOPATHOLOGY

Paleopathology was first defined by Ruffer (1921) as being the study of diseases in earlier human societies. This is a field which draws together several disciplines and contains two major objectives (Kerley and Bass, 1967). The first is to increase knowledge about the temporal and geographical distribution of pathological anomalies in hopes of elucidating the origins of some of the major diseases (Jarcho, 1966). The second objective seeks an understanding of how "the paleopathology of a society reflects its general conditions and growth"...which then offers..."valuable clues to an understanding of the total society" (Ackernecht, 1953:39).

These two objectives have been emphasized at different times in the historical development of the field of paleopathology, with the latter objective being the more recent trend. It is, in essence, an epidemiological approach. This approach stresses the manner in which disease affects populations by a consideration of the health status of the group in terms of prevalence of disease, age-sex distributions, estimates of age-at-death and average life span of the group.

The problems that face paleopathologists in diagnosing diseases in skeletons are numerous and have been described in detail by Jarcho (1966), Wells (1964), and Janssens (1970). Many of these problems arise from the fact that hard tissue involvement in disease is secondary to soft tissue involvement, and bone, therefore, exhibits the effects of disease comparatively less often. Also, bone is capable of reacting to disease in only a limited number of ways. Therefore, different diseases can often have what appear to be the same symptoms in the skeletal system. These problems may be further exacerbated by fortuitous factors which sometimes affect the skeleton after interment (Wells, 1968). Some of these post-mortem changes occasionally mimic pathological states and may confuse diagnoses.

For these reasons, the present analysis has attempted to follow the suggestion made by Jarcho (1966) that descriptions of pathological lesions be given rather than simply offering diagnoses. It is felt, however, that a diagnosis can be helpful to other researchers and, therefore, one will be offered as an accompaniment to detailed descriptions of the pathological conditions observed in this study.

Degenerative Changes

Almost all degeneration of the skeletal system in the Chiggerville people resulted from arthritis in joint areas or osteoporosis of trabecular bone.

Osteoarthritis is a condition in which the cartilage of a joint deteriorates, followed by an alteration of the subchondral bone. This can include a wearing away of bone on the pressure areas (eburnation), with the result producing a shiny or pitted appearance. It can also include on the non-pressure bearing areas of a joint an ossification of cartilage which is termed lipping. This appears as an osteophytic outgrowth at the edge of the articular surface of the bone (Stecher 1961:168).

Osteoporosis is a rarefaction of trabecular bone. This type of degeneration can occur at all ages from several causes, but is usually described as part of the normal aging process (Nordin, 1970). In some aged individuals it is impossible to make up all normal calcium loss through food intake. Cancellous bone then serves as a source for calcium and, in the process, bone is resorbed. It is well established that women experience osteoporotic bone loss more often and with greater severity than men (Adams, et al. 1970).

The incidence of arthritis is reported in Tables 6 through 8. The tables give the number of times a joint surface was observed, the frequency of arthritic involvement, and the percentages of occurrence. The data are examined for side differences, sex differences and differential effects within and between joint systems.

Table 6

Incidence of Osteoarthritis in Adult Females

Articular Surface	Right Frequency	%	Left Frequency	%	Joint	%
Claviculo-Manubrial	1/7	14	0/5	0.0		
Manubrio-Corporal	1/5	20	0/3	0.0		
Costal-head	1/20	5	1/20	5		
Costal-chondral	0/20	0.0	0/20	0.0		
Acromio-Clavicular	1/10	10	1/8	12		
Glenoid Fossa	4/23	17	2/18	11	Shoulder	7
Head of Humerus	0/22	0.0	0/19	0.0		
Distal Humerus	0/20	0.0	0/20	0.0	Elbow	3
Proximal Radius	1/16	6	0/9	0.0		
Proximal Ulna	2/19	11	1/18	6		
Radio-Ulnar (Prox.)	1/11	9	0/13	0.0		
Radio-Ulnar (Dist.)	1/10	10	0/9	0.0		
Distal Radius	0/13	0.0	1/10	10	Wrist	2
Distal Ulna	0/14	0.0	1/14	7		
Carpals	0/22	0.0	0/22	0.0		
Carpo-Metacarpal	0/22	0.0	0/22	0.0		
Metacarpo-Phalangeal	1/25	4	0/25	0.0		
Interphalanges (Prox.)	3/26	12	0/25	0.0		
Interphalangeal(Dist.)	1/26	4	0/25	0.0		
Sacro-Iliac	7/15	47	4/15	27		
Symphysis Pubis	1/7	14	0/6	0.0		
Acetabulum	2/20	10	2/20	10	Hip	5
Head of Femur	0/20	0.0	0/21	0.0		
Distal Femur	2/22	9	4/21	19	Knee	9
Proximal Tibia	0/10	0.0	1/19	5		
Patella	0/20	0.0	0/20	0.0		

