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HEALTH, ECONOMIC CHANGE, AND REGIONAL POLITICAL-ECONOMIC RELATIONS: EXAMPLES FROM PREHISTORY

Alan H. Goodman and Debra L. Martin

School of Natural Science, Hampshire College, Amherst, MA 01002

George J. Armelagos

Department of Anthropology, Emory University, Atlanta, GA 30322

Introduction

While political and economic factors are widely regarded to be primary determinants of health for contemporary populations, they have infrequently been considered to affect the health of prehistoric groups. This incongruity appears to stem from the notion that it is analytically difficult to link political-economic processes to health in populations long dead, and that "simple" prehistoric societies were relatively more affected by ecological than political-economic constraints. We contend that both notions are at least partly incorrect.

This paper, which explores the importance to health of core-hinterland relationships in prehistory, has been prompted by two recent publications. In differing ways both address the relevance to contemporary health research of studying the lifestyle and health of prehistoric populations. Pfeiffer, in a provocative article (1991), focuses on the need for continuities between the present and past. She suggests that one can predict the occurrence of disease in the present from prehistoric data *only* when there are continuities, of which she stresses actual genetic similarities. Eaton and colleagues, in a series of articles and a popular book titled *The Paleolithic Prescription*, have argued that the lesson to be learned from prehistory stems from lifestyle *discontinuities* (Eaton and Konner 1985; Eaton et al. 1988a, 1988b). They suggest that paleolithic humans infrequently suffered from the so-called diseases of civilization because they were active gatherer-hunters, banqueting on a rich and varied diet. The apparent lesson is that if we modern humans also wish to be healthy and happy then we need to more closely follow a paleolithic lifestyle.

Both Pfeiffer and Eaton and colleagues should be commended for their efforts to find contemporary relevance in prehistoric data. Further, we agree with both in their focus and emphasis on patterns of continuity and change. Where we differ is in what elements are most important to track. Pfeiffer's focus on genetic continuity seems to be far too narrow and unlikely to help explain the occurrence of most diseases, while the focus of Eaton and co-workers on lifestyle discontinuity is nearly equally limited. It would be sad if all that paleoepidemiology could suggest is more exercise and a superiorly balanced diet, needs most clinicians are already recommending based on clinical and epidemiological studies of contemporary humans.

In this paper we assert that the study of health in prehistory has broad relevance to the modern human condition. A large part of this relevance stems from the realization that the main forces governing health in both past and contemporary populations—such as production and control of critical resources—have remained constant. These prehistoric studies should be of interest to those studying contemporary systems as they provide a temporal dimension to political and economic processes that are ubiquitous today. Finally, prehistoric data often provide a means for analysis of how changes affect health in the long run.

It is our immediate goal to review health changes at one prehistoric site, Dickson Mounds, Illinois (ca. A.D. 950-

1300), in light of regional and interpopulational processes. Our focus is on how the health of populations at Dickson was affected by their degree of involvement in a larger economic formation, namely the Mississippian system centered at Cahokia, near East Saint Louis. In this regard, a useful conceptualization is that of core and periphery areas as was developed and is used by such authors as Wallerstein (1976, 1977), Amin (1976), and others (Arghiri 1972; Frank 1967; Polyani 1966; Williams 1966) to describe the spread of European capitalism and the development of precapitalist social formations. Additionally, building from the original formation of world systems and dependency theory, a number of authors have also begun to reexamine the relationship between class formation in the periphery and interregional relations, and have given greater emphasis to human agency and political and economic dynamics in the periphery (for examples see Chilcote 1974; Ruccio and Simon 1986; Weeks 1981). Meanwhile critics of capitalism, such as Alubo (1985), Elling (1981), Navarro (1976), Turshen (1984), and De Castro (1977), have recently utilized the concept of core-periphery to help conceptualize the adverse effects of world capitalism on health in the Third World (also see Morgan 1987 on the dangers of overuse of dependecy theory in international health). Were such relations also of importance before the development of European capitalism?

Dickson Mounds

The Dickson Mounds are a multicomponent habitation-burial complex located at the confluence of the Illinois and Spoon Rivers near the town of Lewiston, Illinois (Fig. 1). The mounds, which include the burials, have long been known to exist, but were not intensively excavated until the 1960s by Alan Harn and colleagues (Harn 1978, 1980). The picture that emerges from the archaeological analysis is one of great change in lifeways and social organization. Although this change at Dickson may have been a continuous process, it is heuristically useful to divide this change into temporal phases or horizons of occupation. In broad outline these may be thought of as pre-agricultural, transitional, and agricultural phases (Lallo 1973).

