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RETHINKING DISEASE IN OTTOMAN HISTORY

Abstract
Drawing on a range of recent studies and original sources, this article calls for a revision of the usual paradigm of disease in Ottoman history by applying a more interdisciplinary approach and new insights from environmental history. The historiography of disease in the Middle East developed from the late 1970s to the early 1990s envisioned a steady mortality from inevitable cycles of bubonic plague supposedly accepted with pious resignation by Ottoman Muslims. Focusing on the period from circa 1500 to 1800, the article advances three arguments. First, Ottoman Muslims sometimes did take action to escape or contain epidemics. Second, the region actually suffered from a variety of other infections that together had an equal or greater impact than bubonic plague. Third, shifting political, social, and environmental conditions—especially Little Ice Age climate fluctuations and population movements during the 17th century—played a major role in disease mortality and Ottoman demography.

This article revisits and reinterprets the role of disease in Ottoman history in light of new sources and studies as well as new perspectives from environmental history. Although few historians of the Ottoman lands would deny the place of disease in the region's history, most have been content to leave microbes and their impacts in the historical background—a part of the scenery rather than an actor involved in the unfolding drama of the empire's development. This tendency has been abetted by interpretations that have linked the predominance of rat-borne *Yersinia pestis* and its inevitable outbreaks to inherent environmental conditions of the region and to the plague's purported acceptance with pious resignation by the peoples of the Middle East.

This article makes the case for a more complex and dynamic understanding of disease and its role in Ottoman history, particularly during the relatively neglected 16th and 17th centuries. Drawing upon original research and a range of recent studies, I argue for three major revisions to the present paradigm: first, that Ottomans, including Muslims, were not always as passive or fatalistic in the face of plague as once supposed; second, that the disease environment was more complex than the usual emphasis on bubonic plague would suggest; and third, that shifting environmental and social conditions had a major influence on disease outbreaks and mortality. Through these new interpretations, the study illustrates the potential of new sources and broader, more interdisciplinary perspectives to enhance our understanding of this critical subject in Ottoman history.

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THE PRESENT PARADIGM

Current impressions of disease in Ottoman lands still rely predominately on a handful of studies from the late 1970s and early 1980s. Jean-Noel Biraben's 1975 monograph on plague in the Mediterranean[1] was followed in short order by Lawrence Conrad's work on early Islamic epidemics[2] and Michael Dols' work on the Black Death in the Middle East[3] and then by Daniel Panzac's research on epidemics and public health over the 18th and early 19th centuries.[4] Despite some more recent publications on the topic (which will be discussed), these original works have remained by far the most cited and most influential. Although inspired by Annales' research on early modern Europe, this historical epidemiology of the Ottoman Empire (with the partial exception of Panzac's monograph) has often lacked the considerable methodological and quantitative rigor of its European counterpart. In addition, scholars working on the Near East have not had access to the extensive demographic data that have permitted historians of France and England to develop more precise measurements of mortality and seasonality and more useful statistical correlations.

Past research on Ottoman disease has relied for the most part upon a more limited range of literary and narrative sources, principally Arabic medical treatises, the observations of European travelers (especially Alexander Russell in Aleppo), and the reports of French and Italian diplomats. Until quite recently, few studies had made significant use of Ottoman material, whether narrative or archival. Furthermore, no major work had focused specifically on the classical Ottoman Empire (16th–17th centuries), leaving a significant lacuna between research on the Black Death in the 14th and 15th centuries and Panzac's work on the 18th and 19th centuries leading up to the imposition of quarantine in the 1840s. Such gaps in sources and coverage have left an unbalanced impression of disease in Ottoman lands. Although correct in various respects, the conclusions derived in these studies have also left out important elements of the picture.

