A HOPI SOCIAL HISTORY

Anthropological Perspectives on Sociocultural Persistence and Change

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Southwestern populations. An inescapable conclusion is that the structure of settlements and settlement patterns, a determining factor of community interaction levels, may have been the most important determinant of how severely a particular disease affected a given population. This also suggests that estimating mortality due to disease in the contact period must be undertaken on grouped data using similar kinds and sizes of settlements.

Second, the investigation of the clinical manifestations and infectivity of smallpox revealed that direct person-to-person contact is not required for the disease to spread. Aerial convection, flies, contaminated clothing and food, and even animals can transmit the disease with the same deadly result because the smallpox virus can survive for long periods outside of the host. Climatic conditions, in particular relative humidity and temperature, are the determining variables in the virus' survival. Through the use of regression analysis, relatively precise climatic conditions have been specified. As we turn now to the American Southwest, the data generated above can be used to assess how smallpox may have spread during the early contact period.

Smallpox and the American Southwest

We begin this section with the caveat that direct application of the disease model presented earlier in this chapter is not presently possible. Accurate demographic data and information on prehistoric Southwestern community interaction patterns are not available. Nevertheless, there are data on Southwestern contact history indicating that smallpox could have been transmitted to native populations prior to direct, face-to-face contact with the Spanish. Additional data suggest that Southwestern climatic conditions were ideal for the survival of Variola virus outside of the host. If the following scenario is correct, mortality rates generated by the disease model can be used to account for population loss among contact-period Southwestern peoples.

Like most other types of historical information, the evidence for epidemic smallpox in the American Southwest before A.D. 1800 is sketchy. Dobyns offers the most complete treatment to date about the New World spread of smallpox (1983). Although his work concerns the effects of various diseases on virgin-soil populations, he gives smallpox the most detailed treatment. One of Dobyns' most controversial assertions is that a hemispheric pandemic swept New World populations in the years between A.D. 1520 and 1524. The foundation of this pandemic, according to Dobyns, was smallpox, although other European-introduced diseases were also prominent.

Apart from Dobyns' assertion regarding the hemispheric pandemic, the evidence for the presence of smallpox in the Greater Southwest is remarkably poor before 1780. Although Dobyns argues that smallpox epidemics occurred in Sinaloa in 1592 to 1593 and again in 1602, it is unclear whether the disease in question was actually smallpox (see Dobyns 1983:28–29; Gibson 1964:449; and Sauer 1935). Thus, the first unequivocal Southwestern occurrence of epidemic smallpox was in 1780 to 1781 (Bancroft 1889:266; Stearn and Stearn 1945:48). This is fully 264 years after the Spanish had introduced the disease to the New World and 242 years after the Europeans first entered the Southwest. Following 1780 and until the beginning of the twentieth century, Southwestern smallpox epidemics occurred about every 18 years (± 4.96) (Dobyns 1983:28–29). So, epidemics occurred about once every generation.

There is a remarkable discrepancy in the disease history of the American Southwest. In virtually every other New World region where Spanish contacted Native populations, smallpox epidemics followed such contact almost immediately. If we believe Spanish contact records, however, Southwestern Native peoples somehow escaped the effects of diseases like smallpox until well into the eighteenth century. This is highly unlikely. The first European contact with Southwestern groups occurred in 1539 (Marcos de Niza). The Spanish did not visit the Southwest between 1540 (Coronado) and 1581 (Rodriguez-Chumascado). Although there is no record of epidemics during this time, Southwestern populations were, presumably, no different from other New World groups in their lack of resistance to European diseases.

More importantly, potential disease vectors were introduced to the Southwest in 1540. Mexican Indians, presumably Tlaxcalans who accompanied the Coronado party in 1540, remained in the Southwest. The Spanish identified their descendants some forty years later (Riley 1974:30–32, 1988). Before their arrival in the Southwest, these Mexican Indians had been exposed to smallpox and other Old World diseases for nearly 20 years. Thus, although the evidence is purely inferential, the 40-year period unrepresented in Spanish documents would provide ample time for a smallpox epidemic to have occurred. If an epidemic occurred, one could expect population data related to mortality and annual rates of increase to provide clues.

In nearly all preindustrial societies, a disproportionate segment of the population is below the age of fifteen, producing an age pyramid with an extremely broad base. As Lycett points out (1984), the effects of epi-

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demic disease on populations so structured is devastating due to the transgenerational reproductive consequences. For example, in a population where the mean life expectancy is forty years, that has an annual rate of increase of 2 percent, a birth rate of 4.33 percent, and a death rate of 2.33 percent, 41.1 percent of the population is under fifteen years of age and 74.5 percent of the population is under thirty-four (Shyrock et al. 1975:884). A 30 percent mortality rate due to epidemic smallpox would mean that a hypothetical population of 100,000 would suffer 22,350 of the 30,000 deaths in age categories that are reproductively viable, or would be reproductively viable if survival to maturity had occurred. In this circumstance, recovery to predisease population levels would not occur for roughly five generations (100 years), if the annual birth to population ratio was 0.099 and infant mortality was 50 percent. If infant mortality exceeded 60 percent, the population would never recover to predisease levels.

