

# DISEASE TRANSFER AT CONTACT

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## INTRODUCTION

Disease transfer at contact between peoples is attracting increasing research and interpretive attention from anthropologists, historians, ethnohistorians, Native Americanists, and medical doctors. Historically, massive and frequent disease transfers resulted in a crash in the Native American population and “contact shock in the Americas” (81:2; 82). Mooney (69) explicitly recognized the impact of epidemic diseases on Native North Americans. Anthropologists of the 1930s ignored that aspect of Mooney’s native population analysis, while arguing instead about population magnitudes.

Physiologist S. F. Cook (24) began in 1937 to publish studies of the impact of Old World diseases on Native North Americans. Even though Cook collaborated with archeographers,<sup>1</sup> anthropologists of the period ignored his epidemiological publications. Anthropologists may have been reluctant to recognize that Darwinian evolutionary theory applies to human beings (76:37), regardless of human culture.

In 1966, I pointed out methodological flaws in anthropological analyses of Native American population magnitudes that ignored the biological reality of Old World contagious diseases during post-Columbian times (32). Ten years later, a critical bibliography on Native North American historical demography reemphasized the crucial role of Old World contagious diseases (33) in what

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Following the arguments of Deetz (30a:18), I use the term “archeographer” rather than “archaeologist” for those who attempt “the writing of contexts from the material culture of past actuality” (see also 37).

had in 1972 been felicitously labeled “The Columbian Exchange” (26). Then, a list of known historic pandemics and epidemics appeared (34), leaving unanswered the question of how far each one spread.

Certain scholars skeptical about both the intensity of native commodity exchange and the density of native populations, expressed doubts that true pandemics occurred. In contrast, several archeographers soon seized on the pandemic/epidemic list to formulate hypotheses that could be tested with data from material residues of former native settlements (68, 73, 75, 86). They concluded that contagious diseases caused an abrupt sixteenth century population contraction among native peoples of the lower Mississippi River and southeastern United States. Survivors soon altered traditional settlement patterns.

## GENERAL SUMMARIES

Three authors have now synthesized knowledge about the historic transfer of diseases to the Americas. First, Cherokee sociologist Thornton (102) analyzed Native North American demographic changes during the Columbian Exchange. This volume summarized well the research on historic demography until 1987. Yet, it did not advance understanding of the epidemiology of intergroup contact as Americanist scholar Crosby (27) did by concisely defining the crucial concept of the “virgin soil” epidemic disease. Second, Sale’s dramatically written synthesis of the Columbian Exchange (84) focused on Columbus and his legacy, including genocide. Sale described the decimating impact of Old World pandemic diseases on Native Americans to readers previously unaware of it. Third, Americanist D. E. Stannard’s *American Holocaust*, published in 1992, synthesized studies of disease transfer at contact, but devoted more space to resurrecting the “Black Legend.” He cited numerous early historic accounts of English and Portuguese behavior in the Americas to demonstrate that other Europeans were as adept as the Spanish at murdering, overworking, starving, and otherwise directly decimating native peoples (92).

In a brief review of historic Native American (and Hawaiian) epidemiology and demography, Stannard (91) addressed the need for developing an interdisciplinary theory of variable native responses to biological and cultural invasion. He identified a long list of factors affecting the outcome of such invasions: topography, soil productivity, settlement pattern, population density, food resource range, subsistence mode, labor output and caloric requirements, climate, preinvasion disease load, culture, and political organization (p. 523). Advocating the comparative method, Stannard (p. 534) pointed out that the 95% decline in Hawaiian population “lends credence to the so-called sixteenth century hypothesis” that native peoples suffered great depopulation before literate witnesses reached them. In other words, Stannard also viewed many

decisive demographic events as pandemics. Black (5a) identified the key biological difference between Pacific Islanders and Native Americans versus African and Eurasian populations that made the former two groups more vulnerable to infections. It is relatively homogeneous genetic histocompatibility antigens (MHC) attacked by viruses that adapt to each human host. To illustrate, a virus passing between two Africans has a 0.5% chance of not encountering a new MHC type at the A or B locus, but has a 32% chance when passing between two Native South Americans.

United States historians long ignored anthropological research into historic Native American epidemiology. However, three recent papers are harbingers of a changing view. Limerick (59) summarized the devastating effect of diseases and warfare on native peoples. Daniels (28) published in a major colonial history journal a succinct review article analyzing estimates of Native North American population magnitude in 1492. Although he focused on population magnitudes, Daniels summarized the consequences of post-Columbian epidemiology. Historian-physician Guerra (47) summarized for Spanish readers pre-Columbian epidemiological characteristics of Spain and the Americas. In analyzing pre-1647 epidemics, however, he diagnosed as yellow fever (see 58) what was more likely dengue.