At the risk of a little oversimplification, the established paradigm may be summarized in four parts. First, whatever other diseases may have been present, it was plague that proved the real killer. Overwhelmingly, past authors have focused on recurring epidemics of pneumonic and bubonic plague, from the original pandemic of Justinian in the 540s through the Black Death of the 1340s down to periodic outbreaks throughout the early modern period. Relying upon early Arabic medical treatises, authors have been quick to interpret nearly all references to *taun* as *Y. pestis* and likewise to accept French and Italian mentions of *peste* with the same ready diagnosis. Given the sudden sharp mortality of the affliction—frequently 30 to 40 percent in major cities—the impact of the disease has been assumed to dwarf that of the myriad other infections of the age.

Second, past works have followed the accepted etiology of the plague as a flea-borne disease endemic among the native rodent populations. According to this interpretation, the bacteria thrived amid reservoirs of mammalian hosts and their insect parasites, located particularly in Egypt and eastern Anatolia. This left the inhabitants of the region perennially exposed to periodic zoonotic outbreaks, as fleas jumped from rat to human populations. Basic environmental conditions, therefore, left Ottoman lands inherently more vulnerable to the disease, which broke out inevitably according to cycles in flea and rodent populations.

Third, traditional Islamic precepts taught Ottoman Muslims to accept plague as the will of God, encouraging a fatalistic indifference to the disease. Heath Lowry, in a recent article, has especially emphasized the conquest of Arab lands and the subsequent shift toward a more orthodox imperial faith as a turning point in official attitudes toward plague.[5] By the mid-16th century, Lowry argues, the rulers and religious establishment had assumed a pious indifference or even hostility toward measures to resist or escape the divine judgment embodied in this infectious mortality. (This idea has even been the premise of a recent novel, Orhan Pamuk's *Beyaz Kale*.) Notwithstanding the new research, which will be explained in this article, it has been widely accepted that the Ottomans took no significant measures to combat infectious disease or even to flee the regular outbreaks of plague until the unpopular imposition of quarantine during the Tanzimat.[6]

Fourth and finally, regular outbreaks of bubonic and pneumonic plague remained responsible for the historically low population of Ottoman lands by the early 19th century. Panzac, in particular, maintains that regular pandemics of *Y. pestis* would have more or less canceled out any natural growth, leaving the demographic trend of the region roughly flat. As early modern European states developed effective quarantine measures, therefore, this narrative posits the Ottomans as isolated and in relative decline, missing out on the rapid population growth that most of the world began to experience by the late 1700s. Only with effective public-health measures, pioneered first in Mehmet Ali's Egypt and not widespread in the Ottoman Empire until the later 19th century, could the region resume its demographic ascent in modern times.

Naturally, much of this present paradigm remains beyond dispute. Disease, including major epidemics, certainly played a key role in the high mortality of Ottoman lands, which were indeed quite thinly populated compared to Europe in the period leading up to the Tanzimat and quarantine.[7] Moreover, there is no denying the overwhelming impact of the Black Death on the Near East, as all across the 14th-century world. If anything, as Uli Schamiloglu has recently argued, Ottomanists have not yet given enough consideration to the tremendous population decline of the period and its role in early Ottoman expansion.[8] Finally, as Panzac has demonstrated, epidemics continued to rage throughout the empire over the 18th century, restraining population growth and creating a reservoir of infection for incautious European merchants and their ports.

Nevertheless, there are equally significant parts of this paradigm that should now be critically reexamined in the light of new evidence and interpretations. Above all, the problematic aspects emerge when we focus on the era between the devastation of the Black Death and the steady mortality of the century and a half before quarantine. During this key period, largely neglected by previous studies on disease, we find a rapid population expansion over the late 1400s and 1500s, suddenly checked and reversed by an alarming crisis in the 1590s then followed by a century of severe losses.[9] This striking demographic pattern calls for a revised approach to the topic of disease.