Table 6 (Continued)

Incidence of Osteoarthritis in Adult Females

Articular Surface	Right Frequency	%	Left Frequency	%	Joint	%
Tibio-Fibular (Prox.)	1/15	7	0/16	0.0		
Tibio-Fibular (Dist.)	0/15	0.0	0/14	0.0		
Tibio-Talar	0/24	0.0	0/22	0.0	Ankle	9
Intertarsal	3/22	14	5/23	22		
Tarso-Metatarsal	1/22	5	2/23	9		
Metatarsal-Phalangeal	1/23	4	1/24	4		
Interphalangeal (Prox.)	1/23	4	1/25	4		
Interphalangeal (Dist.)	1/23	4	1/25	4		

The percentages indicate that there may be slight differences in the incidence of arthritis between the right and left sides. For females, in which there was a bilateral arthritic involvement for a joint, side differences were found on 8 surfaces. These include: the acromio-clavicular joint, the glenoid fossa, the proximal end of ulna, the sacrum, the sacro-iliac auricular surface, the distal end of femur, the tarsal-metatarsal junction, and in the intertarsal region. There were also 13 surfaces which showed arthritis on one side but not the other. Males exhibit side differences on five surfaces on which there was a bilateral occurrence of arthritis. These include: the head of the ribs, the glenoid fossa, the proximal end of tibia, the patella and on the intertarsal surfaces. In addition, there were 10 surfaces which displayed arthritic changes on only one side. It is difficult to ascribe any significance to these observed side differences because of the small sample sizes, since for no anatomical feature was there a side disparity of more than three in the raw counts.

This same problem applies in the attempt to discern male-female patterns in the frequency of arthritis. Generally, osteoarthritis of diarthrodial (freely moveable) and amphiarthrodial (partially moveable) joints affects the Chiggerville males and females in more or less equal proportions. Normally, females would be expected to show a greater frequency of arthritic changes since they are

Table 7

Incidence of Osteoarthritis in Adult Males

Articular Surface	Right Frequency	%	Left Frequency	%	Joint	%
Claviculo-Manubrial	2/14	14	0/16	0.0		
Manubrio-Corporal	1/8	12	0/7	0		
Costal-Head	6/19	32	4/19	21		
Costal-Chondral	3/19	16	3/19	16		
Acromic-Clavicular	0/15	0.0	1/13	8		
Glenoid Fossa	3/20	15	3/23	13	Shoulder	10
Head of Humerus	0/27	0.0	3/22	14		
Distal Humerus	0/24	0.0	0/22	0.0	Elbow	1
Proximal Radius	0/22	0.0	0/16	0.0		
Proximal Ulna	0/26	0.0	2/26	8		
Radio-Ulnar (Prox.)	0/20	0.0	1/22	5		
Radio-Ulnar (Dist.)	0/17	0.0	0/14	0.0		
Distal Radius	0/14	0.0	0/15	0.0	Wrist	0
Distal Ulna	0/17	0.0	0/13	0.0		
Carpals	0/17	0.0	0/18	0.0		
Carpo-Metacarpal	0/23	0.0	0/23	0.0		
Metacarpo-Phalangeal	0/23	0.0	0/22	0.0		
Interphalanges (Prox.)	0/23	0.0	0/23	0.0		
Interphalangeal(Dist.)	0/23	0.0	0/23	0.0		
Sacro-Iliac	1/20	5	0/15	0,0		
Symphysis Pubis	0/3	0.0	0/1	0.0		
Acetabulum	0/23	0.0	0/23	0.0	Hip	2
Head of Femur	1/25	4	1/26	4		
Distal Femur	3/29	10	0/25	0.0	Knee	8
Proximal Tibia	3/19	16	1/18	6		
Patella	2/19	11	1/16	6		