### *Breakthroughs in Analyzing Disease Transfers at Contact*

Three studies of disease transfer at almost initial contact between Old and New World populations stand out. Guerra (48) concluded that pigs on Columbus' second voyage of 1493 transmitted swine influenza to the Americas. His diagnosis goes far toward explaining the rapid, calamitous depopulation of the Caribbean islands before smallpox reached the Americas. Guerra made excellent use of the comparative method, contrasting Taino with Filipinos. Lacking influenza virus-carrying domestic animals, Taino perished when Europeans transported swine carriers to their homeland. Filipinos, who kept swine, increased in population at about one percent annually after Spaniards conquered them. Sale (84:149) inferred that the disease was bacillary dysentery, while he recognized the possibility of malaria and syphilis. Stannard (92:68, 300 n. 43) pointed out that influenza's short incubation period militates against human trans-Atlantic transmission. He noted, however, that recent research suggests that symptomless year-round carriers may transmit the bacillus during a "flu season" (51).

Six edited volumes (17, 22, 97–99, 112) stand out for their significant contributions to our understanding of the many processes of disease transfer at contact. *Secret Judgments of God*, edited by historian N. D. Cook and geographer W. G. Lovell (22), contains papers from a symposium at the Amsterdam meeting of the International Congress of Americanists. In Cook's and Lovell's words, "epidemics struck early and lingered late." Disease transfers resulted in

a “web of disease” spreading throughout colonial Spanish America. Consequently, “the effects of disease transfer...continued throughout the nineteenth and well into the twentieth century (23:214).” When the web of disease spread widest, a pandemic resulted.

Other authors identified important dynamics in spreading the web of disease. Alden & Miller (3, 4) made more manifest than earlier scholars that ships engaged in the African slave trade wove strong strands of the disease web. They repeatedly transmitted smallpox to American populations. Fortune (43) identified epidemic diseases that sailors transmitted to native Alaskans: influenza, measles, bronchopneumonia, typhus, and scarlet fever. Dobyns (38) identified as nodes in the web of disease Native North American trade centers whose residents suffered higher mortality than nontraders.

Physical anthropologists Verano & Ubelaker edited a volume split between chapters on skeletal indications of pre-Columbian native deficiencies and changes in the post-Columbian disease environment and population (112). The Cook & Lovell, Stannard, and Verano & Ubelaker volumes symbolize and certify the emergence of a new field of historic epidemiology.

### *The Sixteenth Century*

The sixteenth century became crucial to Native American survival because many of the Old World pathogens carried across the Atlantic Ocean during the century caused “virgin soil” epidemics among American natives. Ninety percent of the population of civilized Mesoamerica and Andean America perished by 1568. Civilized highlanders constituted the vast majority of America’s precontact population (37:544). Consequently, their sixteenth century epidemiology determined the magnitude of “the worst demographic disaster...in the history of the world” (91:535). “It is clear that epidemics played a major role in the demographic collapse of native America (21:212).”

Several writers have significantly advanced our understanding of sixteenth century epidemiology, by focusing on local populations that exemplify epidemiology of the time period. Both Kelsey (57) and Walker et al (115:358) concluded that Old World diseases seriously impacted California’s native peoples during the sixteenth and seventeenth centuries, long before Christian proselytization began in 1769.

1507 While arguing that smallpox did not reach Hispaniola in 1507, Henige (50:15) cited excellent contemporary evidence that plague and another highly contagious disease swept through Spanish Andalucia that year. The unidentified pathogen had found passage on a ship bound for Hispaniola, where it wrought havoc among the Taino who were already reeling from influenza and Spanish domination.

1520 Several studies elucidated details of the smallpox pandemic that began on the islands in 1518 and spread to the continent in 1519. Guerra (47:52) stated that Portuguese slave traders brought contraband Africans with smallpox directly to Hispaniola in 1517. The skeptical bibliographer Henige (50:17) concluded that the 1518 smallpox epidemic finished off the Taino.

Prem (74:31) reviewed evidence, including some sources not previously used, related to the diagnosis of Old World diseases transferred to Mesoamerica during the sixteenth century. He agreed with earlier scholars that smallpox swept through Mesoamerica in 1520–1521. Studying the Izalco Pipil in what is now El Salvador, Fowler concluded that they battled Spanish conquerors only twice because they had already been devastated by epidemic smallpox (44:190). Newson (71) summarized how the web of disease spread through Ecuadorian natives, using archival accounts to add details to the first English language outline of Andean historic epidemics (31). She favored the smallpox diagnosis of the pandemic that killed the Inca emperor and many of his relatives and subjects in 1524. N. D. Cook (21:208–9) reviewed the evidence that this smallpox pandemic decimated the Inca Empire in 1524 or 1525.