NEW STUDIES AND SOURCES

A variety of new studies on Ottoman disease has appeared over the last two decades and especially the past five years, most still very little known but many deserving of more

scholarly attention. These include a trickle of articles on various aspects of epidemics in the Middle East, mostly in Turkish publications[10] but also in some English-language studies.[11] A short book has appeared compiling information on epidemics from archival sources,[12] as has a substantial two-volume collection of documents and articles about Ottoman disease and medicine.[13] These publications have been complemented by three recent dissertations focused specifically on plague in the empire[14] and two more that deal with epidemics in the wider context of Ottoman environmental history.[15] Most recently, Miri Shefer-Mossensohn has published a valuable monograph on Ottoman medicine in the 16th and 17th centuries.[16]

These studies have uncovered a variety of novel sources for the study of disease in the Ottoman Empire, particularly during the 16th and 17th centuries. For instance, Ottoman narrative sources such as chronicles, usually neglected in previous works, contain a number of accounts of epidemics that offer some useful insights on the nature of disease and its impact. Material in the Ottoman archives and especially the imperial orders (*mühimme defterleri*) of the 16th and early 17th centuries offer further evidence on the recurrence of diseases and on Ottoman official reactions. Perhaps most promising of all, however, have been the descriptions found in court records (*kadı sicilleri*), which have opened a new window onto local responses and the day-to-day experience of disease and that have been utilized, for instance, in studies of Trabzon, Bursa, and Aleppo.[17] As some studies have indicated and as this article will explore, we may be able to learn even more from these records by compiling information such as family size and the seasonality of deaths, particularly from series of probate inventories (*tereke defterleri*).[18]

To a certain extent, such work on the Middle East may also benefit from wider developments in the historiography of epidemics and disease over the past three decades. For example, historians of early modern Europe starting with the "Cambridge school" of the early 1980s have used quantitative data to better understand the complex impact of disease and its correlations with other measurable demographic, economic, and even climatic data. We now have a far better sense of the interaction among disease mortality and such phenomena as weather, prices, nutrition, and urbanization as well as the various official policies and social conditions that tended to either exacerbate or alleviate such crises.[19] Although the Ottoman archives lack such extensive quantitative information, Ottomanists may nevertheless apply the discoveries of Europeanists to better explain and understand the complex interactions underlying the causes and consequences of disease in the early modern Middle East. In addition, following the seminal publication of William McNeill's *Plagues and Peoples* in 1976,[20] historians have explored the environmental context of endemics and epidemics, opening an important line of research for environmental history of the Middle East. For example, studies by Peter Christensen and Stuart Borsch have underscored the environmental contexts and consequences of plagues in early medieval Iraq and late medieval Egypt, respectively.[21]

In combination, the studies, sources, and perspectives described here point the way toward a new interpretation of disease in Ottoman history. Building upon this new historiography, the following three sections will each outline a major revision to the paradigm established in the 1970s and 1980s. The first will demonstrate that Ottoman responses to disease were often more practical and less fatalistic than previously supposed. The next will make the case that bubonic plague formed only one element in a more complex disease environment. The third will argue that the prevalence and impact of major

endemic and epidemic diseases did not remain constant as previously supposed but instead shifted over time according to ecological pressures and social and environmental conditions within the Ottoman Empire.

QUESTIONING GOD'S WILL

Perhaps the most dramatic revision to our current understanding of disease relates to the well-entrenched notion of Muslim fatalism in the face of the plague. As described previously, most Ottomanists have continued to follow studies of the 1970s and 1980s by arguing that Ottomans—or at least Ottoman Muslims—accepted plague as the will of God and failed to take serious steps to fight the infection. This conclusion has been based primarily on two types of sources: Arabic theological discussions of disease, especially early hadith, and later accounts by European travelers to Ottoman lands shocked at the apparent indifference of their Muslim hosts during times of epidemics. Doubtless, some Islamic scholars really did believe that resistance to plague meant resistance to the will of God, and just as certainly, many Ottomans really did face plagues with a stoicism rarely found among their European contemporaries. Nevertheless, both European and Ottoman sources contain examples that sharply contradict this supposed fatalism and present a more mixed picture of Ottoman reactions.