The Late Woodland (LW) occupation (ca. A.D. 950-1050) is characterized by a generalized hunting and gathering economy, with seasonal camp sites and a relatively small (75-125) and autonomous group of people. Artifacts from this time period show little evidence of trade or contact with Mississippian peoples at Cahokia, about 100 miles to the south near present-day Saint Louis, or at other areas in the American Bottoms.

Towards the end of this time period, there is evidence for increased Mississippianization of the local population. This signals a new transitional horizon, Mississippian Acculturated Late Woodland (MALW; ca. A.D. 1050-1175). In addition to a mixed hunting-gathering and

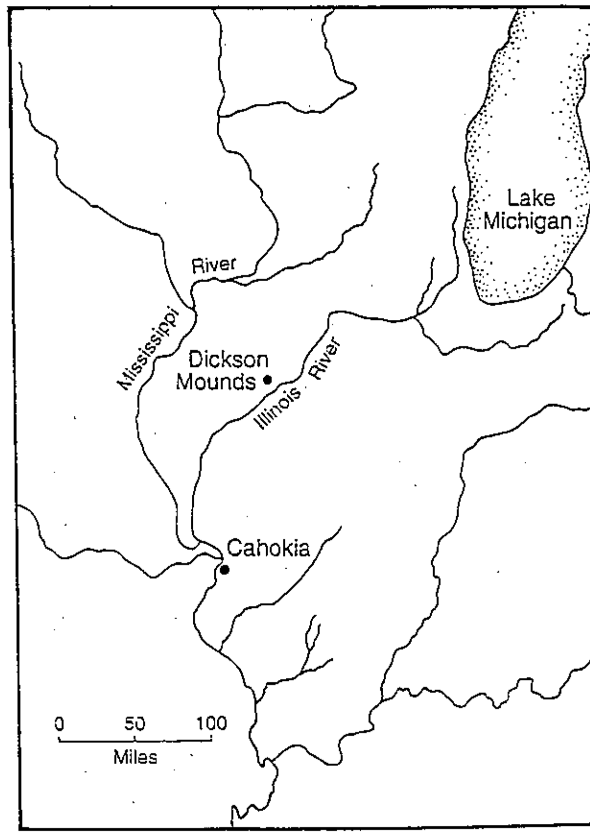

Fig. 1:
Area map showing the location of the Dickson Mounds site.

horticultural economy, during the MALW one begins to find more permanent living sites and the beginning of a village settlement pattern. Evidence for long-distance trade is seen in village refuse and mortuary offerings (Lallo 1973; Harn 1978).

Around A.D. 1175 it becomes clear that the local populations have fully entered into the Mississippian sphere of influence. During this period, called Middle Mississippian (MM; ca. A.D. 1175-1350), one sees the formation of a complex settlement pattern with ceremonial centers, hamlets, and surrounding camp sites. Population size, density, and sedentism continue to increase, and long-distance trade flourishes.

In summary, the main changes in life style at Dickson, through roughly 350 years of occupation, include: (1) intensification of and greater reliance on horticulture, (2) increased population density and sedentism, and (3) expanded and intensified trade. Fortunately, the effects of these changes on health can be directly studied because of the availability of a large skeletal collection, including individuals who lived during the pre-agricultural, transitional, and agricultural phases. The following is a brief synopsis of the paleoepidemiology of Dickson Mounds, focusing on changes in health over the 350-year period. The health indicators that are reviewed include (1) long

Table 1. Summary of select skeletal indicators of health at Dickson.

	LW*	MALW**	MM***
Mean Tibial Length† (mm)	228.6	229.2	209.0
Mean Tibial Circumferenced† (mm)	33.3	32.8	25.2
% of Enamel Hypoplasias Adults	45.0	60.0	80.0
% Porotic Hyperostosis Subadults	13.6	31.2	52.0
% Tibial Infectious Lesions	26.0††		84.0
% Traumatic Lesions Males	17.9	16.4	38.0
% Traumatic Lesions Females	23.5	16.4	31.1
% Degenerative Lesions Males	38.5	42.6	76.0
% Degenerative Lesions Females	41.2	41.0	67.4
Life Expectancy at Birth (years)†††	22-26††		20-22

*LW = Late Woodland
**MALW = Mississippian Acculturated Late Woodland
***MM = Middle Mississippian
†Based on 5-10 year age group
††Combined MALW and Late Woodland
†††Calculations from Johanssen and Horowitz (1986)

bone growth, (2) enamel developmental defects, (3) porotic hyperostosis, (4) infectious lesions, (5) traumatic lesions, (6) degenerative lesions, and (7) mortality, the ultimate indicator of adaptive failure (Goodman, Lallo et al. 1984).