Table 7 (Continued)

Incidence of Osteoarthritis in Adult Males

Articular Surface	Right Frequency	%	Left Frequency	%	Joint	%
Tibio-Fibular (Prox.)	0/14	0.0	0/17	0.0		
Tibio-Fibular (Dist.)	1/11	9	0/13	0.0		
Tibio-Talar	0/18	0.0	0/17	0.0	Ankle	6
Intertarsal	3/21	14	2/21	10		
Tarso-Metatarsal	0/23	0.0	0/23	0.0		
Metatarsal-Phalangeal	0/23	0.0	0/22	0.0		
Interphalangeal (Prox.)	0/23	0.0	0/22	0.0		
Interphalangeal (Dist.)	1/23	4	0/22	0.0		

affected by rheumatoid arthritis at least three times more often than males (Bourke, 1967). The only differences which are probably real patterns and not the result of small sample sizes are seen in the ribs, the sacro-iliac auricular surface and in segments of the vertebral column. Adult males exhibit an arthritic involvement in the ribs in 32% of the skeletons which had some of these bones present. Only 5% of the adult females were similarly affected. On the sacro-iliac surface males exhibited evidence of arthritis in 5% of the observed right innominates while it was not recorded at all for the left side. On the other hand, observed female innominates were affected with a rate of 47% for the right side and 27% for the left side.

The vertebral columns presented special problems since they were, in most burials, extremely fragmentary and reconstruction would have been virtually impossible. Therefore, instead of noting the incidence of arthritis for each individual vertebral body, it was necessary to group observations for each major vertebral segment. Counts were made each time a vertebral region was represented as well as the number of times each region displayed at least one instance of arthritis or osteoporosis. These data are presented in Table 8.

Females appeared to have suffered more from arthritic involvement in all regions of the vertebral column than men. This is especially marked in the thoracic region and the

Table 8

Incidence of Arthritis and Osteoporosis
in the Vertebral Column

	Arthritis Frequency	%	Osteoporosis Frequency	%
Males				
Cervical	9/24	37	6/24	25
Thoracic	11/29	38	3/29	10
Lumbar	15/26	58	10/26	38
Sacral	8/10	80	0/10	0.0
Coccygeal	0/1	0.0	0/1	0.0
Females				
Cervical	9/26	35	5/26	19
Thoracic	7/29	24	1/29	3
Lumbar	16/28	57	2/28	7
Sacral	3/13	23	0/13	0.0
Coccygeal	0/2	0.0	0/2	0.0

first sacral vertebra. For the thoracic vertebrae females were affected in 38% of the observed individuals as opposed to 24% of the males. Females also showed arthritic involvement of the superior margin of the first sacral body in 80% of the observed individuals versus a rate of 23% for males. Concomitantly, females show erosion of bone on vertebral centra in all regions more often than males. This is most evident in the lumbar series where 7% of the observed males exhibit eroded vertebrae while the rate is 38% for the observed females.

The tabulated data clearly show that there is a difference in the incidence of arthritis for corresponding bones at the same joint. This condition has also been observed in the Fairty Ossuary (Anderson, 1963) and in the Gust Island burials (Cybulski, 1973). In the Chiggerville females this occurs at all of the major joints. It is especially marked at the shoulder where the glenoid fossa is affected with a rate of 17% and 11% for the right and left sides, while the head of the humerus was not affected. At the elbow the humerus and the left radius were unaffected but the right radius exhibited arthritis 6% of the time. The right ulna had an incidence of 11% while the left was arthritic in 6% of the observed individuals. The right and left acetabulae had an incidence of 10% while the proximal end of the femur was not affected. At the knee, the femur has an incidence of 19% on the left and 9% on the right side. This contrasts to a rate of only 5% on the left proximal tibia and an absence of arthritis on the right.