Both European travelogues and diplomatic correspondence do in fact record Ottoman Muslims fleeing from plague. It is unclear whether past authors overlooked or simply ignored these accounts, but they strongly suggest that stereotypical descriptions of religious indifference were greatly exaggerated if not altogether false. For instance, when the English traveler John Covel witnessed a plague in Edirne in 1676, he noted in his journal how

> [t]he best sort of people fled to other places, as the Turkes likewise themselves did from Adrianople to their houses here [in the countryside], for that same is a story that [Muslims] are not afraid of the plague, because their fortunes are wrote on their forehead; for all fled, but such as were poor, or had offices about Court, and could not get away. There dyed that year about 100 persons out of the Vizier's own house; and really, those [townsmen] that are forc't to stay value it no more than we do an ague. But this is the same amongst Jewes, Greeks, Armenians, and every body else.[22]

Likewise, during a plague in 1604, the Venetian *bailo* at Constantinople observed in a dispatch that even the muftis had fled the capital, regardless of religious scruples:

> All that have means have retired to gardens outside the city, each attempting to distance himself from the danger as much as possible. In particular, even though in other times they have not taken the trouble to do it, the Mufti and the other doctors of law have departed to their gardens, not withstanding that this goes against one of the principal points of their law.[23]

It appears that Ottoman theological and medical discussion of the plague may have proven more complicated and contested than previously assumed. As recently analyzed in several works, Ottoman religious and legal scholars actively debated the permissibility of flight and other measures to avoid or mitigate the ravages of plague.[24] It is not that the authors challenged the orthodox view that plague was the will of God. Insofar as Ottoman Muslims accepted a divine origin for disease—or for that matter other natural disasters such as earthquakes—they really differed very little from their Byzantine predecessors

or contemporary Christian neighbors. All could account for these events in otherworldly terms without ignoring more immediate natural causes. One could accept fate without necessarily tempting it through carelessness or reckless indifference.[25]

An example from the correspondence of the British ambassador Sir Thomas Roe serves to highlight these similarities between early modern European and Ottoman attitudes. Writing to the archbishop of Canterbury about a plague in Istanbul in late 1625, the ambassador noted how the Ottoman sultan had led processions and prayers for God to ward off the illness. The archbishop replied:

> They are strange accidents whiche your letters report to have fallen out about that Porte, and the rage of the plague hath bene very muche, whiche hath driven those miscreants to prayers and processions. Wee have here, with better knowlege, taken a course to appease God's wrathe in the pestilence, and therefore in parliament decreed solemne fasts and publicke prayers throughout the whole kingdome, the king himself, at Westminster churche joyning with the lords and the rest of the commons.[26]

In other words, despite their application of quarantine, the English had more or less the same religious reaction to the plague.[27]

At the same time, accounts in the *mühimme defterleri* emphasize how remote theological considerations could be from the day-to-day experience of epidemics among the Ottomans. Self-preservation was first on the minds of most subjects, while the imperial government concerned itself mainly with preserving order and collecting taxes. The majority of imperial orders mentioning plague were issued to authorize local officials or *sipahi* to round up fleeing peasants and send them home. In 1571, for instance, the governor of Caffa wrote to Istanbul that the *reaya* had been struck and were fleeing "with the excuse of plague [*taun bahanesiyle*]."[28] Likewise, during an epidemic that struck Diyarbakır in 1544–45, imperial orders specifically forbad anyone to "flee saying that there is plague [*taun vardır diyü kaçup*]."[29] No mention is ever made of religious rights and wrongs. The peasantry had to stay put during epidemics for the same reason they had to stay put the rest of the time: not because it violated divine law but because it violated imperial law. In the case from Caffa, for instance, the wording emphasizes that what was at stake was the collection of provincial taxes and that flight would be considered a sort of tax evasion.

Several orders concerning the Jews of Salonica clarify this policy further. This community evidently had a traditional right to flee the city during plague outbreaks, because that had been their custom "from ancient times [*kadimden*]." (The Jews had settled in Salonica after they were expelled from Spain in 1492, and by the later 16th century the city was mainly Jewish.)[30] On at least three occasions, the Jews appealed to this right to leave, and in all three cases the sultan granted them permission provided that they turned in their mandatory tax contribution, which consisted of broadcloth for the imperial Janissaries. On only one occasion did the sultan send them back and then only because their broadcloth quota remained incomplete.[31] To clarify that religion alone was not the issue, there are other orders forcing fleeing Christians to return to towns during plague outbreaks as well.[32] The deciding factors were clearly traditional rights and outstanding tax obligations.