Long bone growth

Stature and other anthropometric measures are commonly used as a general indicator of nutritional adequacy during the preadult period for living populations (Sutphen 1985). Rather subtle decreases in growth have significance because they have been shown to be repeatedly associated with increases in morbidity and mortality, and decreases in functions such as work capacity (see for examples Chavez and Martinez 1972; Goodman 1991; Martorell 1989). These measures are paralleled in studies of skeletal populations by analysis of long bone growth in length and circumference.

Lallo (1973) calculated the average length and circumference of long bones at Dickson by cultural horizon. He found little difference in length of long bones until about 2 years of age, when there is a distinct decrease in growth velocity for children in the Middle Mississippian. When we compared the average length of tibia for the 5-10 year age groups, we found that the mean Mississippian tibial length is significantly less than the LW or MALW tibial length ($p < .05$; 209.0 mm vs 228.6 and 229.2 mm respectively; see Table 1). Once the greater attained growth of the LW and MALW samples is achieved, they remain relatively constant until maturity. This tibial pattern is typical of the other long bones (Goodman, Lallo et al. 1984; Lallo 1973).

A similar but more pronounced difference is seen in comparing attained tibial circumferences (Lallo 1973). Tibial circumference is slightly greater in the MM at 1 year of age. However, there is little achieved growth between the ages of 2 and 5 in the MM. Therefore, the mean tibial circumference of 5 to 10-year-old MM children is significantly less than that of their age-matched LW and MALW peers ($p < .05$; 25.2 mm, 33.3 mm, and 32.8 mm respectively; see Table 1). In summary, long bone growth patterns suggest increased stress in the Middle Mississippian and highlight the period of 1-5 years of age as one in which stress may be most severe.

Enamel hypoplasias

The frequency and chronological distribution of enamel developmental defects in the Dickson Mounds population further supports the argument that the shift to agriculture had deleterious effects on the health of the group, especially during early childhood. Enamel hypoplasias are deficiencies in enamel thickness resulting from systemic metabolic disruptions (Goodman et al. 1980; see Fig. 2). The pattern of these defects on the surface of tooth crowns provides a kymographic record of stresses during the time of enamel development (Kreshover 1960). In a sense, these defects provide a window into the developmental past of an individual. Enamel hypoplasia data augment general growth data by providing further evidence for growth disruption and pinpointing periods of greatest disruption.

In terms of overall frequency, there is an increase in hypoplasia from 0.90 defects per individual during the Late Woodland to 1.61 per individual in the Middle Mississippian period (Goodman et al. 1980). The prevalence of individuals with one or more hypoplasias increases from 45% during the LW to 80% during the MM (Table 1). The chronology of enamel hypoplasia shows that the Dickson Mounds population experienced peak stress between the ages of 2 and 4, which may correspond to the likely age at the time of weaning (Fig. 3; Goodman, Armelagos, and Rose 1984). The comparison of chronologies between the earlier groups and the intensive agriculturalists at Dickson Mounds shows an earlier age of onset of hypoplasia for the latter group, suggesting an earlier onset of stress. These data are consistent with the overall pattern of earlier weaning in agricultural versus gathering-hunting societies.

Enamel hypoplasia is considered a relatively benign defect; however, we have calculated the mean age at death for those with and without hypoplasias and find startling differences (Goodman and Armelagos 1988). Overall, individuals with no lesions have a mean age at death that is 4.4 years greater than individuals with one hypoplasia and 10.2 years greater than individuals with two or more hypoplastic episodes ($p < .01$; Fig. 4). This discrepancy is even greater for the MM sample. Here the mean age at death of those without hypoplasias is 15.7 years greater than those with two or more hypoplasias ($p < .001$). The association between stress during childhood and longevity in adulthood suggests that the stresses producing these insults have very significant consequences.

