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Households and Plague in Early Modern Italy

The past decade has seen the debate about the Black Death and its successive waves edging away from social and cultural history toward questions of biology and epidemiology: Was the Black Death *Yersinia pestis?* Does it make sense to claim that the three pandemics that swept across Europe from Justinian's time to the twentieth century all had the same pathogen? From studies of ancient DNA extracted from dental pulp in medieval and early modern corpses to epidemiological modeling, the lines of debate have become rigid—for and against the Black Death as being the same as the slow-moving rodent disease that entered Hong Kong in 1894, spread to India, and touched (but failed to decimate) several major seaports in temperate zones at the opening of the twentieth century. Despite striking differences in the epidemiological character of the Black Death and the bubonic plague of the so-called third pandemic, no consensus has emerged as to whether these earlier plagues were *Yersinia pestis;* nor does any look likely to appear in the near future.[1]

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1 Recent contributions to the debate include Susan Scott and Christopher J. Duncan, *Biology of Plagues: Evidence from Historical Populations* (New York, 2001), 128–129; *idem, Return of the Black Death: The World's Greatest Serial Killer* (Chichester, 2004), 140–144; Cohn, *The Black Death Transformed: Disease and Culture in Early Renaissance Europe* (London, 2002); George Christakos et al., *Interdisciplinary Public Health Reasoning and Epidemic Modelling: The Case of Black Death* (Berlin, 2005); and, especially, two conferences, "The Plague Conference," November 9–12, 2005, CEES/DNVA, Oslo, Norway, and "Workshop: The Identity of Plague," April 5, 2006, Wellcome Trust Centre for the History of Medicine, University College London. For the plagues of 542 to 750, see Lester Little (ed.), *Plague and the End of Antiquity: The Pandemic of 541–750* (New York, 2007); Peregrine Horden, "Mediterranean Plague in the Age of Justinian," in Michael Maas (ed.), *The Cambridge Companion to the Age of Justinian* (New York, 2005), 134–160.

Nonetheless, new questions about the character of late medieval and early modern plagues can be posed without establishing definitively what its pathogen may have been. This article investigates several extraordinary sources for Milan and Nonantola in northern Italy from the mid-fifteenth to the seventeenth century. They provide the opportunity for the kind of combined demographic and epidemiological research about plague that is not possible for early medieval plagues, or their repeated waves into the mid-fifteenth century. Analysis of these later sources shows household-composition patterns during and between plague deaths that permit a closer look at plague transmission and more informed speculation about its periods of latency, incubation, and infectiousness. The upshot is the discovery of something about early modern European plagues that most likely was also true about the earlier Black Death: Victims of plague within the same households died within a remarkably short time of one another, most of them on the same day. No other disease now known to medicine progresses with such a pattern.[2]

MILAN'S BOOKS OF THE DEAD To detect whether "true plague" *(vera pestis)* was within its walls, poised to erupt into a deadly epidemic, physicians of the Milanese health board *(ufficiale di sanità)* began registering deaths and diagnosing their causes during the last year of the plague of 1449–1452. Initially called "necrologi," these *Libri dei morti* (books of the dead) continued with few lacunae until 1755. Though not the first attempts to register a city's deaths (as opposed to burials), they are almost unique in that regard, at least until the civil registers of the nineteenth century, given that university-trained physicians—not parish priests, other clerics, or gravediggers—evaluated the corpses, gathered the reports of symptoms, and pronounced the cause of death. Zanetti and Carmichael have constructed elaborate nosologies of diseases from these records, but such were not the concerns of the health board. Rather, throughout the fifteenth and sixteenth centuries, doctors used this evidence to distinguish true plague from other fevers and ailments. Their dichotomous judgments—suspected or not suspected of plague—had grave consequences not only for the vic-

2 Cohn principally collected and analyzed the Milanese data and Alfani those for Nonantola.

tims' families but also for policy, commerce, and the movement of people and goods. Furthermore, houses in which a family member or co-resident was judged to have died from plague *(peste)* were usually marked as *domus infecta,* or boarded up *(domus clausa).* The families were compelled to reside beyond the city walls in *lazzaretti*—makeshift camps with special huts *(campane)* for those with, or "suspected" of, plague.[3]

Deaths diagnosed not to have been caused by plague *(sine contagio, sine aliquali contagione, absque signo pestifico)* generally received less attention about signs, symptoms, and course of illness. Often the cause of death went completely unlabeled. Plague cases, however, no matter how lowly the victim's status, regularly comprised paragraph-long entries. After identifying the victim's parish, household, name, age, and occasionally profession, the death *bollettino* (later to be copied into the *Libri dei morti*) recorded the disease's progress from initial symptoms—continuous fever, headaches, vomiting, pains in various parts of the body, sometimes where buboes might later appear, deep sleep, dazed eyes, milky urine, loose bowels, loss of appetite, and more. When examining the plague corpse, doctors added further descriptions of signs that usually appeared late in the disease, such as buboes, *carbunculi, dragonzoli,* tumors (often accompanied by black or purple spots—*morbilis nigris* or *violaceis,* and occasionally *rubeis*), recording their number and location on the body. Sometimes later symptoms, as with a white and spiky tongue, were also described. These reports and accompanying letters show consultation among the health-board physicians, even debates, about whether a victim had died

3 For the distinction been plague and "vera pestis," see, for instance, a case of June 25, 1468, Miscellanea Storica, no. 1, fasc. no. 1, carte 407, Archivio di Stato di Milano (hereinafter ASM). For a detailed survey of the lacunae in this series, see Giuliana Albini, *Guerra, fame, peste: crisi di mortalità e sistema sanitario nella Lombardia tardomedioevale* (Bologna, 1982). For other books of the dead, see Carlo Cipolla, "I Libri dei morti," *Le fonti della demografia storico in italia* (Rome, 1972), II, 851–866. Similar records with physicians' evaluations survive for Mantua but are not nearly as well preserved, especially for plague years. For previous analyses of the Milanese records, see Ann Carmichael, "Contagion Theory and Contagion Practice in Fifteenth-Century Milan," *Renaissance Quarterly,* XLIV (1991), 213–256; *idem,* "Epidemics and State Medicine in Fifteenth-Century Milan," in Roger French, Jon Arrizabalaga, and Andrew Cunningham (eds.), *Medicine from the Black Death to the French Disease* (Aldershot, 1998), 221–247; Dante E. Zanetti, "La morte a Milano nei secoli XVI–XVIII: Appunti per una ricerca," *Rivista Storica Italiana,* LXXXVIII (1976), 804–852; Albini, *Guerra, fame, peste;* Franco Saba, "Una parrocchia milanese agli inizi del XVII secolo: S. Lorenzo Maggiore, Materiali per una storia demografica," *Nuova Rivista Storica,* LIX (1975), 413–414.

of plague, especially when a death had occurred too quickly for skin disorders to form. Such *casi dubiosi* allow historians to follow doctors' reasoning and understand operationally their definition of plague.

Although the symptoms of continuous fever, headaches, and vomiting were labeled as "pestilential accidents," they were insufficient for doctors to diagnose plague as the cause of death. Nor was the formation of a bubo or tumor in the groin, thigh, or under the armpits sufficient proof. Such swellings could accompany illnesses that physicians declared as "without suspicion." The single most common reason for judging a dubious case as plague was the swiftness of death *(propter celeritatem)*. Cases of plague were not so patently obvious to laymen or doctors from the onset of sickness as historians and present-day scientists usually assume; after all, many diseases began with fevers.