Furthermore, accounts of epidemics in Ottoman records of the classical age demonstrate that both local and central officials could recognize the dangers of contagion and

take action accordingly, even absent comprehensive policies of quarantine. Although accepted etiologies of plague and other diseases focused on miasmas and astral bodies, notions of contagion were apparently widespread.[33] For instance, some municipalities continued to maintain leper colonies (*miskinler tekyeleri*), where according to Evliya Çelebi "all those afflicted with leprosy [*cüzâm*] and foul sickness [*kaba marazı*] are placed . . ."[34] Perhaps the most remarkable example occurs in the court records of Trabzon, as discussed in a study by Ronald Jennings. During an epidemic in that city, the *kadı* had suspected outbreaks investigated, and in some instances he ordered infected persons to be carried to the outskirts of town and left to die—a practice that he apparently deemed consonant with shari'a. Meanwhile, the *sipahi* fled the town, and Ottoman ships avoided Trabzon harbor.[35] In another telling example, it appears from an imperial order of 1566 that the island of Chios still practiced its traditional policies of quarantine, isolating merchants who came from plague-infested areas for twenty-five days upon arrival.[36]

Lest these examples be dismissed as regional holdovers from pre-Ottoman Christian practice, there are also indications of antiplague measures taken by the Porte. In one case from 1579, an order came directly from the capital not to let a plague raging in Egypt reach Istanbul. Although the meaning of the document is not entirely clear, it appears the sultan ordered the governor of Alexandria to prevent pilgrims and merchants from leaving by ship to Istanbul and reprimanded him for failing in his duties.[37] Walled cities could also exclude unwanted vagrants, and the practice could effectively keep out many carriers of disease.[38] In 1568, for example, the sultan chastised Istanbul's *kadı* for letting in sick beggars to wander the streets and ordered him to "expel them according to ancient custom, and do not let them mix with the people [*âdet-i kadime üzere şehirden sürüp ihtilât itdürmeyesin*]."[39]

Alone, none of these indications would be entirely conclusive. However, taken together, this new evidence calls for a serious rethinking of Ottoman fatalism in the face of plague and other epidemics. Such an essentialist conception of Muslim attitudes and behaviors has oversimplified Ottoman responses to disease, and moreover it has distracted historians from seriously pursuing the critical question of why the Ottoman state was so late to adopt a comprehensive quarantine system. The answer might be sought in more conventional issues of imperial policy or center–periphery relations or, as Shefer-Mossensohn has suggested, in a decision to affirm social and family bonds in times of crisis.[40] Aaron Shakow has even proposed that European quarantine had evolved not so much as a tool of public health as a weapon of trade among competing polities, explaining its late development in the relatively unified and open Ottoman Empire.[41]

"A PLAGUE OF PLAGUES"

The second major revision to the current paradigm reexamines the role of bubonic plague in the disease and demographic history of Ottoman lands. As described previously, past studies have focused overwhelmingly on the presumed impact of *Y. pestis*, generally believed to have been the most dominant and deadly of the empire's infections by far. New studies of medieval and early modern Europe, and new evidence on Ottoman history presented here, should call that view into question. Not only have past authors probably proven too ready to identify cases of bubonic plague, but also it appears that

Ottomanists' fixation on this particular pathogen may have led them to overlook a much richer and more complex disease environment.

Since the work of Biraben, Conrad, Dols, and Panzac more than two decades ago, historians of medieval and early modern Europe have begun to doubt once-confident diagnoses of *Y. pestis*, suggesting the need for similar revisions by Middle East historians. Even the etiology of the Black Death has recently come into question, with a serious debate over whether the initial infection may have been some form of anthrax.[42] Although far from conclusive, the evidence has raised serious concerns about the possibility of making accurate diagnoses at the distance of centuries and about accepting premodern terminology and descriptions at face value. Given the skepticism that surrounds "plague" diagnoses even in better documented European cases, Ottomanists ought to be very cautious in assigning a particular pathogen to most epidemics in Ottoman history.