There are at least two hypotheses that have been proposed to explain these difference in mean age at death. The first, a differential social buffering hypothesis, suggests that those with hypoplasia represent a group of individuals who were poorly buffered from stress due to socioeconomic status or class differences early in their lifetime and who continued to be subjected to insults during the rest of their lives. The second, a biological damage hypothesis, suggests that

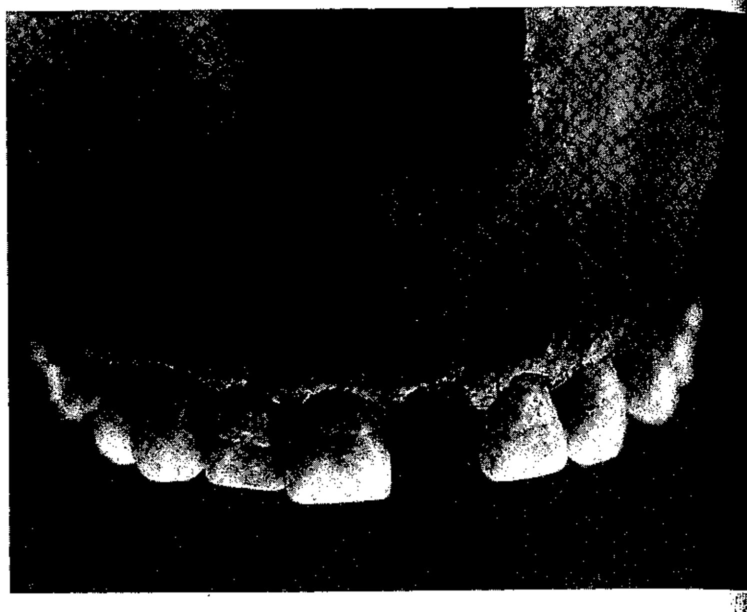

Fig. 2:
Enamel hypoplastic lesions on maxillary anterior teeth. These lines appear to have formed during a systemic stress occurring around three years of age.

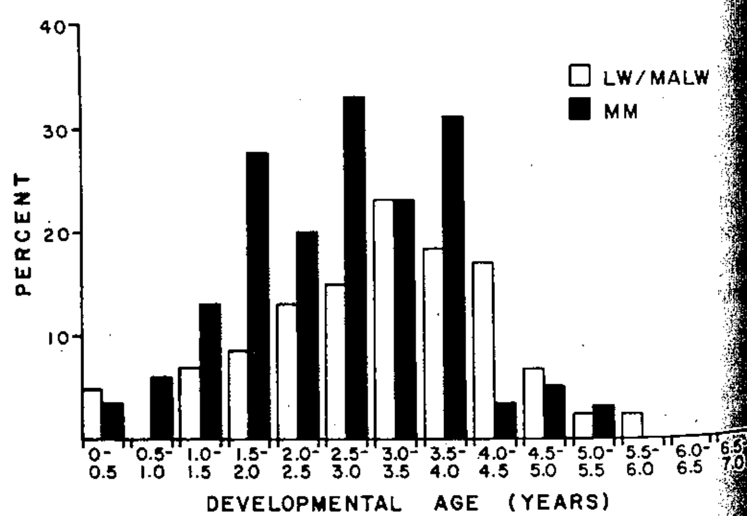

Fig. 3:
Frequency distribution of enamel hypoplasias by half-year periods in two Dickson Mounds populations: MM, Middle Mississippian; LW/MALW, Late Woodland/Mississippian Acculturated Late Woodland (Goodman, Armelagos, and Rose 1984).