Physicians recorded the duration of illness, sometimes calculated to the hour, to make their diagnoses. Judging from the duration of other diseases with strikingly different symptoms, the doctors' reasoning appears perspicacious and consistent. Other than death from wounds, horrific falls, and other accidents, few deaths, if any, were as sudden as those from plague. By contrast, those who died from the second most dreaded epidemic in this period—syphilis, or the French pustules *(ex pustulis gallicarum)* as the Milanese called it—suffered periods of illness so long *(egritudine longa)* that the physicians rarely knew, or bothered to count, the weeks or months of suffering before death. In a Milanese epidemic of 1477 that killed 782 from July 1 to December 31 and that modern scholars have attributed to typhus, the victims died after thirteen days on average, and less than 2 percent died within a week. The modal time of illness of plague victims during the Milanese epidemics of 1452, 1468, 1483, 1502, and 1523, however, was consistently two days, and the median was less than three. Of the 1,683 people who died of plague, only 53 (3 percent) endured their illness for more than a week before death (see Table 1).[4]

4 For the epidemic of 1477, see Fondo popolazione, parte antica, ASM (hereinafter Popolazione), n. 75 (unfortunately the records for the first half of the year are missing.) The duration of plague illnesses may have been even slightly shorter than these figures indicate. Physicians reported the number of days of illness before death or the day of the week when the patient first became ill. If the latter, this study calculated the interval as including both the start day and the day of death, even if a physician noted that a victim became ill at night and died the next morning.

Table 1 Plague Deaths in Milan, 1452, 1468, 1483, 1502, and 1523, by Duration of Illness

NO INFO	1ST DAY	2ND DAY	3RD DAY	4TH DAY	5TH DAY	6TH DAY	7TH DAY	8TH DAY	9TH DAY	>
597	46	301	287	229	82	54	29	14	5	39

These records allow a precision for evaluating the plague that is impossible either with early modern parish records or with earlier burial records collected citywide in towns such as Florence and Arezzo during the late fourteenth or fifteenth centuries. First of all, these other records do not usually indicate whether a death during an epidemic was attributable to plague; after all, individuals continued to die from other ailments, which may well have intensified during periods of plague. Unlike parish registers, the Milanese documents recorded the date of death, not of burial, which could be delayed especially in times of crisis when corpses mounted, cemeteries filled, and gravediggers were in short supply. The Milanese records also provide a second date, not found in these other death records—the moment when the first signs or symptoms of illness appeared, before buboes, *morbilli,* or other skin disorders had been able to form.[5]

FAMILY RECONSTITUTION AND THE DETECTION OF DISEASES This study is not the first to use techniques and evidence of family reconstitution to elucidate characteristics of early modern plague. Scott and Duncan used them to analyze parish burial records from Penrith and Eyam for evidence about the plague's transmission and to differentiate it from late nineteenth- and early twentieth-century bubonic plague *(Yersinia pestis).* They maintain that the efficiency with which the late medieval and early modern plagues (which they call "haemorrhagic plague") were able to spread was due to their long periods of incubation and infection, before any signs became apparent. Consequently, people who carried the plague could travel, mix with others, and infect them by stealth

5 The Aretine books of the dead begin in the 1370s and the Florentine in 1385. On quantitative evidence of the delays between death and burials in plague time, see Roger Schofield, "The Last Visitation of Plague in Sweden: The Case of Bräkne-Hoby in 1710–11" *Economic History Review* (forthcoming).

before they could be ostracized by neighbors or kin. According to Scott and Duncan, the disease was latent during the first ten to twelve days; for the next twenty to twenty-two days, infection was active but without signs; and after or during the final five days of infectivity, the victims died. The interval from infection to death extended to an average of thirty-seven days. Hence, they argue, Venice adopted quarantine, or forty days of isolation, in 1422, and other states across Europe followed.[6]

Scott and Duncan assume that once the first signs of plague illness appeared, people in early modern communities would have easily and immediately recognized the disease and avoided the carrier at all costs. But as numerous sixteenth-century plague tracts reveal, one of the most pressing problems for physicians was distinguishing between pestilential fevers and true plague. The Milanese death books illustrate that plague diagnosis was not always obvious; it often had to await postmortem evaluations, when plague signs might appear for the first time. Often, the fact that an ill person had died within a week was the first clue that plague had been the cause.[7]

Aside from these considerations, how do Scott and Duncan measure these intervals of latency, incubation, and infectivity with such precision, given that such periods until the first appearance of sure signs of plague would have been invisible to contemporaries and left unrecorded by them? How do they determine that invisible moment of first infection? They claim, "By working through the data for a large number of households derived by family reconstitution from parish registers, it is possible to derive estimates of the latent, infectious and incubation periods for haemorrhagic plague." Yet, they fail to explain how they "derive" these invisible periods unsuspected by contemporaries from registers that provide only the dates of burials. Nor do they reveal how such periods can be determined from reconstituting the deaths of family members (who may or may not have lived together). In fact, their charts fail even to indicate clearly the one fact registered in the parish

6 Despite use of the term *quarantine,* governments often found far shorter periods of isolation to be effective. The plague of 1576/77 in Milan established eight- and then ten-day periods; physicians such as Cesare Rincio commented on the effectiveness of these shorter measures in containing the plague. See A. Francesco La Cava, *La peste di S. Carlo: Note storico—Mediche sulla peste del 1576* (Milan, 1945), 55, 116–117.

7 Scott and Duncan, *Biology of Plagues,* 128–129; *idem, Return of the Black Death,* 140–144.

burials—the date of burial and presumably of death. But their assumption seems to be that the longer was the grace period between successive plague deaths within a household, the longer was the period of incubation.[8]

Instead of data from a large number of households, Scott and Duncan's *Biology of Plagues* lists 9 households from the 242 that they reconstituted from the parish records of Penrith during the plague of 1597/98. Their later *Return of the Black Death* supplies only three of the same nine households from the same plague. The number of clear cases in Eyam is even smaller. The authors give little hint of the reasons for relying on such a highly selective and small sample, except that the "early stages [of plague] . . . are much more informative than are the confusing events in mid-summer [1598 at Penrith] when the infection spread with devastating rapidity." But they do not explain why this peak period, which constitutes over 96 percent of their data, should remain unexamined. Nor does measuring the one interval that is readily apparent from the family reconstitutions of deaths—the interval between successive deaths within a household or family—become more difficult with later stages of plague. True, the infections between households might become more complex, but these cross-household infections are highly speculative at the best of times, since they are based entirely on the moment of burial and the presumed location of houses. Did the intervals between the deaths of family members change with different phases of a plague, from when it smouldered in late winter to periods of peak mortality, usually during the summer?[9]

Furthermore, the evidence for the presumable point of infection, which is crucial to Scott and Duncan's analysis, does not come from contemporary observations recorded in parish burial records but from anecdotal sources, of which they have only two—one from Penrith, the other from Eyam. Eyam's, moreover, derives from a story written 177 years after the plague. Both stories record the entry of a stranger to town, who later died of plague. In Penrith, his death came twenty-two days after his arrival; in Eyam, it came fifteen days later. Such stories, however, do not rule out the spread of plague by other avenues, such as the arrival of goods

8 *Idem, Biology of Plagues,* 24. The dates of burial for the three cases are clearer in *Return of the Plague* than in the earlier, more abstruse, *Biology of Plagues*.

9 *Idem, Biology of Plagues,* 128.

(as contemporaries at Eyam and other observers during the Black Death period as well as during eighteenth-century plagues suspected) or, more plausibly, the coming and going of transients who happened not to settle in these market towns and thus were not registered in their parish records.[10]

Similarly, in examining subsequent deaths and intervals between deaths in households, Scott and Duncan do not account for the possibility of new sources of infection from outside the family. Can all deaths within a family or household be traced to a primary, secondary, or tertiary infection within that household or family, as though once infected, these households became sealed units isolated from the larger community? As we shall see, certain large households during the early modern plagues in northern Italy show several clusters of deaths, sometimes separated by as many as two or three months. Should we assume that these later infections, unlike the vast majority of the others, derived from earlier family members who harbored the plague for long periods without showing any signs of illness?