Males show a similar pattern but it is not as marked. Arthritis occurs at the glenoid fossa with a rate of 15% for the right side and 13% for the left. The head of the humerus was affected 14% of the time on the left side but was unaffected on the right. The acetabulae were unaffected but the right and left proximal femora exhibited an incidence of 4%. At the knee, the distal end of the femur was affected on the right side in 10% of the cases and was not affected on the left while the proximal end of the tibia showed an incidence of 16% and 6% for the right and left sides.

The pattern of differential incidence at individual joints suggests that concave surfaces are more often affected than convex ones. In the major joints, the only exceptions to this generalization are at the knee for females and in the hip for males.

Regional differences for the 6 major joints were examined by combining the incidence of affected surfaces within one joint system. The sample sizes for all areas is adequate and it appears as though there are some slight regional differences. In males, the most frequently affected joint is the shoulder (10% of the surfaces) while the ankle and wrist are not affected at all. The highest incidence, in females, occurs at the knee and the ankle (9%

of combined surfaces at both joints) while the least affected is the wrist (2% of the surfaces).

Trauma

A total of 9 healed fractures of the upper and lower limb were observed in 6 individuals. In addition, one case of hip dysplasia was noted. Descriptions of these burials and traumatic lesions are given below.

There were also 10 compression fractures observed in 9 individuals. All of the vertebrae affected by this type of trauma appear wedge-shaped in cross section and the superior one-half of the vertebral body is the part that has been altered to produce this shape. In one case (Burial 11) a compression fracture was associated with a "cyst-like" formation approximately 1 cm. in diameter. This vertebra, like all others subjected to compression fractures, displayed a generalized erosion of trabecular bone throughout the vertebral body and an increase in the density of bone in the area immediately below the superior surface of the centra. In addition, greater densities of trabecular bone were also observed at the ventral margin of the collapsed vertebrae. This type of fracture is most often seen in lumbar vertebrae (7 cases) although thoracic vertebrae are also affected (3 cases). The burials that exhibited compression fractures were: 14, 21, 25, 34, 33, 58, 66, 97 and 101.

Descriptions of Traumatic Lesions

Burial 9. Male between 30-39 years.

The shaft of the right radius was fractured near the distal end. The bone realigned well and was well healed. There was little callus formation which indicates that the injury which caused the fracture had occurred long before the death of the individual. The right ulna was also present but showed no indications of having been subjected to the traumatic insult which had caused the fracture of the radius.

The right third metacarpal had been fractured at the proximal end. This bone healed well and there is some callus formation present.

Burial 11. Male between 40-49 years.

The right fifth metacarpal exhibits a fracture of the shaft. There is little callus formation and the distal end is inclined more towards the palmar surface than normal.

The shaft of the left tibia was fractured near the distal end. The bone was well aligned and most of the callus formation had been resorbed. The fibula was not complete enough to determine if it had been involved in the trauma which had caused the fracture of the tibia.

Burial 14. Female between 40-49 years.

On the shaft at the proximal end of the right femur is a great proliferation of bone which is situated primarily on the posterior section of the bone. This osteophytic growth is inclined linearly in the direction opposite that of the linea aspera. Above this is another, somewhat flattened and more extensive area of bone proliferation. This extends to include the posterior, medial and anterior aspects of the bone. The head is greatly distorted and flattened and appears as if it was attached directly to the shaft with the neck being almost completely obliterated. Along part of the margin of the head is a small area of eburnation.

Neumann (1967:9 and Figure 8) has discussed a lesion similar to this one and he has interpreted this to be the result of a traumatic experience prior to the fusion of the epiphysis and the diaphysis, which then arrested the normal growth pattern.