Archeographer S. Upham (83:75, 91, 94; 109:125) argued from disease modeling and physical residues of western Pueblos that smallpox spread north to these peoples at this same time. Ethnohistorian D. T. Reff argued that it did not (79:705; 80). Upham (110:710) later refuted quantitatively the erroneous claim that human populations can quickly recover from a severe crash caused by *variola* (79:705; 104). “Unfortunately, there were other diseases...with their own epidemic cycles” (87:184). Moreover, archeographer S. Campbell (15) interpreted residual physical evidence of abrupt settlement attrition in the Columbia River basin in the first quarter of the sixteenth century as evidence that the first continental smallpox pandemic spread north nearly to the border between Canada and the United States. Regional specialists are convinced by her interpretation of the data (9:249; 49:7, 28). In contrast, Thornton et al (105) argued that if smallpox spread through southeastern chiefdoms at this time, it spread slowly across buffer zones and rapidly through the populous chiefdoms. Their argument rests, however, on assertions about the eradication of smallpox made by medical students who never saw a “virgin soil” pandemic of *variola major* causing mortality up to thrice the maximum rate the authors presented. Epidemic disease struck eastern South America in 1522 (70:63).

1531 New studies confirmed that another American pandemic began in 1531, but they illustrated the difficulties of diagnosis. Prem (74) concluded that in 1531 Spaniards transferred to Central Mexico what may have been measles, chickenpox, scarlet fever, or some combination. Guerra (47:53) claimed typhus struck in 1530. Lovell (61) diagnosed the 1533 Guatemalan episode as probably measles. Newson (71) considered plague and measles both possible diagnoses

of the early 1530s pandemic in Ecuador, and N. D. Cook (21:209–10) concluded that the disease that decimated Panamanian natives could not be diagnosed. Reff (78:85–86; 81:103–10) concluded that Spaniards in 1530–1531 directly transferred malaria, other endemic diseases, and measles to northwestern New Spain. Dobyns (36) attributed abandonment of three among ten riverine Hopi pueblos to the 1520 and 1531 pandemics.

1545 Prem (74:31–34) characterized the 1545–1548 epidemic as “probably the most disastrous ever to hit central Mexico.” Summarizing arguments that the disease was not typhus, Prem omitted evidence that it was bubonic plague (see 21:220; 31). In contrast, Lovell (61) diagnosed the Guatemalan episode beginning in 1545 as pneumonic plague. Guerra (47:53) diagnosed influenza, evidently ignoring the evidence for pneumonic plague. According to Fowler (44), plague or typhus caused precipitous decline in Izalco Pipil numbers in 1545–1548. Newson (71:95–96) favored pneumonic plague as the cause of the 1546 general pestilence in Ecuador, as did N. D. Cook (21:210) for the Peruvian component. Reff (81:114ff) labeled *matlazahuatl* the disease that became epidemic in portions of northwestern New Spain in 1545. These analyses reaffirm that the pathogen became pandemic. In 1545, Orellano directly transferred a lethal pathogen from the Cape Verde Islands to Brazilian natives (70:74).

1559 Prem (74:35–37) diagnosed the Central Mexican episode as influenza or a cluster of ailments. Guerra (47:53) deduced influenza. Lovell (61) dated the Guatemalan episode as 1558–1563, but diagnosed it as measles. Pedro de Orsua’s 1559 expedition directly transferred pandemic influenza to Amazonians (70:65). Newson (71) identified influenza as the ailment that struck Ecuador in 1558. These studies confirm that pandemic influenza wove a wide web. Ubelaker (107:368–69) calculated for a small sample of skeletons excavated from the Zaguan of the Convento de San Francisco in Quito the shortest life expectancy found in any Ecuadorian sample he has studied. The skeletons were interred between the church’s founding in 1535 and 1570 so they apparently reflect both the 1546 and 1558 epidemic mortalities. Ubelaker’s analysis well illustrates the shortcomings of archeography (imprecise dating) and skeletal morphology (bone is unaffected by acute lethal infections) in contributing to our understanding disease transfer at contact. Anthropologists J. A. and J. E. Villamarín (113:118–22) used archival materials ranging from viceregal reports to parish registers to reconstruct the epidemiology of the Sabana de Bogotá from 1536 to 1810. They identified the 1558 epidemic as smallpox, which also assaulted natives of the Río de la Plata in 1558–1560 (4:42).

1562 Recent scholarship has identified an apparent smallpox pandemic affecting Native Americans born after 1524 that was not earlier discerned. Recogniz-

ing a 1562–1563 Central Mexican epidemic, Prem (74:37–42) favored a measles diagnosis. Upham (109:125; 83:94) argued from disease modeling and a few historical clues that smallpox spread to the western Pueblos during the 1541–1581 interval. Reff's (79:705–6) objections to the concept that *variola* was transmitted by person-to-person contacts are epidemiologically uninformed about viral transmission mechanisms. Dobyns (36) attributed documented abandonment of one riverine Hopi pueblo to mortality caused by either this pandemic or the 1545–1548 plague. Upham & Reed (111:58) concluded that catastrophic native depopulation during the initial 75 years of contact and subsequent Spanish colonization of Pueblo territory “inexorably changed the sociopolitical and economic fabric of native society.” Consequently, Upham labeled the ethnographic image of Pueblo groups created as “an inappropriate analog for archaeological interpretation.” Dobyns (37) concurred. Portuguese who sailed from Lisbon transmitted smallpox to Brazil where it assaulted natives in “a classic virgin soil epidemic” (3:199; see also 4:43, 70:74).