Finally, Scott and Duncan presume that long periods of incubation and infectivity were the necessary preconditions for any disease spreading rapidly and effectively during the early modern period. Briefly, they mention the Great Flu of 1918, maintaining that its rapid and global transmission depended on the invention of steam power and the mass movements of troops, which would have been impossible before the twentieth century. The history of influenza, however, fails to substantiate these claims. Well before the harnessing of steam and the railway, as early as the mid-thirteenth century, chroniclers described respiratory diseases accompanied by fever, headache, coughs, and runny noses racing across European regions in late autumn, winter, and early spring. At least six such visitations have been noted for the fourteenth century, four for the fifteenth century, nine for the sixteenth century, twelve for seventeenth century, and sixteen for the eighteenth century. In 1510, 1557, 1580, 1732, 1782, and 1837, these types of disease spread from Asia through Russia and Turkey to the countries of Western Europe and across the Atlantic Ocean to

10 Scott and Duncan follow the story of William Wood, *History and Antiquities of Eyam,* written in 1842. On the problems of the Eyam sources and its legends, see Patrick Wallis, "A Dreadful Heritage: Interpreting Epidemic Disease at Eyam, 1666–2000," *History Workshop Journal,* LXI (2006), 31–56.

America. In 1826, a prominent physician in Philadelphia reported a flu pandemic in North America that affected "a whole region in the space of a week, nay, a whole continent as large as North America, together with all the West Indies, in the course of a few weeks."[11]

Hirsch, a physician writing at the very moment when steam and mass motorized transport were transforming global communication, observed that influenza "has not spread more quickly in our own times, with their multiplied and perfected ways and means of communication, than in former decades or centuries." In fact, epidemiologists today recognize that the extent and speed of an influenza epidemic depend on the virulence of the virus and the balance between immune and susceptible populations as much, if not more, than on a region's transportation infrastructure. Moreover, they have discovered that the short time between primary and secondary cases (not a long time, as Scott and Duncan theorize) was critical for the rapid and devastating transmission of the 1918 pandemic.[12]

By arguing that the plague had a long period of infection before any signs became apparent, Scott and Duncan undercut one of their own conclusions about plague that is solidly based on their parish records and corroborated by other plagues across Europe from the late Middle Ages to the eighteenth century—the household or family clustering of plague deaths. They find that 485 plague deaths occurred within 242 nuclear families in Penrith, slightly more than two deaths per family. This figure compares fa-

11 Thomas Bevill Peacock, *On the Influenza or Epidemic Catarrhal Fever of 1847–8* (London, 1848), iii; C.W. Potter, "A History of Influenza," *Journal of Applied Microbiology,* XCI (2001), 572–579; Gerald F. Pyle, *The Diffusion of Influenza: Patterns and Paradigms* (Totowa, 1986), 23–25; Alfred W. Crosby, Jr., *Epidemic and Peace, 1918* (Westport, 1976); *idem,* "Influenza: In the Grip of the Grippe," 148–153, in Kenneth F. Kiple (ed.), *Plague, Pox & Pestilence* (London, 1997). The physician in Philadelphia ("Dr. Jones") was cited by August Hirsch (trans. Charles Creighton), *Handbook of Geographical and Historical Pathology. I. Acute Infective Diseases* (London, 1883), 36, from the *Philadelphia Journal of Medicine and Physical Science,* IV (1826), 5. Certainly, further research could add to these lists. For instance, a physician from Macerata in the Italian Marches observed an epidemic of "very contagious coughing" in 1562 that spread through Macerata, Perugia, Roma, Naples, Venice, Padua, Milan, Bologna, and many other parts of Europe (Marino Massucci, *La preseruatione dalla pestilenza, con molte materie appertinenti a' l'arte di medicina* [Macerata, 1577], 43). In the following year, Giovanni Filippo Ingrassia, a Sicilian physician, reported a "epidemial catarro" that spread through Sicily, killing mostly the poor in two or three days (*Informatione del Pestifero et contagioso Morbo* [Palermo, 1576], 60).
12 Hirsch, *Handbook.,* I, 36; Pyle, *Diffusion of Influenza,* 2; C. Mills, J. Robins, and M. Lipstich, "Transmissibility of 1918 Pandemic Influenza," *Nature,* CDXXXII (2004), 904–906.

vorably with late fifteenth- and early sixteenth-century plagues in Lombardy, although the household clustering was even stronger there. For the plague of 1468, Milan's health board recorded 1,880 plague deaths between February 4 and September 21, occurring in 654 houses *(domus infecte)*—2.88 deaths per household. For the same plague in Parma, 1,810 died within 543 "infected homes," at a rate of 3.33 plague deaths per household. Ever since the Black Death of 1348, contemporaries have seen this household clustering as a key characteristic of true plague and proof that the disease was transmitted from person to person.

For diseases that are much less contagious, such as *Yersinia pestis* (even with primary and secondary cases of pneumonic plague), household clustering is much lower. At Sydney in 1900, *Yersinia pestis* struck 276 households, but only in ten did more than one person become infected. If the victims of early modern plagues were able to interact for thirty days or more with fellow villagers or townsmen, why would their deaths have clustered so strongly within households? Would plague not have resembled other diseases, which have long incubation periods and tend not to cluster in households?[13]

FAMILY RECONSTITUTION: COMPARISON WITH THE EVIDENCE FROM EARLY MODERN PENRITH The average interval between deaths in Scott and Duncan's three afflicted Penrith households with clear dates of burial in *Return of the Plague* is 15.6 days. The interval in the first household (J. Railton) is forty-two days, of the second household (A. Railton) two days, and of the third household (Hewer) thirteen days. When the intervals for Scott and Duncan's seven other households affected by the same plague in *Biology of Plagues* are included—the Hewers' nine days, the Haskews'

13 Miscellanea storica, no. 2; Miscellanea storica, no. 1, nos. 485–486, ASM; Albini, *Guerra, fame, peste,* 31. Similar rates of household clustering are found for the late medieval plagues. See Cohn, *Black Death Transformed,* 117–121, 134, 235; Carmichael, *Plague and the Poor in Renaissance Florence* (New York, 1986), 24, 80. For the sixteenth-century plagues, see the observations of the Cesare Rincio, Milan's head physician during the plague of 1576, cited in La Cava, *La peste di S. Carlo,* 55. On the household clustering of *Yersinia pestis,* see J. Ashburton Thompson, "On the Epidemiology of the Plague," *Journal of Hygiene,* VI (1906), 540. The Indian plague commission also found comparable percentages for villages and the City of Bombay during epidemics from 1903 to 1906. See *The Etiology and Epidemology of Plague: A Summary of the Work of the Plague Commission* (Calcutta, 1908), 64–67.

three days, the Watsons' and the Cookes' zero days, the Walkers' twenty-five days, and the Blysees' seven days—the average falls to 10.1. The inner household clusters are narrower still.[14]

Do these results show significantly longer intervals than cases of *Yersina pestis* in the rare instances when it appears to have been transmitted from person to person? A study of the bubonic plague in the village of Nawra in Nepal between September 6 and November 5, 1967, is the only one available to explore in detail the transmission of the plague at the household level. The number of cases is limited, but the intervals between household deaths in this setting are longer than Scott and Duncan can find for the early modern plague, thus allowing for longer periods of incubation and infectiousness. In one of the Nepalese households, the interval spanned from September 24 to November 5—forty-three days—longer than any case supplied by Scott and Duncan. The intervals in the other three households at Nara ranged from twenty-three days to five days, an average of 16.2, six days longer than the interval Scott and Duncan discovered for late sixteenth-century plague in Cumbria. Yet, despite these longer intervals—as well as more modern forms of communication, transport, and commerce—the plague of Nawra did not spread quickly from one village to the next. Moreover, the bubonic plague found in Nawra was a rare form of interhuman plague, a mixture of pulmonary and tonsillar plague, in which the human ectoparasite may have been *Pulex irritans*. This variety killed faster and spread more quickly than the more usual rat-flea vector variety of *Yersinia pestis*.[15]

THE EVIDENCE FROM THE MILANESE PLAGUES The empirical data from the early modern plagues in Milan present a vastly different picture of plague transmission than Scott and Duncan's for "haemorrhagic plague" in general. For one thing, the Milanese data can supply more examples of households with multiple deaths. Indeed, the number of the death records for Milan—one of the largest cit-