Southwestern Climate and Smallpox

As noted earlier in this chapter, the incidence and severity of smallpox is highly correlated with particular climatic conditions. Conditions favoring the survivability of the smallpox virus outside of the host include a mean annual relative humidity ranging from 10 to 50 percent, with mean annual temperatures between 32° and 86° F. Stable climatic conditions are also required. Annual fluctuations in temperature should not exceed 102.2° F or drop below 32° F. Fluctuations in relative humidity are less important, except when high relative humidity is coupled with elevated temperatures.

Table 6 presents generalized mean annual temperature and relative humidity data for various elevations in the Greater Southwest. Upham derived the data from a regression equation in which elevation was predicted on the basis of mean temperature and relative humidity. In the regression analysis, he used data from twenty-two weather stations at a variety of elevations in Arizona and New Mexico. Because no data were available for climatic conditions below 32° latitude, predictions are uncertain for areas south of the international boundary. Nevertheless, the data broadly characterize climatic conditions at varying elevations for much of the Greater Southwest.

Table 6 shows that Southwestern mean annual temperature and relative humidity fall within the optimal range favoring smallpox virus survivability outside a host. For elevations between sea level and 6,000 feet, Southwestern mean temperature and relative humidity is "ideal." These

Table 6. Generalized Climatic Data by Elevation for the Southwest

Elevation (ft.)	Mean Annual Temperature	Mean Annual Humidity
Sea level	74.0	30.7
200	73.3	30.9
400	72.5	31.2
600	71.7	31.5
800	70.9	31.8
1,000	70.2	32.1
1,500	68.4	32.7
2,000	66.5	33.4
2,500	64.6	34.1
3,000	62.7	34.9
3,500	60.8	35.6
4,000	58.9	36.3
4,500	57.0	37.0
5,000	55.1	37.7
5,500	53.2	38.4
6,000	51.4	39.1
6,500	49.5	39.8
7,000	47.6	40.5
7,500	45.7	41.2
8,000	43.8	41.9
8,500	41.9	42.6
	error = 2.4 degrees	error = 1.6%

data do not, however, show the variation in mean temperature and relative humidity. Such variation is critical to the virus' survival. An examination of monthly mean temperature data for the region indicate that, for elevations below 1,500 feet, there are usually three months with temperatures that exceed 86° F. Similarly, elevations above 7,000 feet are likely to have an average of three months with temperatures below 32° F. In other words, Southwestern areas between about 2,000 and 6,000 feet provide the most stable climatic conditions for smallpox. Daily fluctuations in summer and winter temperatures, particularly at the lowest and highest elevations in this range, may hinder the virus' survival.

These data suggest that once the smallpox virus entered the Southwest, climatic conditions would favor its survival. They also indicate that modes of disease transmission other than direct person-to-person contact probably occurred. Aerial convection, flies, garments, food, and animals could all contribute to the spread of epidemic smallpox among

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completely susceptible Southwestern host populations. If climatic conditions in the Southwest are so favorable for smallpox, why didn't the disease become endemic to the area? The answer to this question must lie in the size of the reserve population following smallpox's initial introduction and spread. Small numbers of susceptibles following an epidemic may have effectively limited the extent to which the disease could become entrenched in the population.

A Probable Scenario

The data presented in this chapter suggest that contact-period Southwestern conditions favored the spread of epidemic smallpox. Such conditions included the presence of a completely susceptible host population, the introduction of potential disease vectors, and an ideal climate. Because of the presence of these conditions, despite lacking corroborating historical texts for the occurrence of smallpox in the Southwest before 1780, we offer a likely scenario for the spread of this disease to Southwestern groups.

Either the hemispheric pandemic Dobyns describes or another early, more localized epidemic probably affected Southwestern Native peoples. Snow and Starna (1984) and Snow and Lamphear (1988) have taken a dissenting position on the hemispheric character of this event, based on their study of populations in the Mohawk Valley, New York. We believe, however, that climatic conditions in the Northeast may have prevented the spread of smallpox to this region. The data presented here would suggest that the "pandemic" to which Dobyns alludes or other epidemics may be restricted to those areas of the New World where climatic conditions favor survival of the Variola virus outside of the host. The repeated textual references to Southwestern epidemic smallpox after 1781 make it likely that this disease recurred after the initial pandemic. A plausible date for this recurrence is between Coronado's departure in 1541 and the Rodriguez-Chumascado expedition's arrival in 1581. Given the frequency of later Southwestern smallpox epidemics, at least one other epidemic probably occurred between the 1580s and 1780s.