Europeans fished off the coast of Newfoundland and dealt with native fur traders long before they began recording these increasingly frequent activities. Carlson et al (16:147) concluded “that numerous localized epidemics probably occurred during this [sixteenth] century due to contact with traders and fishermen.” A Narragansett chronology collected in 1638 indicated 1568, 1574, 1584, and 1592 epidemics (34:318–19).

1576 Lovell (61) diagnosed the Guatemalan 1576–1578 episode as having been caused by multiple pathogens. Plague or typhus again sent Izalco Pipil numbers into rapid decline in 1576–1577, killing 90 to 98% of the 1549 population, according to eyewitnesses (44:192–93). Davidson (29:221) calculated that the Pech (Paya) Indians of Honduras diminished by about 20% between 1582 and 1592. Pech survived by fleeing to mountainous refuge areas. Guerra (47:53) diagnosed typhus. Reff (81:124) suggested multiple pathogens: plague, typhus, typhoid, and dysentery. Dobyns (36) attributed abandonment of one Hopi riverine pueblo to mortality during the 1576 pandemic and/or during the 1592–1595 episode. These studies confirm that a lethal pandemic occurred, even if its diagnosis remains uncertain.

1593–1595 Prem (74:43) was more certain that measles recurred in Central Mexico in 1595. Reff (78:87; 79:704; 81:132ff) argued that missionaries correctly diagnosed both measles and smallpox among natives in northwestern New Spain in 1593.

In 1963, Dobyns (31) had concluded that colonial New Spain and the Andes became separate epidemic regions after 1565. In the Andean zone, the Villamaríns (113) diagnosed possible influenza in 1568–1569 in Colombia.

1585–1591 The Villamaríns (113) diagnosed recurrent smallpox in 1588 in Colombia. “It is clear that between 1587 and 1591 several epidemics afflicted Ecuador” causing mortality of three-eighths of Quito’s inhabitants but 97.5% and 96.7% farther south (71:99). N. D. Cook (21:210) labeled the two or more epidemics that swept northwestern South America “one of the most devastating epidemic series of the entire sixteenth century.” Smallpox recurred locally in Brazil in 1585, 1597, and transmitted by a Spanish ship, in 1599 (3:200; 4:44).

Unusually well-preserved records of Aymaya, Bolivia, enabled Evans (41:150) to carry out a sophisticated demographic analysis of its population between 1580 and 1623. In 1590, smallpox caused a 20 to 25% mortality.

ARCHEOGRAPHY An increasing number of archeographers has concluded that physical residues of native settlements, accurately dated and correctly interpreted, reflect a mid-sixteenth century population crash. Using sophisticated statistical techniques, Ramenofsky (75) reported the abandonment of numerous lower Mississippi River Valley settlements at that time. Dating residues quite precisely with recovered Spanish artifacts, Smith (86) demonstrated that native population crashed in the southern Appalachian Mountains in the wake of the 1539–1543 Soto expedition.

Pertulla (73:512) concluded that Old World infectious diseases decimated Caddoan-speaking peoples before literate Europeans contacted them toward the end of the seventeenth century. Caddoan mound construction and shaft burial both halted soon after the mid-sixteenth century in East Texas and the Ouachita Mountains, and after 1650 in the Red River basin. The northern Caddoan area was almost entirely abandoned after 1520.

Excavators reported cumulative evidence of the sixteenth century consequences of biological invasion and warfare. “The most likely explanation” for a mass burial of 77 persons in Tatham Mound, Florida, dated prior to 1550, “is a disease epidemic” (68:56). Marrinan et al (65:78) inferred from an archaeological survey in the Apalachee heartland “significant decreases in population during the sixteenth century.” Campbell (15) marshaled residual evidence of an early sixteenth century Plateau population crash indicating that the initial continental smallpox pandemic spread north through the Rocky Mountains almost to modern Canada.

Some archeographers continue to argue, however, that Old World contagious diseases did not assault less populous native peoples such as Mohawks farther north until the seventeenth century (88, 89). Others have concluded that newcomers disrupted Huron populations, causing other changes by the mid-sixteenth century (77).

## *Seventeenth Century*

During the seventeenth century, growing numbers of newcomers apparently sufficed to transfer Old World pathogens to nearby natives on schedules that usually differed in various parts of the Americas. In 1606, epidemic diphtheria struck Quito, and epidemic measles struck central Mexico (71:100; 74:43). Lovell (61) did not diagnose pathogens that spread throughout Guatemala in 1607–1608. French colonists in 1608 transmitted a lethal dysentery agent to natives at Quebec (16:147).