14 Scott and Duncan, *Biology of Plagues,* 129.

15 F. Marc Laforce et al., "Clinical and Epidemiological Observations on an Outbreak of Plague in Nepal," *Bulletin of WHO,* XLV (1971), 693–706. The failure of the infection to spread beyond the village of Nawra did not result from the intervention of medicine. Physicians and other plague workers from Tehran reached Nawra a month after the plague had erupted and had almost run its course.

ies in Western Europe, with a population that ranged from 60,000 after the mid-fifteenth-century plague to more than 120,000 on the eve of the plague of 1523—poses problems for household and family reconstitution. Yet, even without family reconstitution, the day-to-day tally of plague deaths in Milan reveals a remarkable household clustering. The proportion of such household deaths can be crudely estimated from physicians' identifications of plague cases coming from previously "infected" households (*domus infecta* or *clausa*). More surprisingly, around one-quarter of all deaths caused by plague were ones that occurred within households on exactly the same day, as evident in the chronological listings of plague deaths.[16]

The Milanese *Libri dei morti* began on July 21, 1452, during the last months of the plague of 1449–1452, the first major Italian pandemic since 1400. In this final phase of plague, 185 people died in Milan; 74, almost 40 percent of them, came from "infected" or "suspected" houses. The proportion, however, may well have been larger. Not only did physicians fail to label many cases as new or from infected houses; thirty-six plague victims also died *ad locum montanee,* a special plague camp of provisional huts built beyond the city walls. The physicians specified that twenty of these victims had come from infected households. Nothing, however, was said about the rest of them. But why else would they have been brought there? If these sixteen unlabeled cases are added to the infected households, the proportion rises to half of the plague victims, a figure not unlike that seen for other plagues, when the health board tallied summaries of plague victims by household.[17]

16 For these population estimates of Milan, see Albini, *Guerra, fame, peste,* 28–29; Beatrice Besta, "La popolazione di Milano nel periodo della dominazione spagnola," in *Atti del Congresso Internazionale per gli studi sulla popolazione* (Rome, 1933), I, 593; Domenico Sella, "Premesse demografiche ai censimenti austriaci," *Storia di Milano,* XII (Milan, 1955), 459–478; Stefano D'Amico, "Poveri e gruppi marginali nella società milanese cinque-seicentesca," in Danilo Zardin (ed.), *La città e i poveri: Milano e le terre lombarde dal Rinascimento all'età spagnola* (Milan, 1995), 273.

17 According to the records of the Ospedale Maggiore, this plague reached its peak in April 1451. See Cesare Decio, *La peste in Milano nell'anno 1451 e il primo lazzaretto a Cusago: appunti storici e note inedite tratte dagli archivi milanesi* (Milan, 1900); Albini, *Guerra, fame, peste,* 121. From the end of September 1451 to the end of December 1452, about 4,000 died within the urban parishes of Milan, 64.8% of them from plague. *Bolletini* or slips of paper survive for the period between September 28 and October 24, 1451 (Carteggio Sforzesco, n. 657); they record the daily death tolls, totaling 1,694 in October alone. See Albini, *Guerra, fame, peste,* 127.

Milan's next plague struck sixteen years later in 1468. The *Libri dei morti,* however, do not survive for this plague, although the physicians' *bolletini* scattered throughout other archival collections give some indication of what they must have contained. These small paper slips, later copied into the now lost volumes of the dead, also point to a significant number of household plague fatalities. Those who died of plague within infected households or who died on the same day of plague with other household victims in 1468 comprise 43 percent of the plague deaths, similar to the proportion in 1452. But, again, the actual clustering was probably higher; many slips failed to mention whether a case was new or from an infected home. Moreover, sixty-six family members or their domestic servants (in two cases) died of plague on the same day, constituting one-quarter of all deaths registered in the *bolletini.* In another three cases, deaths on the same day were described as coming from "contiguous households." These people may have been next-door neighbors, or living in *stalli* within large compounds, which were common for the poorest sections of sixteenth-century Milan. Furthermore, in two cases, three household members died of plague on the same day: In one of them, a thirty-year-old woman, a five year-old boy, and a four year-old girl, none of whom appear to have been related, died of plague on July 5. Hence, the daily interval separating the deaths in these seventy-two household plague deaths was zero.[18]

The health board's records provide a far more detailed account of the period from the first signs of illness to death than do the parish burial registers. Although later documents from the *Libri*

Unlike the *bolletini* that the health board issued after 1452, these initial ones did not examine corpses or diagnose causes of death. There were no plague cases from December to at least January. See the chronicle references to this plague across Italy in Alfonso Corradi, *Annali delle epidemie occorse in Italia dalle prime memorie fino al 1850* (Bologna, 1865–1869), I, 282–289; IV, 145–162. For epidemics of early modern Italy, see Lorenzo Del Panta, *Le epidemie nella storia demografica italiana: secoli XVI–XIX* (Turin, 1986). The data from Milan come from Popolazione, n. 73. Bernabò Visconti's castle once stood where the special plague camp was located; the hospital of the Filarete took its place later.

18 Miscellanea storica, n. 1, ASM. These facts come principally from two fascioli, n. 2—"Elenchi morti auctor Hector de Marchesi, Januarii–Decembre 1468"—and n. 6—"Elenchi mortis sine auctore 1468 March and April." In "Contagion Theory" and "Epidemics and State Medicine," Carmichael elaborated on the careers of two physicians—Giovanni Catelano and Hectore Marchesi—whose diagnoses fill these records. For the examples given, see Miscellanea storica, n. 1, carte, no. 180, ASM. D'Amico, *Le contrade e la città: Sistema produttivo e spazio urbano a Milano fra Cinque e Seicento* (Milan, 1994), 149–150.

dei morti recorded the duration of illness more consistently than they did in 1468, these earlier records are suggestive. Physicians recorded the duration of illness for two cases of same-day/same-household plague deaths. In both, the onset of first symptoms—headaches and continuous fever (which could have been most any disease)—also started on the same day. In one household, they arose three days before death and in the other, on the day of death. In this instance, the physicians were particularly precise: One sister died within eighteen hours from the first appearance of fever; the second sister died in sixteen hours, before any buboes or other skin disorders had time to form.[19]

The next plague struck fifteen years later, after almost the same amount of time as that separating the previous two. Its inception was mild. Between the first recorded case of plague on March 12, to June 8, 1483, only twenty-seven plague cases were diagnosed. But by the autumn of 1484, this plague had become one of the most devastating of the fifteenth century. Unfortunately, the records are sketchy and scattered throughout the health board's *bollettini* in four different archival registers, along with a smattering of records in the *Libri dei morti* for 1483 and more complete ones for 1485. But even during its initially mild phase, the household clustering of plague deaths is noteworthy. Nine of the twenty-seven cases arose in infected households, and another four were multiple household deaths that occurred on the same day.[20]

In 1503, plague struck Milan again, though only 190 plague deaths were recorded, constituting less than 6 percent of that year's mortality (3,172). However, starting in 1503, the health board no longer rigorously reported the deaths of plague victims who had been moved to the makeshift huts or to its Lazzaretto. Only six are described as having been taken from their homes and placed in huts, now called *in loco sanitatis*. Nonetheless, 58 of the 190 plague deaths came from infected homes, a clustering of at least 31 percent.[21]

19 Only 88 of 265, one-third of the records for this year, recorded the duration (Miscellanea storica, n. 1, carte nos. 167, 149 [ASM]).

20 Popolazione, nn. 76, 77; Albini, *Guerra, fame, peste,* 163–165, 179–180; Sella, "Premesse demografiche," 459–461; Miscellania storica, nos. 1–4, ASM. In none of these records did the physicians specify the duration of illness. Since completing this article, Cohn has coded all of the plague deaths for 1483 and 1485 found in the Milanese archival registers of Popolazione, parte antica. These results do not alter the conclusions drawn herein and will be evaluated in a later monograph.