Burial 38. Female between 40-49 years.

The distal end of the left ulna is the site of a healed fracture. The region of the styloid process has been greatly flattened but the shaft does not appear to have been affected. Accompanying this is a marked area of eburnation on part of the lateral margin of the distal articular surface. The carpals do not appear to have been subjected to the trauma which caused this lesion.

The right femur and right innominate exhibit the most dramatic instance of pathology in this skeletal collection. These bones are in a very fragmentary condition but were complete enough to allow a determination of hip dysplasia (traumatic dislocation of the femur). The femur was pulled from the acetabulum and created a pseudo-acetabulum superior to the original one. This new acetabular socket was formed by a great proliferation of bone above the rim of the original acetabulum. The pseudo-acetabulum is very irregular with numerous vascular foramina and channels on its surface. Similarly, the femur head is distorted and badly pitted on the articular surface.

The lower limb is incomplete and fragmentary but the little reconstruction that was possible revealed some of the sequellae that are associated with this type of pathology. There is an obvious atrophy of the distal end of the right femur. The condyles were not complete enough to allow making any of the standard measurements and the only measurement that could be made was the posterior width of the lateral condyle. The width of this condyle was 19 mm on the affected side and 24 mm on the left side.

Since the burial was incomplete it is impossible to state with certainty if this case of hip dysplasia represents a congenital condition or resulted only from traumatic insult. The latter is suggested since no other skeletons in the Chiggerville population display this type of pathology nor has it been reported for any other Shell Mound Archaic burial series.

Burial 123. Male between 40-49 years.

The right fifth metacarpal exhibits a healed fracture.

This fracture occurred on the shaft near the distal end. There was no displacement in the alignment of the bone and there was little callus formation.

Burial 125. Male between 30-39 years.

The right fibula shows a healed fracture at midshaft with callus formation at this point. The callus formation extends 55 mm along the shaft on the posterior side and 40 mm on the anterior side. There was some distortion in the realignment of the bone and it deviates by approximately 15 degrees from the original linear orientation of the bone.

Of the nine instances of trauma in the limbs it is probably significant that 6 fractures occurred in males while only 3 traumatic lesions occur in females (2 from a single individual). This likely reflects the greater hazards and more rigorous life of males in a hunting and gathering society.

All nine individuals with compression fractures, of the vertebrae, were mature to old adults. In addition, those are frequently associated with osteoporotic bone loss of the affected regions of the vertebral column which explains the relatively high frequency of this type of trauma in females (8 individuals).

Neoplasms

Burial 65. Female between 30-39 years.

The neoplasm on this individual appeared as a round, discrete growth of bone directly above the mastoid process on the posterior aspect of the left temporal. A similar pathology has been illustrated by Anderson (1963) and Brothwell (1967:332). Brothwell (1967) diagnoses this as an ivory osteomata which is a primary benign tumor. Brothwell (1961) has noted that, in early British populations, ivory osteomata are most often found on the frontal or parietal bones. Further, Hooton (1930) observed that at Pecos Pueblo all adult age categories were affected, but middle age adults exhibited this type of tumor most often.

Non-Specific Pathology

Burial 6. Male Between 30-39 years.

On the proximal end of the humeral shaft is an osteophytic development. This exostosis occurs linearly on the lateral margin and is located superior to the groove for the radial nerve. The pattern of osteophytes suggests a calcification of the tendinous insertions of the lateral head of the triceps muscle.

Burial 11. Male between 30-39 years.

On the right and left patellae and on both the articular and non-articular surfaces is an extensive erosion of bone. There are numerous small "cyst-like" holes which are found in greater frequency on the anterior surface. There are no abnormalities of the distal ends of the femora or the proximal ends of the tibiae associated with this pathology.

One-third of the head of the left radius has been eroded away. This erosion is confined to the medial aspect of the head and the margins are very smooth.

There are no signs of either trauma or arthritis in the radius or on the patellae. The cause of these pathologies was probably a non-specific infection.