In 1611, typhus and measles assaulted Quito, and in 1613 struck central Mexico (71:100; 74:43). A lethal fever killed Algonquins near Montreal in 1611 (16:147). In Brazil, smallpox also recurred in 1613 (3:200; 4:45). Scarlet fever invaded Quito in 1612, typhus in 1614, and measles in 1618 (71:100–1), but these appear to have been localized outbreaks. High mortality occurred in Aymaya, Bolivia, again in 1609, 1610, 1620, and 1622 (41:150–51). A slave ship carried smallpox from the Kongo to Brazil in 1616 (3:200; 4:45).

Epidemic disease decimated coastal New England natives in 1616–1619. One analysis recently argued that reported symptoms implicate hepatic failure (90), despite two eyewitness identifications of bubonic plague (16:148). Prem (74:43) diagnosed measles in central Mexico in 1615–1616, ignoring good evidence of bubonic plague.

Smallpox returned to Brazil in 1621–1623, carried by coastal ships (3:201–3; 4:47–50), spreading to Maranhão natives (70:74). Smallpox, or perhaps plague, was the disease epidemic in northwestern New Spain in 1623–1625 (78:88; 79). Smallpox may also have been the disease that struck Guatemala in the 1620s (61).

Snow (87:178) considered the 1633 measles outbreak to be the first historic epidemic in the Northeast. Yet he accepted contemporary diagnoses of smallpox in 1634 despite evidence that they were misdiagnoses. Like his sources, Snow did not identify the “new” epidemic of 1636, although survivors described it in the same terms used for scarlet fever in 1710. Smallpox clearly struck in 1639 (87:179) causing mortality on a scale that would have been impossible had the 1633–1635 episode involved *variola*.

In 1641 smallpox also struck Brazilian slaves, later spreading to Indians (3:202; 4:47). It ravaged upper Amazon tribes in 1642–1645 (70:65).

A slave ship carried the yellow fever pathogen and its mosquito vector to the Americas for the first time in 1647, specifically to Barbados, where population density had reached 200 people per square mile. Kiple & Higgins (58) marshaled convincing quantitative historic evidence that people from Africa’s endemic yellow fever zone were resistant to the disease whereas Europeans were not. Consequently, it was more yellow fever than plantation sugar production that Africanized the non-Hispanic Caribbean islands. Native Ameri-

cans along the historically Africanized tropical coasts of the Americas were, one must infer, as much at risk of contracting yellow fever as were Europeans.

A malady with symptoms suggesting influenza struck Northeast natives and newcomers in 1646–1647. Smallpox reportedly recurred in 1658 among Montauk, and spread to the interior in 1662–1664 (87:179–80).

Influenza struck Brazil in 1660, followed by smallpox in 1662, in 1664–1666 (on a pandemic scale), in 1680–1684, and in 1690–1695 (3:201–3; 4:47–50), again spread by coastal shipping. Measles assaulted upper Amazonians in 1660 (70:66).

Reff (78:87–89; 81:142–79) identified regional northwestern New Spain epidemics involving smallpox in 1601–1602, in 1607–1608 in “fulminating” form, and again in 1612–1615; plague in 1616–1617 and in 1636–1641; what appeared to be malaria in 1645; smallpox and plague in 1652–1653; an undiagnosed ailment in 1658; and smallpox, measles, and typhus in 1692–1693. Dobyns (35) rediagnosed the 1636–1637 disease as scarlet fever; Stodder & Martin (94:66) confirmed that it spread to New Mexico Pueblos followed by a 1640 epidemic disease. Lovell diagnosed as typhus a pandemic that spread throughout Guatemala in 1631–1632 (61:68–81). Elsewhere in North America, epidemic disease mortality—from measles, scarlet fever, and smallpox in 1634–1639 and apparently from influenza in 1671—led survivors to abandon native trading centers one to ten years later (38). Snow (87:180) noted epidemic disease in New France in 1669–1670, influenza among the Hurons in 1676, smallpox in 1678, and measles or smallpox in 1682.

These and earlier studies of regional epidemic sequences revealed three likely seventeenth century smallpox pandemics. They occurred in 1620–1623 in Amazonia, Brazil, Bolivia, Guatemala, and northwestern New Spain (3:201; 41; 61; 70; 78; 79); then in 1639–1644 in North America, northwestern New Spain, Amazonia, and Brazil (3:202, 34:15; 70; 78; 79); and again in 1690–1695 in Brazil, 1693 in northwestern New Spain, and 1695–1699 in the southeastern United States (3:203, 34:15, 81:179).