21 The figures come from G. Ferrario, *Statistica medico-economica di Milano dal secolo XV fino*

MILAN'S PLAGUE OF 1523 The fullest record of plague deaths for any epidemic recorded in the Milanese *Libri dei morti* is that of 1523. By some chroniclers' estimates, this may have been Milan's worst plague since the fifteenth century, with 40 percent of the population succumbing to it. The death records for the city, however, do not reveal this level of severity. With greater care than in any previous plague year, the physicians on the health board recorded 1,013 plague deaths from January 4 to September 17, 1523, in a separate *filza.* This figure, however, amounted to less than one-third of Milan's normal annual mortality during the first half of the sixteenth century and only one-fourth of that year's deaths.[22]

Contra Carmichael, these plague records do not decline in attention to detail compared to the ones kept by such physicians as Hector Marchesi and Giovanni Catelani, who died at the end of the fifteenth century. The physicians on this health board described plague symptoms and signs more fully and more consistently than any of their predecessors, recording the duration of illness before death as well as demarcating various moments in the brief course of the disease before sudden death, when certain symptoms or signs arose. Often buboes, tumors, pustules, *glandule,* and the like appeared only after death, in postmortem examinations. Unlike in earlier outbreaks of plague, when physicians reported the duration of illness in only one-quarter of the cases (173 of 670), the 1523 records specified them in more than 90 percent (913 of 1,013 cases). The detailed records of 1523, moreover,

ai nostril giorni (Milano, 1838), 374, who copied them directly from summaries made in 1791. According to Albini, *Guerra, fame, peste,* 158, however, they contain errors, but she does not further explicate or correct them. Saba, "Una parrocchia milanese," 414–415, however, finds a close correspondence between the 1791 summary figures and his counts from the surviving *Libri dei morti,* from1607 to 1640.

22 These impressions come from contemporary and later chroniclers, who estimated plague deaths from 50,000 to 160,000. See La Cava, *La peste di S. Carlo,* 28; Gasparo Bugati, *Historia universale . . . dal principio del mondo fino all'anno MDLXIX* (Ferrara, 1571), 770–771, who estimated that more than 100,000 died within the city walls of Milan within four months alone in 1523, leaving the city "dishabitata, incolta, & selvaggia." The plague, moreover, continued into 1524. The combined city death toll for both years, however, was only 10,567, and the plague deaths in 1523 comprised only 20% of the total deaths (at least until mid-September, when the plague was in decline). Fewer deaths were tallied for 1524. No one has yet distinguished plague deaths from others for this year, but contrary to the reports of the chroniclers, the summer months show low levels of mortality compared with 1523 or other plague years. By contrast, 1522—not a plague year—experienced higher city mortalities than either 1523 or 1524. Ferrario, "Statistica medica di Milano," 374–375, tallies 5,288 deaths in 1523 and 3,962 before October.

identified plague victims by more than their parishes, adding the street or locale of their houses and supplying the names of their landlords. This precision may well be helpful to later studies that attempt to chart the plague's spread. The 1523 records also offer extensive information about victims' households, and not just that of their families. They even go so far as to report those without any apparent relation who lived in the same cell, room, or apartment *(in eodem stallo)* as another victim who died on the same day.[23]

With the inclusion of this detail, the 1523 plague registered 284 households in which either a victim died in an infected household or two or more household members died of plague on the same day. At least 28 percent of the households had multiple cases. Nonetheless, indications of infected or "locked" households appear understated in this plague year. By far the largest component of these multiple cases comes instead from evidence of same-household/same-day deaths. Furthermore, the coincidence of household plague deaths within twenty-four hours may have been even higher. Whether a particular scribe's marginal note about a previous plague death—*ut supra*—referred to the household or only to the parish is often difficult to tell. Consistently and conservatively, this study interprets it to mean the same parish only.

The records for the epidemic of 1523 allow a more precise calculation of the intervals between the appearance of illness and death of household members dying on the same day than the records for any earlier plague. Of the eighty-eight households satisfying this criterion only five fail to supply the duration of illnesses. The amount of time between notice of the first symptoms of household victims dying on the same day shows a pattern similar to their death dates: Little, if any, time separated the onset of their respective symptoms—that is, the formation of buboes and *morbilli*—when physicians, friends, or family may have realized that they were plague victims. As with the date of death, most of these household members showed their initial symptoms on the same day (fifty-five of eighty-two households) (see Tables 2 and 3).

Although, in most cases, no more than two people died of plague within a household on the same day (seventy-one house-

23 Carmichael, "Epidemics and State Medicine," 237–240.

Table 2 Duration of Plague Illness before Death for Plague Victims, Various Years

	NO INFO	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS	6 DAYS	7 DAYS	>
1452	145	0	1	10	10	4	5	1	11
1468	223	4	8	8	15	5	2	1	0
1483	14	1	1	0	8	0	1	2	0
1503	115	1	11	14	32	3	0	5	8
1523	100	40	280	255	164	70	46	21	37
Multiple Deaths in 1523	14	11	88	63	39	15	7	4	6

Table 3 Intervals between First Signs of Illness of Households Members Dying on the Same Day, 1523

NO INFO	0 DAY	1 DAY	2 DAYS	3 DAYS	4 DAYS	8 DAYS	15 DAYS
5	32	23	15	7	3	1	1

holds), three died on the same day in ten households, four died on the same day in one household, and five in another. On July 17 in the parish of San Calimero just outside the city walls *(foris)* near the porta Romana, Angolina de Bufineo, age fifty, died at home with three daughters, Caterina, Paognina, and Margerita, and an unrelated woman, Elizabeth, the wife of Francesco de Patuliis, who resided in the same apartment *(in eodem stallo)*.[24]

FAMILY AND HOUSEHOLD RECONSTITUTION: FOUR MILANESE PARISHES DURING THE PLAGUE OF 1485 Given that one-quarter of the plague victims died within the same households on the same day, did other household members die later of plague, over extended periods? And could such later deaths lend credence to Scott and Duncan's contention that intervals between deaths in households were long and that plague could be infectious for as long as a month before showing any distinctive signs? To test for subsequent fatal attacks, we reconstituted household plague deaths in

24 Popolazione, n.p., July 17, 1523. Although Margherita is identified as a daughter of Angolina, she is listed as fifty years old. Either she was the household head's sister, or the scribe wrote down the wrong age.

1523 from four of Milan's most populous and most impoverished parishes—San Lorenzo, San Protasio, San Simpliciano, and Santo Stefano. All of them except for San Simpliciano had communities within and beyond the city walls *(intus et foris).* Of Milan's sixty or more parishes, these four alone accounted for 430 plague deaths in 1523 (42 percent). Characteristically, plague victims came from the poorest families. Only two of the 1,013 victims in 1523 bore a title—a friar and a parish priest—and not a single victim was a nobleman. In an age when family names had become diffused throughout northern Italian urban and rural populations, only 15 percent of these victims (75 of 1,430) possessed a family name.[25]

This paucity of identification for such impoverished victims may appear not to bode well for reconstituting subsequent household deaths. However, the plague victims appear to have been mostly recent emigrants to the city. More than 61 percent of them were identified by a place name, and only 13 percent of them had neither a place nor a family name. Moreover, these victims were not from major cities or even minor ones but from a myriad of small villages and towns within Milan's hinterland—Arzate, Cassata, Corbetto, Glusiano, Oltolina, Carnago, etc. The identifiers were highly specific, usually appearing only once or twice, and none more than five times.