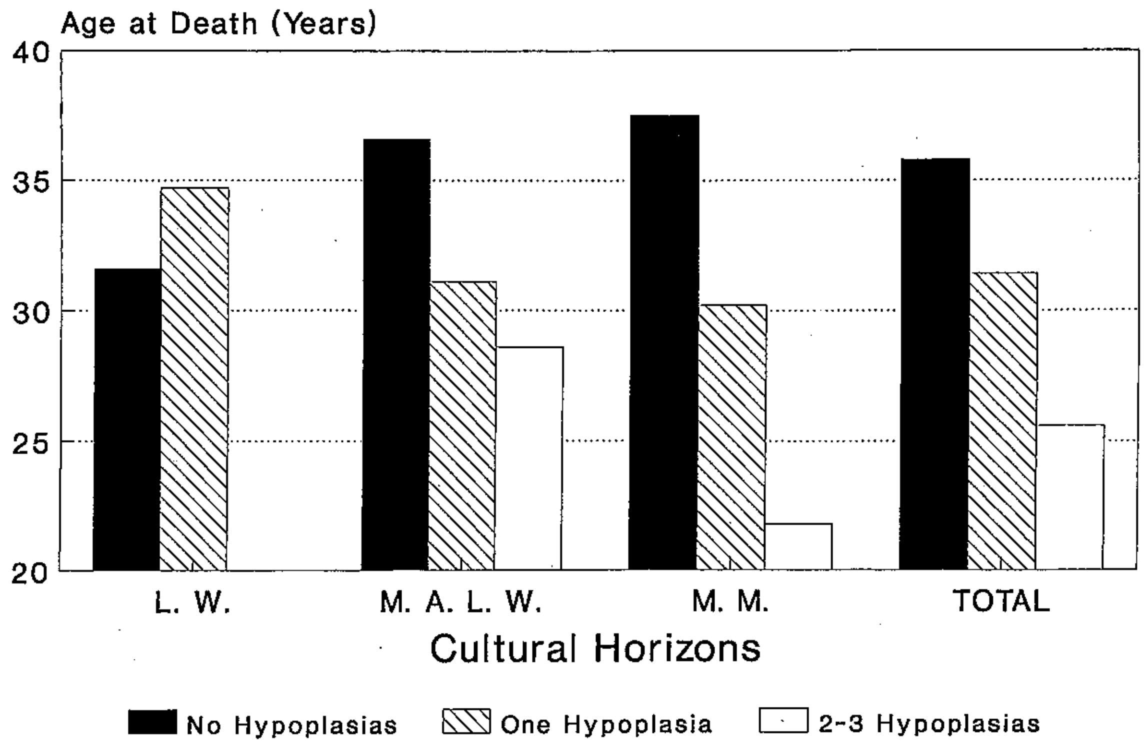

Fig. 4:
Mean ages at death of Dickson Mounds adolescents/adults by number of hypoplasias-stress periods between 3.5-7.0 years developmental age. LW = Late Woodland, MALW = Mississippian Acculturated Late Woodland, MM = Middle Mississippian (Goodman and Armelagos 1988).

early stresses leave the individual less able to rally from future insults. Although individuals may survive the stress, they are left in a damaged and weakened state. While we cannot surely distinguish which of these hypothetical mechanisms is correct, the social buffering hypothesis is consistent with an increased difference in life expectancy between stressed and non-stressed individuals in the more socially stratified Mississippian period.

Porotic hyperostosis

Porotic hyperostosis is a general term used to identify bony lesions on the superior border of the orbits and the external surface of the crania that are characterized by a thinning of the subperiosteal cortical bone and corresponding expansion of the diploe (Fig. 5). These lesions develop as a result of an anemia, and the endemic and mild nature of these defects suggests that the anemia is due to iron deficiency (Mensforth et al. 1978).

Lallo and co-workers (1977) have provided a detailed study of the presence of porotic lesions in Dickson subadult crania. Their sample consists of 238 individuals, of which 87 (36.5%) show evidence for porotic hyperostosis. The frequency of porotic hyperostosis increases from 13.6% in the LW to 31.2% in the MALW and 51.5% in the MM

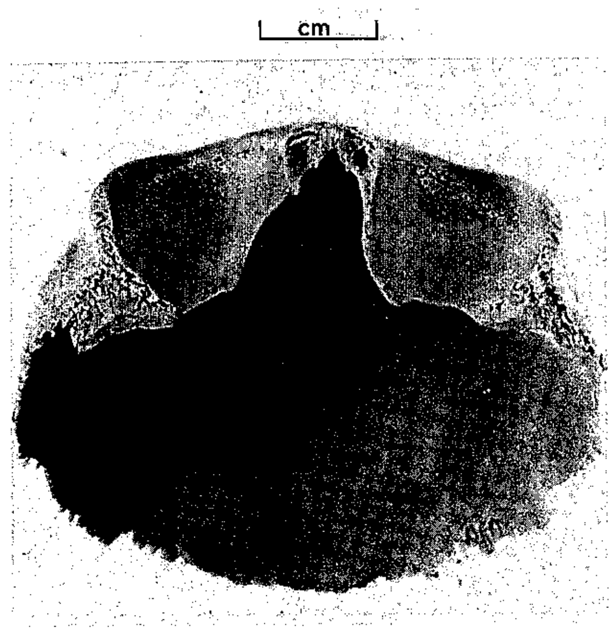

Fig. 5:
An example of severe porotic hyperostosis (*criba orbitalia*) showing an active lesion at the time of death. This specimen is from Wadi Halfa, Sudanese Nubia.

(Table 1). Differences between cultural horizons in the frequency of porotic hyperostosis are statistically significant by chi-square analysis ($p < .05$; Lallo et al. 1977).

In the LW, porotic hyperostosis is limited to the superior border of the orbits, a condition specifically referred to as cribra orbitalia and the primary site of occurrence. However, in the MALW and MM, individuals with cribra orbitalia tend increasingly to have porotic involvement at other sites, suggesting a more inclusive and a more severe manifestation. Not only does porotic hyperostosis show a four-fold increase in frequency, but the percentage of "severe" cases increases from none in the LW to 6.5% in the MALW to 17.8% in the MM (Goodman, Lallo et al. 1984; Lallo et al. 1977).