### *Eighteenth Century*

The major lethal viral infections frequently recurred during the eighteenth century in Brazil (3:205–9; 4:52–61). A Portuguese slave ship carried smallpox to Rio de Janeiro in 1715. A bishop brought smallpox from Lisbon in 1724 and it recurred in 1730–1732, 1737, and 1743, followed by measles in 1749. Then smallpox struck again in 1750, influenza in 1756, smallpox in 1759, 1762–1763, 1766–1767, 1768, 1774, and 1779–1780. A slave ship transmitted smallpox in 1787, and a pandemic occurred in 1793–1799. New Mexico Pueblos died from epidemic smallpox in 1719, measles in 1728–1729, smallpox in 1733–1734 and 1737–1738, undiagnosed pathogens in 1748 and

1770, and smallpox in 1781 and 1799 (94:66). Influenza in 1756 and smallpox in 1762–1763 struck many Upper Amazon natives (70:67–68).

The increasing frequency of smallpox epidemics should have lowered mortality, episode by episode, as the number of susceptible youngsters decreased. The Brazilian data suggest that nine episodes may have been pandemics because they occurred simultaneously in North America. These were smallpox in 1715–1716, 1729–1733, and 1737–1739; measles in 1748–1749; smallpox in 1750–1752; smallpox and other ailments in 1762–1766; and smallpox in 1774, 1779–1783, and 1793–1799 (34:15–17; 43:227). Alchon's (1:178; 2) Quito epidemic chronology strengthens the case for classifying smallpox as pandemic in 1750–1752 and 1779–1783, and for recognizing a plague component of the 1762–1766 episode.

### *Nineteenth Century*

Smallpox recurred in Brazil in 1808, 1819 (carried by a slave ship), 1828, and 1831, at least in Río de Janeiro (3:209; 4:68). The virus was epidemic among Native North Americans in 1801–1802, 1828, and 1832–1834 (34:15) and native Alaskans in 1835–1840 (43:197), which suggests that it became pandemic at those times. The 1801 episode involved Northwest Coast peoples (9:249), but diphtheria struck the mission Chumash in 1800–1802 (114:134–35), followed by measles in 1827–1828 and influenza in 1832. An undiagnosed contagious disease decimated Northwest Coast and Plateau peoples in 1824–1825, followed by malaria in 1830, smallpox in 1836, measles in 1847, smallpox in 1853 and 1862–1863, measles again in 1868 (8:138–42), and smallpox again in 1877, certainly among urban newcomers and probably among surviving natives (49:20). Measles assaulted native Alaskans in 1848; tuberculosis had become common among them by 1806 (43:206, 257). Epidemic smallpox spread to New Mexico Pueblos in 1816, 1840, 1853, and 1898 (94:67). A 1900 measles and influenza epidemic among Alaskan natives “must rank among the most significant single events in the recorded history of the people they affected (43:197).”

### *Demography and Epidemiology of Christian Missions*

S. F. Cook (25) pioneered quantitative analysis of the impact Christian missions had on native American peoples. Several scholars recently emulated him. Jackson wrote, “The destruction of the Indian populations congregated into the missions, rather than the image of the romanticized heroic missionaries, is the most tangible legacy of the mission regime” (54:154). He spoke of Alta California missions, but this statement applies generally to Christian missions on America's colonial frontiers. Relying on missionary records, Reff (78:89) calculated that two of three natives in northwestern New Spain perished between 1591 and 1638.

Northern Californian missions were perhaps atypical in that endemic rather than epidemic diseases caused most mortality (54:150). Mission populations declined 95% over a generation at Santa Clara, 94% at San Francisco Solano, 92% at San Francisco (54:145–47). In the same environment, Mestizo military post populations grew at a mean rate of 1.2% annually over a 45-year sampling period. Some 36% of the Chumash children less than two years old at three coastal California missions died within 12 months; and two-thirds died before reaching five years of age (55). At the Sonoran Desert Tumacacori mission, 93% of the children born between 1773 and 1825 died before reaching ten years of age (53:465).

Epidemiologically parallel to the Christian mission was the plantation migrant worker camp. A quantitative analysis of Pacific island migrant worker mortality found bacillary dysentery, tuberculosis, and influenza-pneumonia to have been the principal causes of death. At missions as on plantations, “the spread of bacillary dysentery...was facilitated by the aggregation of workers...where sanitation was inadequate” (85:592). Gastrointestinal infections causing anemia and fatal dehydration certainly were a major factor in the high endemic disease mortality rates in California missions (115:356).

Meighan (66) identified factors in native emigration from secularized California missions after 1833. The death rate from infectious diseases shows that depopulation antedated secularization. Stodder (93) analyzed bones of Costanoan natives buried at missions to demonstrate that the mission diet was quite deficient in Vitamins A and C, riboflavin, and the high quality protein required to resist infectious diseases.

Kelsey (57:502) made a basic point concerning pre-mission period European contacts with California’s native peoples. Where observers reported children with European fathers, syphilis and other communicable diseases prevented native peoples from achieving equilibrium prior to mission impact. Even during the mission period, when smallpox, measles, and dysentery took a huge toll, syphilis was the great killer (57:507), causing much sterility and killing three out of four infants in their first two years. On the other hand, Jackson (53:469) calculated that 67% of the net population decline at San Francisco de Borja Mission occurred in “major epidemic years.” Walker & Johnson (114:133–34) identified high epidemic mortality of the Chumash. Epidemics struck in 1790–1792 and 1796; diphtheria in 1800–1802; measles in 1806, 1821, 1822, 1827, and 1828; influenza in 1832; and smallpox in 1844.