In this sample of parishes, the percentage of household plague deaths occurring on the same day nearly matched that of total plague deaths in 1523 (25 percent compared to 24 percent). Later plague deaths within these households, moreover, were extremely rare. Only seventeen victims in nine households can be added to the household plague deaths, an increase of only 13.6 percent (see Table 4). The household reconstitutions indicate that a staggering 86 percent of the multiple plague deaths within households occurred on the same day. Furthermore, the onset of illness also struck on the same day (fifty-two cases) or on the following day

25 For San Lorenzo, see Saba, "Una parrocchia milanese." Carlo Borromeo's reforms in 1567 divided the territory of the parish outside the city walls into three new parishes. See D'Amico, *Le contrade e la città,* 54, 146–147, for the social and economic character of these communities. In the plague of 1576/77, these neighborhoods (especially San Simpliciano) were the first and worst hit (La Cava, *La peste di S. Carlo,* 51). For a map of Milan's sixty parishes, see D'Amico, *Le contrade e la città,* 18–19; for percentages of family names, Anthony Molho, *Marriage Alliance in Late Medieval Florence* (NewYork, 1994), 281; Cohn, *The Laboring Classes in Renaissance Florence* (New York, 1980), 23–24, 43–44.

Table 4 Reconstituted Deaths, Plague of 1523

NAME	PARISH	DEATH DATE
Asta filia Leonardi de Cribellis	S. Stefano "intus"	8 Feb.
Lucia filia Leonardi de Cribellis	S. Stefano "intus"	2 April
Interval between deaths: 53 days		
Petrus de Bregnio	S. Protasio "intus"	20 Feb.
Domenica de Bregnio	S. Protasio "intus"	12 July
Interval between deaths: 165 days		
Zaninis de Oltolina	S. Simpliciano	1 March
Caterina filia Zaninis de Oltolina	S. Simpliciano	5 March
Domenico de Oltolina [possibly]	S. Simpliciano	9 August
Interval between deaths: 4 days and possibly 157 days		
Johanna filia Leonardi de Bustio	S. Protasio "intus"	4 April
Francesca uxor Leonari de Bustio	S. Protasio "intus"	16 April
Leonardo de Bustio	S. Protasio "intus"	16 April
Interval between deaths: 12 and 0 days		
Ambroxius Iacobi de Corbecta,	S. Lorenzo "foris"	15 June
Abiatus Iacobi de Corbecta	S. Lorenzo "foris"	15 June
Battista Ambroxii de Corbecta	S. Lorenzo "foris"	7 September
Interval between deaths: 0 and 83 days		
Baldasarus de Carnago	S. Lorenzo "foris"	11 July
Arcangela de Carnago	S. Lorenzo "foris"	13 July
Interval between deaths: 2 days		
Lucia uxor Stephani de Roxate	S. Lorenzo "foris"	13 July
Antonius-Augustinus filius Ambroxii de Caxate	S. Lorenzo "foris"	27 July
Interval between deaths: 14 days		
Caterina famula Magistri Iacobi Barbitonsoris	S. Lorenzo "foris"	5 August
Caterina uxor Johannis-Iacobi Barbitonsoris	S. Lorenzo "foris"	7 August
Interval between deaths: 2 days		
Domenicus Muzani de Cusonio	S. Lorenzo "foris"	13 August
Lucia uxor Domenici Muzani	S. Lorenzo "foris"	27 August
Caterina, famula Domenici Muzani	S. Lorenzo "foris"	13 September
Interval between deaths: 15 and 16 days		

(thirty-six cases), comprising 74 percent of the recorded cases (119).

This apparent rarity of later plague deaths within households may have been due, in part, to the difficulties of household reconstitution, but the tendency to find matches from ambiguous identifiers also may have slightly overstated the numbers. Moreover, physicians occasionally identified unrelated victims who died in the same household on the same day with the marginal note, *in eodem stallo*. No such indicators, however, exist for those who died later in households. Yet, these unrelated household members constituted only a small portion of same-day deaths (9 of 245 deaths, 3.7 percent).

The unusually rich data for the 1523 plague enable the linkage of later inter-household deaths of those who bore no signs of kinship. A search of the owners of houses where victims resided increases the multiple household plague deaths, however, by only one, and that case is questionable. On July 13, Lucia, wife of Stefano from Roxate, died while residing in a house owned by Giovanni-Ambrogio de Caxate in San Lorenzo outside the walls. Two weeks later, on July 27, Antonio-Agostino, son of this Ambrogio, also died of plague in what may have been the same house; its owner was Ambrogio of the same parish outside the walls. The physicians did not label the case, however, as originating from an infected or closed house. The sporadic absence of such tags may signal oversight on the part of physicians, but Ambrogio may have owned more than one house in San Lorenzo "foris."[26]

A change in the registration of plague deaths may account for an underestimation of later household plague deaths. Infected people sent to the Lazzaretti, or the huts for quarantine, do not seem to have been recorded among the plague deaths in 1523. Yet such a change would probably not account for the absence of a large portion of successive plague deaths. First, the 1523 records continued to document those dying in previously infected households, some closed *(domus clausa)* and others possibly left more open *(domus infecta)*. Second, those carted *ad locum montanee* for quarantine during the plague of 1452, or *in loco sanitatis* during the

26 According to the Stato d'anime of 1610, only 44 of the 1,251 people in San Lorenzo Maggiore owned their houses (Saba, "Una parrocchia milanese," 437).

plague of 1503, did not constitute a large proportion of the plague victims. Of the 187 plague deaths registered in 1452 only 16 (less than 9 percent) died *ad locum montanee,* and in 1503, only 6, or 3 percent, died while in the sanitary zones. Only during the first seven months of the 1485 plague, before it escalated, did those transported to the Lazzaretto represent a high proportion of the plague dead. Quarantine primarily took place in the home, within the city walls.[27]

HOUSEHOLDS AND DEATH IN MILAN'S LAZZARETTO DURING THE PLAGUE OF 1485 Was the plague of 1523, with its high portion of household members dying on the same day, anomalous? Did the absence of subsequent household plague deaths result from problems intrinsic to household reconstitution? As already noted, the surviving *bollettini* of 1468 report the same proportion of household plague victims dying on the same day as in 1523 (25 percent). The 1485 record, however, provides an even more definitive answer to the question; this register is organized not only by time but also by household. Physicians listed those sent to the Lazzaretto of San Gregorio from January 1 to July 25 by household and in a separate column noted if and when they died. The number of dead at the Lazzaretto was 262, most of them presumably from plague (although unlike in the other entries, the causes of death were not mentioned).[28]

Most surprisingly, the Lazzaretto does not appear from this evidence to have been the ineluctable death trap that it is often portrayed to be (most vividly in Alessandro Manzoni's *I Promessi sposi* [1842]). The survival rate (two-thirds, or 517 of 779) was remarkably high, especially if everyone interned there had already been afflicted with plague, as Albini assumes. As the architecture and reports from the plague of 1576/77 make clear, the enclosed

27 According to the records of 1468 and 1483, no plague victims died in special sanitary or quarantine zones, even though the Lazzaretto of San Gregorio and a place called the Barone were in operation during the plague of 1468, and most likely in 1483 as well. See Albini, *Guerra, fame, peste,* 30. The percentage of plague deaths in the Lazzaretto during the first seven months of the plague of 1485 appears higher than for other plagues charted in the *Libri dei morti*—262 deaths. On quarantine enforcement, see the ordinances and descriptions for the plague of 1576/57 in Ascanio Centorio de'Hortensij, *I cinque libri degli avvertimenti, ordini, gride et editti . . . della Peste de anni MDLXXVI & LXXVII* (Venice, 1579).