Periosteal (infectious) lesions

The percentage of individuals with periosteal bone infections (either periostitis or osteomyelitis) doubles from the combined LW-MALW horizons to the more agriculturally intensified MM period (31 to 67%; Table 1) (Goodman, Lallo et al. 1984; Lallo et al. 1978). This overall pattern is evidenced in all segments of the population: adults and subadults, females and males.

Severity of infection, based on the extent of periosteal involvement and tissue destruction, was determined for the tibia, a bone with a high rate of preservation and infection (Lallo et al. 1978). The percentage of tibiae with evidence for infection increases from 26% in the LW-MALW sample to 84% in the MM sample (see Table 1). Furthermore, of the 90 cases of tibial infection in the LW-MALW, all but 8% are slight to moderate; however, of the 163 cases of infection in the MM nearly a fourth (23%) are severe (Lallo et al. 1978). Infectious lesions increase in both prevalence and severity.

Traumatic lesions

The most common bones with postcranial fractures at Dickson are the humerus, clavicle, ulna, and radius (Goodman, Lallo et al. 1984; Lallo 1973). Since the distribution of pathologies within individual skeletons is not significantly different among cultural horizons, we have combined all postcranial fractures. For the entire sample (ages 0-65 years), the MM has a slightly higher frequency of fractures than the MALW and the LW (19.4, 16.4, and 13.4%, respectively; Goodman, Lallo et al. 1984; Lallo 1973). However, this pattern is not consistent among age and sex classes. For subadults the overall trend is reversed: LW subadults have a higher frequency of fractures than those in the MALW and the MM (10.2, 9.8, and 6.4%, respectively). Adults (males and females combined) in the Mississippian have nearly twice the frequency of traumatic pathologies as adults in the MALW and LW groups (32.4 to 16.4 and 20.5%). Finally, when data for the sexes are analyzed separately, it becomes clear that adult males, especially in the Mississippian, are most frequently affected by traumatic conditions. The frequency of traumatic lesions increases from 16.4% in MALW females to 23.5% in LW females and 31.1% in MM females, and from 16.4% in MALW males and 17.9% in LW males to 38.0% in MM males (Table 1). This increase in traumatic lesions may be a direct result of an increase in work and activity. In summary, postcranial traumatic pathologies follow the trend of increased prevalence through time. Furthermore, this trend is most pronounced for males.

Degenerative pathologies

The possibility of an increase in activity and activity-induced pathology has also been explored via an analysis of osteoarthritis, osteophytosis, and degeneration of the vertebral centrum in the Dickson populations. For all adults there is a significant increase in the frequency of degenerative pathologies (of all sites combined) from 39.7% in the LW to 41.8% in the MALW and 65.8% in the MM. This trend is similar in both sexes (Table 1; also Goodman, Lallo et al. 1984; Lallo 1973).

Mortality

Lallo and co-workers (1980) have constructed life tables for the three Dickson cultural horizons. Assuming no migration or population growth they compute mean life expectancies at birth averages of only 19 years in the MM and 26 years in the combined LW-MALW. In general, age-specific mortality and probability of dying consistently increase while survivorship and age-specific life expectancy consistently decrease through the cultural horizons at Dickson. In all age classes there is a general trend toward an increased probability of dying in the MM relative to the LW.

Johansson and Horowitz (1986) have recently suggested that the assumption of zero population growth [illegible] Dickson is unfounded. They model stability or a mo[illegible] decrease in rate of growth during the LW and a gro[illegible] rate of around .5%/year after agriculture. These changes in assumption have an effect of lessening the degree [illegible] difference in life expectancy between LW and MM ([illegible] 1); however, there remains a modest decrease [illegible] expectancy over time.

Discussion and comparisons

All indications point towards a decrease in [illegible] through time at Dickson. While morbidity and mortality levels in the pre-agricultural groups were already [illegible] high they became even higher with agriculture. What caused this decline in health? Are we ill-suited [illegible] agriculturally based diet, as Eaton and co-workers [illegible] or are other processes implicated?

Most of the indications of deficient health are [illegible] tially explainable by a decline in dietary intake [illegible] indications include the trends in growth and development of bones and teeth, the increased mortality, and the increased frequency and severity of porotic hyperostosis. Furthermore, the increased prevalence and severity of infectious disease may be related to decreased host resistance due to poor nutritional status.