Dental Pathology

The dental pathologies encountered in this study are presented in Tables 9 and 10. The total number of sites (TP-S) for each tooth is the number of times a particular portion of the mandible or maxilla was present. These were counted whether or not teeth were present at the locale. Teeth observed (TO) indicates the frequency with which each tooth was present. The frequency difference between TO and TP-S is accounted for by the fact that very often teeth were observed that were not *in situ*, and in a number of circumstances teeth were present in a burial but the corresponding mandibular or maxillary structures were not. Antemortem tooth loss is designated AM. This condition can result from several factors, including: trauma, abscess formation, caries or normal wear. Antemortem percentages were derived by dividing the frequency of this event by TP-S. Caries (C) incidence rates were derived by dividing TO into the frequency of caries for a particular tooth.

Table 9

Frequency of Dental Pathologies

	TP-S	TO	AM	A	E	C
			Maxilla			
I1	87	64	4	0	2	4
I2	84	65	3	1	1	7
C	86	68	2	1	2	3
PM1	86	64	4	1	5	4
PM2	85	66	8	2	5	2
M1	83	66	8	9	17	4
M2	79	65	3	6	9	9
M3	81	67	1	0	3	7
			Mandible			
I1	112	68	8	1	1	0
I2	111	80	3	1	2	1
C	111	92	2	2	1	2
PM1	110	84	6	1	2	1
PM2	110	83	10	1	0	0
M1	111	82	13	7	14	4
M2	112	87	10	6	10	6
M3	112	83	7	0	0	11

TP-S=Total possible sites
TO=Total number of teeth observed
AM=Antemortem tooth loss
A=Abscess formation
E=Exposure of pulp chamber
C=Caries

Abscess (A) percentages were given in the same manner described for antemortem tooth loss. Exposure (E) describes a condition in which the attrition of the occlusal surface was more rapid than the formation of secondary dentin and the pulp chamber was then opened.

The percentages cited in Table 10 indicate that there are only slight differences in the rates of antemortem tooth loss between the maxillary and mandibular dentition. The rate for the central incisor differs by only 2% (5% for the maxillary central incisor and 7% for this tooth in the mandible). Similarly, the rate for the lateral incisor differs by only 1% between the tooth rows (4% in the maxilla and 3% in the mandible). The incidence of antemortem loss between the opposing tooth rows is identical for the canines (2%), first premolars (5%) and second premolars (9%). The first molar also shows an insignificant difference of antemortem loss. This tooth is affected with a rate of 10% in the maxilla and 12% in the mandible. The second and third molars display the greatest disparity between the upper and lower dentition. The lower second molar is affected in 9% of the observed cases while the maxillary second molar is affected only 4% of the time. The mandibular third molar was lost antemortem with a rate of 6% while the maxillary third molar was the least affected of all teeth with a rate of only 1%.

Generally the percentages indicate that the cheek teeth

Table 10

Incidence of Dental Pathologies

	AM	A	E	C
		Maxilla		
I1	5%	0.0%	3%	6%
I2	4%	1%	2%	11%
C	2%	1%	3%	4%
PM1	5%	1%	8%	6%
PM2	9%	2%	8%	3%
M1	10%	11%	26%	6%
M2	4%	8%	14%	14%
M3	1%	0.0%	4%	10%
		Mandible		
I1	7%	rare	1%	rare
I2	3%	rare	2%	1%
C	2%	2%	1%	2%
PM1	5%	rare	2%	1%
PM2	9%	rare	0.0%	0.0%
M1	12%	6%	17%	5%
M2	9%	5%	11%	7%
M3	6%	0.0%	0.0%	13%

The key to the abbreviations in this table are given in Table 9.

were subjected to more frequent loss than the anterior teeth. This is probably a result of the greatest stress being placed on the cheek teeth during the processing of food.