The case for most "plagues" in the empire may rest on a linguistic simplification. Historians such as Panzac and Dols, relying on descriptions in Arabic medical texts, have almost always interpreted Ottoman references to *taun* as bubonic plague. Most modern Turkish writers have also assumed that *taun* had this technical meaning, in contradistinction to *veba*, which might refer to any other epidemic disease.[43] However, there does not appear to be a firm basis for such a distinction in most Ottoman writings, nor should historians assume that chroniclers or imperial bureaucrats used such words in a precise clinical manner. As Conrad notes, even in classical Arabic accounts *taun* did not always refer to bubonic plague,[44] raising serious doubts about the way writers in Istanbul would employ the term a millennium later.

Anecdotal evidence suggests that in practice Ottomans used *taun* and *veba* quite flexibly for various descriptions of disease, sometimes even pairing the two for emphasis. In one late 16th-century example, we hear of how "a great *taun* and *veba*" caused people to swell up before, it seems, "it roasted their livers [*ciğerlerin biryan eyledi*]."[45] The same chronicle describes another disease that struck Istanbul that year, which one copyist has recorded as "*mübarek maraz*" while another copyist has written "*maraz-ı taun*," which implies that the term was not always used very precisely.[46] Elsewhere, the chronicle mentions two outbreaks of *taun* wherein victims apparently died of "a stomach sickness [*maraz-ı su-ı mide*]."[47] In still other cases, the word is used metaphorically for any great scourge, as in official descriptions of bandits as a *taun-ı ekber*.[48] In fact, *taun* seems to equate rather closely with the English "plague" in all its variety of meaning.

Historians must take the same care when dealing with frequent European reports of *peste*, whether in French or Italian. Panzac in particular assumed that such descriptions emanating from European consuls in Istanbul proved that bubonic plague held a near permanent grip on the capital and other major cities of the empire. However, a closer reading of the European evidence leaves a more mixed impression. In the 17th century, for instance, English consul Paul Rycaut made reference to "the Plague, which is the Epidemical [*sic*] Disease of this Country, and the common distemper of the Summer Season," suggesting the term was used rather broadly.[49] Elsewhere, different diagnoses contradict each other. To take one example, in 1595 the Venetian *bailo* Marco Vernier refers to a particularly severe epidemic as a "*peste acutissima, et mortifera*."[50] However, his lengthy description of its victims, covered in black marks and suffering from a gradual choking death, may more strongly suggest anthrax—a diagnosis seemingly confirmed by the contemporary chronicler Mustafa Ali, who describes the disease as

"*şir-pençe*"[51] (Persian for anthrax or literally "lion's paw") and gives an account of a major epizootic of the time that may have come from the same pathogen.[52] Adding to the confusion, Ambassador Vernier specifically contrasts the current infection with past episodes of *peste*, which were apparently treatable and not always fatal—and so certainly not bubonic plague at all. There are relatively few major epidemics mentioned in such reports whose descriptions would positively distinguish them as *Y. pestis*, as opposed to an infection such as typhus.[53] Based on case studies of outbreaks in the 1720s and 1760s, Shakow has argued that French descriptions of *peste* represented no more than an "arbitrary diagnostic category" covering myriad overlapping diseases.[54]

Upon closer examination, our sources describe a host of other infections in Ottoman lands that taken together probably influenced mortality more than plague alone. Although Alexander Russell's *Natural History of Aleppo*, for instance, gives a detailed description of one plague epidemic, it spends far more time cataloguing a variety of regular seasonal ailments, including what would appear to be frequent serious respiratory and gastrointestinal infections. Likewise, travelers to Ottoman Egypt have left historians with lengthy accounts of the various gruesome parasitic diseases that raged along the Nile.[55] The first comprehensive modern accounts of Ottoman disease and mortality from the 19th century, moreover, confirm the impact of widespread endemic pathogens even in the absence of bubonic plague. Based on such figures, the demographer Justin McCarthy has argued that "epidemics . . . were an occasional disaster to the population, but they were no match for the toll taken by endemic diseases."[56] Likewise, for the Egyptian cities of Cairo and Alexandria, Panzac found that gastrointestinal infections led all other causes of death at 34.9 percent and 37.4 percent, respectively, followed by pulmonary infections at 24.1 percent and 28.3 percent. Among infant deaths, the former figure rose to well over half.[57]