The population increase associated with the changeover to agriculture probably also contributed to the decline in health. Increased population density and sedentism, coupled with intensification of contact with outsiders, could create an increased opportunity for the spread of infectious diseases. While the dietary shift hypothesis, including the effect of demographic change, offers an explanation for much of the health data, it does not easily account for the increases in degenerative and traumatic pathologies. In addition, a few other facts remain unaccounted for. If this society was experiencing difficulties providing enough food for its people then we might expect some evidence for environmental degradation due to over-exploitation. However, no such evidence exists. Furthermore, archaeological evidence at Dickson strongly suggests that gathering-hunting was never completely abandoned. Many of the local Mississippian sites have a great concentration of animal bones and projectile points used for hunting (Munson and Harn 1966). A balanced diet seems to have been available, although data on health (Goodman, Lallo et al. 1984) and trace elements (Gilbert 1975) suggest that the Mississippian diet was deficient. There is a disparity between what was produced and available and what was distributed and eaten.

We believe that the explanation to this paradox centers not on local ecological factors, but on more long-distance relationships (Goodman, Lallo et al. 1984; Goodman and Armelagos 1988). Of great potential interest is the relationship between populations at Dickson and Cahokia. It is clear that the builders of the Dickson Mounds received many of their symbolic items, such as copper-covered ear spools and marine shell necklaces, from or through the Cahokia region. Much of the health data would be explained if Dickson had been trading perishable foodstuffs for these luxury items. In particular, the diversion of meat or fish down river to Cahokia would explain the discrepancy between diet and resources.

In order to generate a surplus of foods for trade, individuals at Dickson may have had to intensify their agricultural production while continuing to hunt and gather. The increase in degenerative conditions could have resulted from this increased work load. This system could also have put increased social strain on the community, leading to internal strife. And, the accumulation of luxury items may have required protection from outside groups, such as the Oneonta to the north. This would explain why the Larson site, the main MM living area, was pallisaded.

While Dickson may be a classic case of health being negatively affected by increased involvement in a larger economic system, we believe it is not an isolated case. For example, a slightly different dynamic seems to have been played out by populations living at roughly the same time in Sudanese Nubia. Armelagos and colleagues (Armelagos 1969; Martin et al. 1984) have examined health changes to a group of intensive agriculturalists near Wadi Halfa, located in the Northern Sudan, while Van Gerven and co-workers (1981) have extended this analysis in studying populations slightly to the south at Kulabernadi. This area is not very far to the north of where a devastating drought is now affecting Sudanese populations, much as it might have during prehistoric times.

The intensive agriculturalists who tried to eke out a living in this marginal environment date to the Meroitic (A.D. 0-350), X-Group (A.D. 350-550), and Christian (A.D. 550-1350) periods. The picture that emerges from Nubia is of improved health during the X-Group period. Greene and co-workers (1974) have shown that mortality increases during the latter phase of the cemetry at Meinarti (levels 6-4, A.D. 1150-1300), while Rudney (1981) found that enamel microdefects concurrently increase. Van Gerven and co-workers (1981) suggest that health may be inversely related to political centralization. Specifically, when either the Kingdom of Meroe to the south or the Christian kingdom to the north reaches the height of its power, Nubians lose political autonomy and their health suffers. Conversely, when these kingdoms decline in power and can no longer control areas as far away as Kulubnarti, health in the periphery improves. Infants and young children appear to be particularly affected by this process.

Somewhat of a contrast to the above scenarios is seen in examining the health of the prehistoric Anasazi living on Black Mesa in Arizona (ca. A.D. 800-1150). Like Nubia, Black Mesa is a harsh and ecologically marginal environment, with a landscape dominated by desert and pinyon-juniper scrub brush. Although maize agriculture was practiced throughout the occupation of Black Mesa, other subsistence activities, including the harvesting of annuals such as chenopodium and amaranthus, have been documented to be important (Martin et al. 1991).

In order to examine trends in health over time, the skeletal series was divided into an early and a late group. During the early period on Black Mesa (A.D. 800-1050), the number and size of settlements increased, suggesting an increase in population size and density. Conversely, during the latter period (A.D. 1050-1150) the population appears to have declined, with individuals and groups moving off the Mesa.