28 Albini, *Guerra, fame, peste,* 183, reports around 250 deaths, but her figures show 256. She has also either miscounted or rounded down the total number admitted to San Gregorio during this period to 760; it was actually 765.

were well fed and cared for. But did all of the interned show visible signs of plague affliction or carry the disease when admitted? The age structure of inmates suggests that entire households, not just the members with plague, had to relocate. Only 13 (0.077 percent) of the 1,683 people who died of plague (as coded thus far from 1452 to 1523) were older than seventy years old, and not a single plague victim was older than eighty. By contrast, at San Gregorio, eight were older than seventy (3 percent), and half of them were older than eighty.[29]

The average family size of those admitted to San Gregorio also suggests that families entered as a whole. One family numbered twelve, and 42 of 271 (more than 15 percent) possessed five or more members. By the end of the sixteenth century, when *stati d'anime* records first appear, allowing family size to be calculated for Milan, the figures are similar to those found for Florence and other Tuscan towns in 1427. On average, families numbered 4.5 members, and after plagues as few as 3.5. This average, however, was steeply graded by class—elites possessing the largest families and the poor, the smallest. The families at San Gregorio reflect the typical profile of plague victims—poor people, recent immigrants, and individuals in search of work: 65 of the 271 "families" were comprised of one person, and family size on average was 2.87—not unlike that of Florence's poor families in 1427 or of the Milanese parish of S. Lorenzo "foris" in 1610, when 634 of 1,251

29 Albini's tallies are different (507 of 765), but the proportion is about the same—66.27%. On the conditions of the Lazzaretto, see La Cava, *La peste di S. Carlo,* 175, 190. According to Giacomo Filippo Besta, an officer during Milanese plague of 1576, in *Vera Narratione del successo della peste* (Milano, 1578), 18v., those at San Gregorio were divided into three groups—the infected, the suspected, and the recovering. The lists from 1485, however, suggest that entire families were brought to the Lazzaretto at the same time. Lethality rates were much higher at Lazzaretti in Tuscan cities (Florence, Pistoia, Prato, and Empoli) during the plague of 1630/31. In Florence they were just under 70%, but even there it is not clear whether only those showing clear signs of plague or other "suspected" family members were also interned. See John Henderson, "'La schifezza, madre della corruzione': Peste e società nella Firenze della prima età moderna, 1630–1631," *Medicina & Storia,* II (2001), 49. For sixteenth-century indictments of frightful conditions in Lazzaretti, see Lorenzo Condivi, *Medicina filoscofica contra la peste: Di Lorenzo Condio dalla Ripa Transone* (Lyon, 1581), 178r: Giovan' Andrea Bellicochi, *Avvertimenti di tutto ciò che in publico da Signori & in Privato da ciascuno, si debbe far nel tempo della peste* (Verona, 1577), 411v–412v (folios from the Vatican copy); Heronimo Donzellini, *Discorso Nobilissimo e dottissimo preservative et curative della pesta* (Venice, 1576), 311v–312r (Vatican copy); *idem, Discorso de Annibale Raimondo versonese ne quale chiaramente si conosce la viva et vera cagione, che ha generate le fiere infermità, che tanto hanno molestato l'anno 1575 & tanto il 76 acerbamente molestano il Popolo de l'invittissima Città di Venetia* (Padua, 1576), 392v and 393v (Vatican copy).

households (not families) possessed less than four members. If the loners are subtracted from the San Gregorio families, they numbered 3.47 on average.[30]

Had the residents of the Lazzaretto all been infected with plague, research would expect to discover a greater than average household clustering of plague victims, but this clustering was considerably less than that found for the total population of Milan or Parma during the plague of 1468. At San Gregorio, 262 people in 156 families, or 1.68 per household (only half as many as at Parma during the plague of 1468), died.[31]

More striking still are the differences in the duration of plague illness between San Gregorio's inmates and victims recorded for other plague years, including 1485—that is, if we assume that all of those admitted to the Lazzaretto already showed signs of plague. Instead of dying within two to three days after the first signs of illness, and even less time after buboes or other pustules had formed, giving doctors reasonable grounds for suspecting plague, those who died in the Lazzaretto lasted 11.76 days on average from the day of admission to death. Furthermore, although only 5 percent of those with plague (58 of 1,086) endured the disease for more than a week, almost half of those dying at San Gregorio (111 of 245) survived as long from their admission, and seventeen lasted for more than a month.

These patterns strongly suggest that the Milanese health board carted away complete households whenever a plague death or illness was discovered within them. Such a policy would have been consistent with their larger policy of locking up entire homes within the city. Thus, the Lazzaretto data would understate the number of household members who died on the same day, since 27 of the 262 (10.3 percent) victims arrived dead at the Lazzaretto or died on the day that they arrived—that is, on the day when at least one other household member had probably died, thus prompting the board's action. These prior deaths, however, are not recorded in the San Gregorio list (see Table 5).

Despite this probable underestimation, the clustering at San Gregorio in 1485 shows a striking similarity to that in the city as a

30 For Florence and other Tuscan cities, see D'Amico, *Le contrade e la città,* 58–60; Daniel Herlihy and Christine Klapisch-Zuber, *Les Toscans et leurs familles: Une étude du catasto florentin de 1427* (Paris, 1978), 472–479. Saba, "Una parrocchia milanese," 441.

31 Popolazione, no. 77, n.p.

Table 5 Intervals between Deaths within Households: The Lazzaretto of San Gregorio, 1485

0	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS	6 DAYS	7 DAYS	8 DAYS	9 DAYS
30	7	5	5	1	5	3	4	2	4
10 DAYS	13 DAYS	14 DAYS	15 DAYS	17 DAYS	19 DAYS	20 DAYS	21 DAYS	29 DAYS	34 DAYS
2	2	3	2	1	2	1	2	2	1
51 DAYS	76 DAYS								
1	1								

whole during the plague of 1523. In both instances, nearly one-quarter of all plague deaths occurred in the same household on the same day (60 of 262, or 23 percent of the plague deaths, compared with 24 percent for the general population in 1523 and 25 percent for the four large parishes in that year). The overwhelming modal interval of plague deaths within households for Milan's total population in 1523 and San Gregorio's in 1485 was 0 (thirty pairs), and the next most frequent interval was a single day (seven pairs). Forty-seven (or 94 deaths, 55 percent) occurred within three days, and 120 or 70 percent within a week. Afterward, the intervals between plague deaths extend to as long as seventy-six days. Is the conclusion that this tiny minority represents a normal long incubation period for plague, as Scott and Duncan assumed from their data, warranted? Might these few have caught the disease later from outside the household, or might they have had an unusual resistance to the disease that ultimately failed to save them?[32]

NONANTOLA AND THE PLAGUE OF 1630 Even though the Milanese registers contain different ways of listing plague deaths for each of the six years, could Milan's remarkable household clustering have depended on some inherent peculiarity of the city or its records?

32 On the problems of enforcing strict household isolation, see Centorio de'Hortensij, *I cinque libri,* 12, 77–78; La Cava, *La peste di S. Carlo,* 113–134.

Nonantola, an agricultural/rural town, not at all like or near Milan, possesses a remarkable series of registers, which are entirely different from those in Milan. Nonantola's baptismal, marriage, and burials records (with almost 20,000 vital events from 1560 to 1650), in combination with its salt-tax records—the *Boccatico del Sale,* which recorded all of Nonantola's residents grouped by hearths, including servants—enable the reconstitution of not just families but also households. Thus, it can convey crucial information about the victims of the plague of 1630, which inflicted the highest mortality on many regions of Italy since the Black Death. Not even the San Gregorio register, which divided the Lazzaretto's inmates into families and later added death dates, can claim to duplicate the household structures of nucleated families so accurately. This assemblage of Nonantola's records represents, by far, the most comprehensive attempt to study a plague through family reconstitution. A later study will explore more thoroughly this rich documentation; for now, it serves to control for the conclusions drawn from late fifteenth- and early sixteenth-century Milan.[33]

On the eve of the plague in 1629, Nonantola counted 3,439 residents living in 626 different households. Between June 9, 1630, when the priest of San Michele wrote "*qui comincia il contaggio* (here begins the plague)" in the burial register, and December 31, 760 died in Nonantola, a twenty-five-fold increase in deaths relative to normal years. Only rarely did these parish registers report the cause of death, but the vast majority of these burials must have resulted from plague. Because burials of infants younger than four were never recorded, the total number of deaths during the plague year was certainly higher, but the jump in mortality for this year would probably have been much the same. To evaluate the population decline at Nonantola, children under four have been subtracted from the Boccatico, along with those dying between the Boccatico's redaction and the beginning of the plague in June.