These three postulated smallpox epidemics accord well with what we know about the size of Southwestern populations during this period. Elsewhere, Upham (1984) provides a revised Western Pueblo population estimate tied to a baseline date of 1520. The figures for the three groups of pueblos that he considered total 66,967 at that time (29,305 for the Hopi villages, 24,662 for the Zuni villages, and 13,000 for Acoma). Given a 30 percent mortality rate for each occurrence of smallpox, the spread of the initial epidemic in 1520 and another smallpox epidemic occurring in the 1541 to 1581 interval would result in a total remaining Western Pueblo population of approximately 32,813 (14,359 for Hopi, 12,084 for Zuni, and 6,370 for Acoma). These figures are close to what one would predict for these groups based on both Dobyns 20:1 depopulation ratio (Dobyns 1966; Upham 1982) and Ubelaker's estimate of a 91 percent decline among the Pueblos (1988).

Two friars made one of the first relatively reliable Western Pueblo population estimates. In 1745, the Catholic priests visited the Hopi Mesas and recorded 10,848 people living there (cited in Donaldson 1893). As discussed in Chapter 5, approximately 4,000 of these inhabitants were refugees from the Rio Grande pueblos in New Mexico. This means that approximately 7,500 Hopis were present. The postulated third unrecorded occurrence of smallpox after 1583, probably sometime in the 1600s and possibly related to one of the epidemics in Sinaloa that Dobyns cites, would leave a population at Hopi of 10,051. This figure is within range of the two friars' estimate.

The above scenario is speculative. It is based only on the etiology of smallpox, inferential data regarding the spread of the disease, and plausible contact routes to the Southwest. Despite the hypothetical nature of our conclusions, the data are compelling. Minimally, anthropologists should attend more fully to the possibility of Southwestern population decline or collapse following Spanish contact.

Conclusion

Our consideration of smallpox has provided a largely inferential way to assess how this disease may have affected Southwestern populations during the contact period. We focused on disease and consequent population decimation for several reasons. First, and most important, is the widely held notion among anthropologists and archaeologists that Southwestern populations were extremely small during the protohistoric and early contact period. Elsewhere, Upham addresses why this idea persists and why it is wrong (Upham 1984, 1987). Second, the size of Southwestern native populations is directly related to the types of interpretations of sociopolitical and economic systems that are generated. Ethnographic descriptions and interpretations of the Western Pueblo, for example, have all been based on the study of small, relatively autonomous groups that survived Spanish, Mexican, and European-American contact. Many of these descriptions and interpretations have been extended to the prehistoric period without considering the pos-

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sible effects of disease and population reduction. We argue that the size and organizational complexity of Western Pueblo groups that anthropologists recorded in the ethnographic present are poor analogs when applied to groups from earlier periods.

The data presented in this chapter do not prove that Southwestern smallpox epidemics occurred prior to 1781. The data indicate, however, that conditions for the spread of smallpox were ideal at that time. Remember that between 1520 and 1581, the Spanish were only one of several potential disease vectors that could have transmitted smallpox to Southwestern populations. Riley (1980, 1987) describes the social, economic, and political ties among Greater Southwestern native populations between 1520 and 1650. Information, goods, and people were circulating throughout the Greater Southwest at that time. Given the infectivity of smallpox and the climatic conditions in the Southwest, the introduction of infection to one group could have resulted in widespread transmission of the pathogen. If this occurred before 1540 or between 1541 and 1598, historical documents would likely fail to record it. Consequently, model building coupled with archaeological research on sites dated to these intervals will provide the only information that might resolve the epidemic and population issues.

5. Hopi Resistance to Subjugation and Change (A.D. 1680–1879)

ANTHROPOLOGISTS OFTEN CHARACTERIZE Hopi history between 1680 and 1880 as a period of sociocultural stability and resistance to outside influence (Titiev 1944:3; Spicer 1962:208; Eggan 1970:vii; Dozier 1970:209; Dockstader 1979:524).[1] During this era, there were numerous expeditions to Hopi territory by Spanish, Mexican, and American explorers, missionaries, military personnel, and civilians. Throughout this time, outsiders sought to convert, subjugate, and exploit the Hopis, as Europeans were doing among many other Native American peoples. All of these efforts failed, however, because the Hopis passively and actively resisted them. This resistance is represented by Hopi participation in the Pueblo Revolt of 1680 and by their later destruction of Awatovi pueblo during the late fall of 1700 or early winter of 1701. The Pueblo Revolt of 1680 is the most famous example of historically documented political cooperation among the diverse Pueblo groups. Between 10 and 13 August of that year, Puebloan peoples responded to the repressive conditions of Spanish domination. They attacked Spanish military personnel, priests, and other colonists, killing many and driving the remainder south. As a result, Puebloan peoples were free from Spanish rule until Don Diego de Vargas and his troops reestablished control over the territory in 1692.

As noted, Hopis cooperated with other pueblos in the overthrow of Spanish authority. They, too, were free of colonial domination until de Vargas returned with his troops. At that time, leaders from all Hopi villages except Oraibi ostensibly acquiesced to de Vargas' demands. In the ensuing years, however, only Awatovi citizens actually resubmitted to Spanish and Catholic domination. The other Hopi pueblos passively or actively defied the outsiders. Because of the Awatovi resubmission, during the late fall of 1700 or early winter of 1701 Hopis from other villages destroyed much of that pueblo (including its Catholic mission). They also killed some of Awatovi's inhabitants and resettled the rest among

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