Few significant differences have been found in comparing the patterns of health between the early and late groups (Table 2). Morbidity and mortality were generally high. For example, life expectancy at birth averaged around 25 years in both groups (Table 2). However, such high rates

Table 2. Summary of skeletal indicator of health at Black Mesa.*

	Early	Late
Mean Stature Males**	167.0	163.1
Mean Stature Females**	156.5	152.5
Mean Enamel Hypolasias (Upper I1)	1.80	2.58
Mean Enamel Hypoplasias (Lower Canine)	1.29	2.11
% Tibial Infectious Lesions Adults	57.1	42.3
% Tibial Infectious Lesions Subadults	50.0	68.2
% Porotic Hyperostosis Adults	28.6	32.0
Life Expectancy at Birth	25.5	24.9

*Data from Martin et al. (1991)
**Formulae of Genoves

are to be expected for a small, dispersed prehistoric group living in unpredictable, fluctuating, and marginal environments. Black Mesa morbidity and mortality rates are actually low in comparison to rates documented for contemporaneous sites such as Chaco Canyon and Mesa Verde that are larger and more centralized political centers.

While this might be expected if one focuses on group size and density as factors contributing to the maintenance and spread of infections, it is not consistent with an exploitation model. A partial explanation for this is Black Mesa's location on the extreme periphery of extant political centers. Successful adaptation on Black Mesa was attained because of a flexible adaptive strategy with little outside influence.

Summary

Recent archaeological research on trade and regional relationships, along with the concept of precapitalist social formations as developed by Wallerstein and others, suggests that intergroup (as well as intragroup) relationships throughout most of human prehistory were more complex, intense, and pervasive than has been generally realized. This research also suggests the need to look at health in prehistory in relationship to regional systems and interpopulation contact.

We have reviewed data on the extreme decline in health accompanying agricultural intensification at Dickson Mounds, Illinois (ca. A.D. 950-1300). In addition to increases in nutritional, infectious, degenerative, and traumatic morbidity, there is also an increase in mortality over time at Dickson. We suggest that the main factor contributing to this decline in health was neither agricultural intensification, nor the parallel increase in population, but the relationship between these factors and Dickson's increased involvement in trade and possibly exploitative relations with other Mississippian cultural groups.

These data were then compared to those for similar small-scale agricultural societies from Sudanese Nubia (ca. A.D. 0-1350) and Black Mesa, Arizona (ca. A.D. 850-1150). Health generally improves when groups such as these, located on the periphery of political-economic systems, are left on their own. Conversely, when these societies become increasingly involved in exchanges with core areas, health invariably declines.

How is it that increased involvement with larger economic systems, which is frequently cited as "progress" and involves economic growth, might have a negative effect on the health of local populations? We suggest that the process may be as simple as trading foods for items of symbolic value. While such a process might initially be without harm if there is an excess of foods, the process may continue to the point where needed foods are being traded away and health is compromised. This scenario may seem to make little sense from an objective, outsider's perspective; however, similar situations have often occurred in historical and modern times. An indigenous group with little political or economic clout learns that it can trade something it has access to (sugar cane, alpacas, turtles) for something it greatly admires (radios, metal products, alcohol), but only through trade with a more powerful group. Group members do not perceive that the long-term health results of such a trade are usually unfavorable. Nor are all such "trading agreements" strictly voluntary. The pattern of health at Dickson is seen in most situations where there is a decline in access to, and control over, resources. For example, lower classes in stratified societies live shorter lives and suffer more from nearly all major diseases.

Agriculture is not invariably associated with declining health. The recent volume edited by Cohen and Armelagos (1984) includes health data from 23 regions of the world where agriculture developed. In many areas, such as at Dickson, there is good evidence of a decline in health with agriculture, but this is not a universal pattern. Perhaps a decline in health is more likely to occur when agriculture is intensified in the hinterlands of a political system. Groups living far away from the centers of trade and power are apt to be at a disadvantage. They may send the best fruits of their labors to market and receive little in return. And during times of economic turmoil they may be the ones to suffer the most as resources are concentrated to maintain the central parts of the system.

The adaptive problems faced by these populations are intriguing and suggest a number of lessons for modern humans. However, we suggest that the intrigue and the lessons are different from those suggested by Eaton and colleagues (Eaton and Konner 1985; Eaton et al. 1988a, 1988b) and Pfeiffer (1991). As wealth began to develop so did inequities, both within and between regions. These inequities cannot be overlooked in explanation of patterns of health in prehistory. In a sense, the situation at Dickson may parallel many of the most persistent problems we see today. Due to increased monetization, shifts in markets, and lack of control over pricing, small groups in the sociopolitical hinterlands find themselves unable to meet basic needs they could once meet by reliance on local resources and labor. The lesson to be learned from these prehistoric data is that economic exploitation, on a regional level, may be as old as the origins of agriculture. Moreover, the determinants of health in prehistory may be no different than the causes one finds today. Control of and access to essential resources was as critical to health then as it is now. Life style and health are invariably linked to politics and economics.

Acknowledgments

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