Deagan (30:301, 306) used ceramic shards from St. Augustine as one index of native demographics, to gain additional perspective on documentary records of local population trends. Documents indicate that native numbers fluctuated between 90 and 225 during the seventeenth century. Native refugees from colonial conflicts peaked in 1728 at 1350. Thereafter, natives declined to a mere 79 (in 1760) or 86 (in 1763). Ceramics reflect the mortality caused by

three disease epidemics between 1649 and 1659: Guale vessels increased considerably while Timucuan types decreased.

In a long summary of colonial Christian missions in Spanish colonial Florida, Thomas (96:374–77) noted that missionary exactions motivated native movements that elicited official repression with demographic consequences. After the 1597 Guale “revolt,” the governor demolished stored harvests, causing famine along the Guale coast. The 1647 Apalache “revolt” brought “overly severe retaliation.”

Reff reconstructed the historic epidemiology of the native peoples located on Mexico’s west coast, analyzing previously ignored natives between Mesoamerica and the Puebloan and Rancherían peoples. Consequently, Reff described the mission period as well as pre-mission disease transfers. He concluded that during the initial century of contact, from 1530 to 1630, the Acaxee declined by 95%, the Irritilla by 93%, and the Tepehuanes by 90%. Over a slightly longer period, the Yaquis and Mayos diminished by 90 and 94%, respectively (81:194–252).

Maeder (63) reanalyzed population trends of the Guaraní in Jesuit missions using data from Jesuit annual reports. Crude death rates of 70 per 1000 clearly reflected epidemic diseases, but migration also fundamentally affected mission populations.

## CASE STUDIES

A number of excellent analyses have offered case studies. Stannard (92) perhaps overgeneralized when he offered numerous descriptions of how Spanish blood-lust in battle resulted in so much slaughter that native blood literally ran in the streets of American cities. In contrast, good case studies focus upon one decisive demographic event, a single locale, or a relatively short time period.

### *Epidemiology of Warfare*

Rich Spanish archival documentation of the colonial frontier in Chile enabled Casanueva to analyze the effects of a 1791 smallpox epidemic among native groups south of the Río Bío Bío on both natives and newcomers. Nomadic Pehuenche traders spread infection from one native chiefdom to another. Attendance at funerals for tribal chiefs and participation in drinking parties also spread infection (19:189–90). Many Mapuche blamed the mortality on witches (19:206–7). A quarantine failed.

MacLeod (62) showed that, contrary to earlier inferences, the number of native warriors fighting with French colonial forces during North America’s French and Indian War actually fell twice during the 1755 and 1757 smallpox epidemic episodes, and rose when the episodes ended. MacLeod’s ethnohistorical analysis is also significant because it documents an instance of

33% mortality (100 of 300 warriors) in a native population previously exposed to *variola major*.

Excavators recovered two bones of people wounded by metal blades from Tatham Mound, Florida. The cut marks attest to one Tocobaga-Spanish sixteenth century clash (52:65–66; 68:56).

Calloway (11) concluded that disease mortality and warfare motivated the Vermont Abnaki to retreat into Canada after 1600. By analyzing newcomer records of native leaders, Grumet (46) found that more than half of those named disappeared between 1680 and 1715. He attributed their disappearance to two wars, four epidemics, and emigration during that 35 year period.

Interethnic conflict in Guatemala during the 1970s and 1980s markedly reduced the number of Mayan speakers (17, 60). Selective killings and massacres reduced Santa Cruz Quiché's population by more than 4000 persons (18:56). After selectively killing eight of nine key community leaders or agents of change, the army in 1982 destroyed La Esperanza colony in the rain forest (64:72–80), forcing villagers to flee. When rebels took up arms in the Ixil triangle, the army retook the area at a high cost in Mayan lives, murdering inhabitants of entire villages and displacing survivors (95:101–14). Army assaults on peasant villagers killed many until survivors fled to the mountains (42:237–52). San Pedro la Laguna's local death squad murdered people for political reasons, greed, and vengeance (72:122–31). San Juan Ostuncalco's first elected Mayan mayor and his alliance-building Ladino successor appear to have minimized mortality there (40). Many Mayan refugees fled to Mexico's Chiapas state (39), struggling to open new fields and survive. Even in a "peaceful town," selective killings marked the continuation of land conquest (5). Rigoberta Menchú, Nobel Peace Prize recipient for 1992, provided an emic account of Guatemala's travail from a personal, familial, village, and national perspective (67).