Abscesses are a pyogenic infection of the alveolus surrounding the root of a tooth as a result of bacterial invasion of the interior part of the tooth. These occur following trauma or advanced deterioration due to attrition or caries. With the exception of the molars, the differences between the incidence of abscess occurrence in the maxillary and mandibular teeth is insignificant. For all the teeth anterior to the molars the maximum difference between upper and lower teeth is less than 2%. The first molar displays the highest incidence of abscesses and the greatest disparity between tooth rows with a rate of 11% and 6% for the upper and lower first molar, respectively. The difference between upper and lower second molars (8% and 5%, respectively) is less than that observed for the first molar but again the maxillary tooth exhibits a slightly higher rate than the mandibular tooth. There were no abscesses observed for third molars.

Exposure in the anterior dentition occurs with only slight differences between the opposing tooth rows. The disparity between upper and lower anterior teeth is not more than 2%. The premolars exhibit a greater difference in observed incidence. The first and second maxillary premolars displayed exposure 8% of the time. The corresponding mandibular teeth were affected with a rate of 2% for the first premolar while the second was unaffected. The molars, generally, also had the pulp exposed with greater frequency than the anterior teeth. The first molar displays the greatest disparity between the tooth rows with an incidence of exposure of 26% for the first maxillary molar and 17% for the mandibular first molar. The second molar had the pulp chamber exposed with a rate of 14% in the upper arcade and 11% in the lower. The third molar was affected in only 4% of the observed cases for the maxilla while exposure was not observed in the mandibular third molar.

Caries formation is, overall, more frequent in the maxillary teeth. In addition, molars are usually more often affected than other teeth. The upper central and lateral incisors exhibit rates of 6% and 11%, respectively. Caries incidence rates for mandibular incisors are less than 1% for the central incisor and 1% for the lateral incisor. The canine exhibits only a small difference in caries rates between tooth rows. The upper canine is affected 4% of the time while the lower one in only 2% of the observations. The maxillary premolars had caries present in 6% of the observed first premolars and 3% in the second. This contrasts to rates of 1% for the mandibular first premolar and 0.0% for the second. The first molar displays a difference of only 1% between the tooth rows (6% in maxillary M1 and 5% in mandibular M1). The second molar shows a disparity of 7% with the maxillary second molar affected in 14% of the observations and the mandibular second molar with a rate of 7%. Incidence rates are only slightly divergent for M3 with a difference of only 3% (10% for the upper third molar and 13% for the lower third molar).

The people from the Chiggerville Site suffered from very poor dental health. The loss and destruction of teeth in this population is much higher than that often observed for hunters and gatherers (Brothwell, 1972:146). This can, for the most part, be ascribed to the heavy dependence upon fresh water mussels in the subsistence of the Central Riverine Archaic peoples. This food source introduced a high grit component into the diet which ultimately caused the severe dental problems described above.

Summary

From these observations of pathological disturbances in the Chiggerville skeletal material it is suggested that these people possessed relatively good health. No evidence was found of gross nutritional deficiency or congenital abnormality (with the possible exception of hip dysplasia) and there appears to be little evidence of bone infection.

The most common pathologies were osteoarthritis and dental disease. Osteoarthritis was observed in 31 adults

(44% of all individuals over 20 years). Degenerative dental conditions (including attrition) were observed in all of the adults of the population. Fractures were also a fairly common occurrence. A total of 19 fractures, of all types, were observed in 13 individuals.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Paleodemography and an epidemiological approach to paleopathology are complementary fields of analysis since both are ultimately concerned with assessing the nature of stress and providing a measure of the degree of success, in adaptation of human societies. Paleodemographic analysis describes the biological structure of past human groups and identifies the age and sex groups which were subjected to the greatest mortality during the life cycle. An analysis of the paleopathology of a population determines some of the sources of stress observed, in the paleodemographic analysis and, occasionally, the sources of morbidity (Brothwell, 1968).

The demographic analysis, based upon the age and sex determinations, was primarily concerned with comparing the mortality experience of the Chiggerville people with other prehistoric populations. This yielded some interesting although unexpected results. The Chiggerville subadults (under 20 years of age) experienced a reduced level of mortality when compared to the subadults of the Illinois Archaic Series and the Indian Knoll Site. During the adult years the mortality profile of the Chiggerville people lies between the profiles of these other 2 Archaic groups.