33 Except for the presence of an important Benedictine Abbey and of vast common lands, Nonantola's social and economic structure was typical of rural towns in early modern Italy. Alfani, "Battesimi, sepolture, matrimoni a Nonantola: dinamiche demografiche e strategie sociali (secoli XVI–XVII)," *Proceedings of the Congress "La Partecipanza agraria di Nonantola: le radici del futuro," Nonantola, 2004* (forthcoming). All relevant sources are in S. Michele: Registers of Baptisms, Burials, Marriages, Nonantola. Although those younger than five or older than sixty were not liable for the salt tax, they were listed in the *Boccatico* nevertheless (Ruolo di popolazione—*Boccatico,* 1629, Archivio comunale di Nonantola).

Table 6 Intervals between Deaths within Households in Nonantola, 1630

0	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS	6 DAYS	7 DAYS	8 DAYS	9 DAYS
46	35	28	23	9	16	15	9	15	6
10 DAYS	11 DAYS	12 DAYS	13 DAYS	14 DAYS	15 DAYS	16 DAYS	17 DAYS	18 DAYS	19 DAYS
10	9	10	11	4	4	7	5	5	5
20 DAYS	21 DAYS	22 DAYS	23 DAYS	24 DAYS	25 DAYS	26 DAYS	27 DAYS	28 DAYS	29 DAYS
5	3	3	4	3	1	2	3	0	3
30 DAYS	31–40 DAYS	41–50 DAYS	51–60 DAYS	61–70 DAYS	71–80 DAYS	81–90 DAYS	91–100 DAYS	101–110 DAYS	>110 DAYS
1	11	6	5	4	5	3	0	1	2

With these adjustments, Nonantola's population would have been 3,042 living in 623 households at the plague's start. Hence, the first seven months of plague felled 25 percent of the population.[34]

Because of homonymy among Nonantola's most common surnames (Zoboli, Vaccari, and Piccinini), some record linkages may not be justifiable. As a result, 23.7 percent of the burials (180 out of 760) cannot at present be linked to households in the Boccatico. These burials, however, rarely concerned households with more than a single death; their absence does not seriously alter the intervals between plague deaths. But if better information about families emerges later to link more deaths to households, the intervals between plague deaths in Table 6 would become even shorter.

The reconstitutions of deaths at Nonantola show patterns similar to the ones observed at Milan for the plagues from 1452 to 1523. Like Milan's, Nonantola's modal interval of plague deaths

34 The average annual number of deaths from 1624 to 1628 was thirty-two. See G. M. Sperandini, "La peste del 1630 a Nonantola," *Nonantola e la Bassa Modenese: Studi in onore di Mons. Francesco Gavioli, Quaderni della Bassa Modenese,* XI (1997), 231–247. After December 1630, the plague disappeared. In March 1361, a few cases reappeared, but the plague never regained its former momentum.

was 0 (13.65 percent of cases), followed by intervals of one, two, and three days, the deaths declining thereafter progressively. Although the proportion of household plague deaths occurring on the same day was lower in Nonantola than in Milan, the proportion of those who died within three days after a previous household death was higher at Nonantola—40 percent of the multiple household deaths as compared to 34.7 percent at San Gregorio in 1485, the highest for any of the Milanese plagues examined thus far. Hence, this different place at a different time according to different sources corroborates the pattern of earlier plagues seen in Milan. Plague infection and death struck quickly in households, whether urban or rural, clustered within households and in rapid succession.

After intervals longer than a week, the string of subsequent household deaths in Nonantola tended to be slightly more protracted–20 percent of them occurring between three and nine days, another 20 percent between nine and nineteen days, and 10 percent thirty-two days or more after the last household death. The longest interval was 118 days. These longer gaps might have been a consequence of Nonantola's sizable households. On average, each included 5.74 members; Milan's poor families consisted of fewer than three. The differences might also have derived from differing social networks, communal forms of living, or contingencies attendant on isolating the plague stricken in a rural versus an urban setting. But despite these minor variations, the two plague settings were remarkably similar.

Rather than long periods of incubation reflected by long intervals between successive household deaths (as Scott and Duncan argue), the modal interval of household plague deaths and the speed at which death followed the first signs of illness suggest that the transmission of early modern plagues was similar to that of a deadly influenza. As in the case of influenza, a short incubation period of a day or two for the plague would not have impeded transmission. Instead, a short incubation period allowed these two diseases to spread as quickly as any known infectious disease, with the possible exception of food poisoning, since pre-industrial times.

Long before the railway, steam power, or the transport of troops overseas during World War I, the spread of influenza was so rapid that contemporaries attributed it to the wind or other clima-

tic condition rather than by human contagion. The early modern plagues were even more extraordinary; no other known disease causes such a high percentage of deaths within individual households on the same day. This new finding for early modern plagues was probably the same for the Black Death and its successive strikes to the mid-fifteenth century but cannot be shown without such records as Milan's *Libri dei morti* or Nonantola's combination of parish and tax records.[35]

The early modern plagues were not influenza. Not only does influenza fail to show tumors, pustules, and the like; the seasons of the two diseases also differ radically, being near mirror opposites. The early modern plagues generally struck in summer, and influenza most often from January to March. More important, the early modern plagues from 1452 to 1523 (at least in Milan) do not show a vital trait common to the earlier plagues from 1348 to 1400. Despite their high contagion and rapid spread within households and across cities and regions, the later plagues no longer presented the pneumonic traits or respiratory symptoms that chroniclers and physicians attributed to the early ones—coughs and the spitting or vomiting of blood. In the voluminous Milanese death books studied for this article, which contain far more detail on plague signs and symptoms than is available in any of the earlier plague accounts, not a single physician's report alluded to coughs *(catarrah)* or the vomiting of blood. The closest description to any respiratory ailment associated with plague was a bloody nose *(effluere sanguinis enaribus),* but even this symptom is found in only eight plague cases (0.05 percent). Instead, vomiting, stomach ailments, and effusions suggest that by the mid-fifteenth century, the

35 When influenza reached virgin soil, such as the Faroe Islands, St. Kilda, and Greenland, in the nineteenth century, the mortality rates may have been as high. Descriptions of the flu's rapid transmission in these isolated places resemble that of the Black Death in 1348. See Hirsch, *Handbook of Geographical and Historical Pathology,* I, 37, who reports that as soon as the Danish ships arrived, the natives died "suddenly and without prelude." From hundreds of diseases described in Gordon Cook and Alimuddin Zumla (eds.), *Manson's Tropical Diseases* (London, 2003; orig. pub. 1898), none parallels the devastation of the early modern plague, during which one-quarter of deaths occurred within households on the same day. In a private correspondence, Hajo Grundmann of the Medical School of Groningen, a microbiologist and epidemiologist who has worked in tropical and subtropical regions, maintains that he is unaware of any present-day disease with this characteristic. Only certain forms of food poisoning, the incubation periods of which can be as short as four hours, spread more rapidly than influenza.

intestinal tract had become the plague's principal means of diffusion.[36]

Despite the absence of sneezing, coughing, and other symptoms characteristic of respiratory transmission, however, the early modern plagues continued to spread with remarkable alacrity and deadly contagion. Although the detailed records of the early modern period now allow historians to trace family and household patterns of illness with greater precision than any records from the late Middle Ages, scientists and historians still cannot confidently attribute the plague to any modern disease with a known pathogen. Nonetheless, these later sources add a valuable characteristic to the profile of a disease that periodically decimated European cities and regions across four centuries.

36 The *Libri dei morti* provide specific quantitative evidence of the distribution of symptoms and skin disorders for the plague. Similarly, in long and detailed lists of plague symptoms, sixteenth-century physicians recorded stomach pains, effusions, and vomiting of meals, but rarely mentioned coughs or any other respiratory symptoms. When they did—as with Andrea Gallo Tridentino, *Fascis de Peste, Peripneumonia pestitentiali cum sputo sanguinis, fibre pestilentiali ac de quibusdam symptomatibus, in quinque daciolos digestus* (Brixiae, 1566), 37v–38r—their references are to the Black Death of 1348.