### *Epidemics*

The native epidemic mortality episode decimating New England native peoples in 1616–1619 influenced future newcomer invasion of North America more than any other episode. Bratton (10) tried again to diagnose the illness, considering yellow fever, measles, typhoid fever, chicken pox, typhus, plague, cerebrospinal meningitis, and smallpox as candidates. The Spiess (90) favored hepatic failure.

Boyd (9) compared two virgin soil epidemics among Northwest Coast peoples. In 1830–1840, epidemic malaria caused an 87% decline among Lower Columbia River Chinookan and Kalapuyan peoples. In 1862–1863, smallpox caused more than 80% mortality among the Queen Charlotte Islands Haida who had gone more than 90 years without a *variola* assault. Trimble (106) documented differential 1837 smallpox mortality among northern Plains

peoples vaccinated and not vaccinated. For the major threat to native health today, retired Indian Health Service physician J. Justice (56) described retrospectively the emergence of the diabetes threat among residents of Warm Springs Reservation, Oregon. This is the first data-rich report of the high incidence of the disease among Plateau natives.

On an entirely different analytical level, the Blakeleys demonstrated the near impossibility of detecting the impact of highly contagious diseases from skeletal remains. They found no evidence of disease mortality in paleodemographic data, nonspecific stress indicators, lesions, or mortuary behavior at the sixteenth century King site in northwestern Georgia (6). They made, however, the logical error of interpreting the lack of evidence to mean that the phenomenon (epidemic disease) was absent. They concluded illogically that regional epidemic mortality inferred by others (52, 68, 75, 86) did not reach the population whose bones they studied.

### *Cities*

Analyzing public health and disease in Quito, Alchon (1:178–79; 2) found archival records of 15 eighteenth century epidemics. These included smallpox in 1709, 1746, 1751, 1759, and 1783, at intervals usually long enough to keep *variola* epidemic rather than endemic. Measles struck in 1728 and 1785, dysentery in 1769 and 1780, plague in 1763, fevers in 1700, coughs in 1708, pestilence in 1724, multiple ailments in 1777, and the unidentified disease “pujos” in 1779. The colonial web of disease connected Quito to both Bogotá and Lima as centers of pathogen transmission.

### *Genocide*

Stannard (92:57–95) quite explicitly entitled his chapter about Spanish colonialism from 1494 to 1600 “Pestilence and Genocide,” estimating that between 60 and 80 million natives perished. Sale noted Spanish slaving (84:134) and massacres (pp. 152–59), but added that English treatment of natives differed “only in scale, not in severity” (p. 278). In 1624, for example, sixty “heavily armed” Englishmen massacred “800 defenseless Indian men, women, and children” (92:107). “The most blatant killing anywhere of North American Indians by non-Indians surely occurred in California, particularly in northern California during the mid-1800s” (101:119). If Central America constitutes part of North America, the Guatemalan government’s actions toward its Mayan-speaking rural peoples (17, 60) are just as blatant and have killed more natives than newcomers killed in California in the mid-nineteenth century.

United States citizens continued the extermination policy past 1850 against the Texas coastal Karankawa (45:237). Boyd (8:136) balanced the record by noting that Northwest Coast peoples who obtained firearms before their neighbors waged wars of ethnic extermination.

The United States Congress in 1832 mandated federal vaccination of native populations against smallpox. Yet, officials in the Indian Office and private sector fur traders obstructed the St. Louis Indian Superintendency's vaccination program of 1831–1834, according to historian Unrau (108). Anthropologist Trimble (106) attributed high Mandan, Hidatsa, and Arikara and contrasting low Dakota smallpox mortality in 1837 to contract vaccinators traveling upstream to the latter but not to the former.

Federal officials forced Northern Cheyenne to migrate in 1877 to Indian Territory. G. Campbell (12) found that the migrants then suffered malaria, measles, and dysentery with high morbidity and mortality at the new agency.

Thornton (100, 103) reexamined records of the 1838 forced removal of Cherokees to Indian Territory. He concluded that about 8000 perished on the way, roughly 50% of the nation. Mooney (69) had calculated Cherokee migration loss to exposure, diseases, and malnutrition at only 25% of the population.

## CONTINUITY OF CONQUEST

Newcomer governments in North America have unilaterally pronounced natives to be citizens. Thus, natives are eligible for the same governmental services as other citizens, but eligibility does not always mean natives are actually served. Only a birth rate atypically high in the contemporary world enables native peoples to increase their numbers. For native peoples remain at markedly higher risk than newcomers for accidents, suicide, violence, and infant mortality—all forms of mortality inextricably related to social and cultural dimensions of intergroup contact.

This grim prognosis has been confirmed for both Canadian natives (7), and United States natives (13), including a specific study of Montana natives (14). Diabetes has emerged during recent decades as the major epidemic affecting North American natives (13, 33, 56). AIDS had by mid-1988 spread to natives. The native population already suffers from a high rate of sexually transmitted disease, so regular native travel between high risk cities and reservations gives AIDS the potential to become the “new smallpox” (20).

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