When the Chiggerville profile is compared to the 2 food producing populations they are found to be very similar except that subadults under 10 years had a slightly higher mortality at Chiggerville although subadult mortality overall is not greatly different at the 3 sites. An additional difference is that the Chiggerville life span was somewhat shorter than at the other 2 sites.

From these comparisons, as well as from the analysis of bone pathology, it can be inferred that the Chiggerville people possessed relatively good health in spite of the relatively shortened life span. This is indicated not only by the favorable comparisons of overall subadult mortality but also, by the decreased mortality of the 3-6 year old children (see Figure 6). This age group is a sensitive indicator of a population's health status since this group is the most susceptible to nutritional stress or disease and the deaths in this age category are not inflated by neonatal deaths.

These observations suggest that the Chiggerville people possessed a subsistence base which provided most, if not all, essential nutritional requirements and was probably not strongly affected by seasonal fluctuations. This follows from the fact that gross nutritional inadequacies or marked seasonal fluctuations would appear as an increased mortality rate in the subadult profile, especially for those children at the age of weaning (partially reflected by the 3-6 year age group). In addition, there were no cases of enamel hypoplasia in the subadult dentition. Hypoplasia of the enamel appears as pits or grooves and reflect stress conditions which occur during the growth period when the enamel is formed. This condition is a result of uncertain etiological factors although the exanthematous fevers, hypoparathyroidism and various forms of nutritional deficiency have been implicated (Scott and Symons, 1967). The absence of this type of pathology then partially confirms the supposition that the diet was adequate and that the level of health was probably good. The adult mortality profile, although less sensitive as an indicator of health conditions, also compares favorably to the food producing groups which provides some further substantiation to the idea that nutrition was adequate both in quantity and quality.

An analysis of settlement and subsistence of the Indian Knoll sites supports the hypothesis that the people of the Indian Knoll settlement system had achieved an adequate food resource base (Winters, 1969; 1974). Winters (1974) has suggested that the Indian Knoll Culture (including the Chiggerville Site) was characterized by a narrow-spectrum or harvesting economy based primarily upon the gathering of nuts and fresh water mussels as well as the hunting of deer. These basic resources were available with reliability and in such quantity that the adoption of a narrow-spectrum or "focal" economy was possible.

In this respect the hunters and gatherers at Chiggerville had achieved a level of stability, in basic resources, similar to that of populations engaged in food production. It is hypothesized, then, that it is the adoption of a narrow-spectrum economy, based upon a few essential and reliable resources, which is the basis for many of the similarities observed between the profiles of the peoples of Chiggerville, the Klunk Mounds and the Dickson Mounds.

Too much should not be made of this point, however, since it is known that different causes may produce parallel effects in mortality profiles. There were almost certainly some differences in the sources of mortality between Chiggerville and the food producing groups. The most significant of these was probably an increased disease load carried by the agricultural populations. The larger size of the agricultural communities would permit the occurrence of pathogens which can only be maintained by a large reservoir of potentially infectable people (i.e. those that have not already built up immunity). Despite this difference the other sources of mortality, such as infant diseases, intersocietal conflict and attrition associated with parturition, must have had sufficiently similar relative frequencies in the 2 agricultural groups and Chiggerville to produce the parallels observed in the curves. A final test of the hypothesis must wait for further studies. When paleodemographic data becomes available for other populations which are known to be representatives of narrow-spectrum hunting and gathering economies then comparisons can be made with other agricultural groups to determine if this is a general phenomenon or if it is unique to Chiggerville.

The paleodemography and paleopathology of the Chiggerville Site has been studied but much work still remains to be done. The findings presented here represent only the second comprehensive report on the pathology of a major Archaic Indian skeletal series. It is hoped that this information can help form the basis for the further study of disease in the Central Riverine Archaic Cultures. It is also hoped that the results of the demographic analysis will be incorporated into an expanding regional data base and that it may ultimately contribute to a better understanding of the vital biological events occurring in prehistoric human societies.

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