Comprehensive statistics may be lacking for earlier centuries, but research into *tereke defterleri* offers some strong anecdotal confirmation of these regular annual infections and their demographic impact. Although usually analyzed for their data on wealth and living standards, these probate inventories were also dated by month and year, which allows historians to compile a rough seasonal breakdown of deaths. The picture obtained is quite striking. Almost without exception, deaths rose significantly in winter and fell in spring. As hotter weather set in, mortality rose sharply again, peaking in the hottest months of late summer, before dropping off with the cooler weather of autumn. Only on occasion do we find the distinct early summer peaks associated with the spread of plague-carrying fleas or the more gradual autumn peaks associated with famine.[58] Although far from conclusive, the evidence so far would suggest that most annual mortality variations probably arose from winter fevers and respiratory ailments on the one hand and gastrointestinal infections and perhaps malaria on the other—just as we would expect from the 19th-century figures.

Therefore, although by no means negligible, the demographic role of plague must be put in its proper perspective. Even in good years, mortality in Ottoman lands remained quite high, due to serious infections of all sorts. Major plague epidemics only exacerbated an already difficult situation. Panzac's earlier estimates of region-wide death rates of 20 percent or more, which would far exceed the estimates of Biraben for similar European cases, thus probably overstated the impact of pandemics[59] and his work did not take into account the way that birth rates might subsequently rise to compensate for such

serious, sudden losses.[60] Without minimizing the role of *Y. pestis*, Ottomanists need to search further to account for major trends in the empire's demography and particularly the region's relatively low population by the early 19th century.

ENVIRONMENTAL AND SOCIAL FACTORS AND CRISIS MORTALITY

The third major revision proposed in this study involves reexamination of environmental and social factors in the history of Ottoman disease. The accepted paradigm of disease in Ottoman history has supposed a static or cyclical situation: plague, the leading cause of disease mortality, was purportedly endemic to the region and its rodents, and Ottoman Muslims supposedly took few serious steps to avoid it. Consequently, regular outbreaks should more or less have leveled regional population growth. Yet the rapid demographic growth of the late-15th to late-16th centuries and the sudden population loss over the following century contradict this picture. There is no evidence that outbreaks of plague were altogether less common in the 16th century or more common in the 17th century. As one recent dissertation has argued, the range and frequency of epidemics may even have been greater during the rapid growth of the 16th century, when imperial conquest and trade brought new populations into contact.[61] Rather than simply counting plague outbreaks, we need to look more closely at factors that mitigated or aggravated exposure and vulnerability to infection, such as climate, nutrition, migration, and economic and political stability.

Initially, favorable environmental and economic conditions of the early to mid-1500s probably reduced the overall demographic impact of infections. This period of imperial expansion left a relative abundance of agricultural land, reflected in earlier *tahrirler*, presumably alleviating problems of acute malnutrition and vagrancy, which have both been found to promote the spread and mortality of infections.[62] Furthermore, general economic growth and an abundance of economic opportunities in the late-15th to mid-16th centuries would probably have buoyed overall birth rates, especially in the wake of unexpected losses from epidemics. Finally, climatological evidence firmly indicates that Ottoman lands were enjoying a relatively benign, drought-free climatic period between the disasters of the late-14th and early-15th centuries and the Little Ice Age from the late 16th to the early 18th centuries.[63]

The rising troubles of the later 16th century put this era of growth in perspective. As population pressure eroded agricultural surplus and a new class of landless men began to drift into towns and cities,[64] the empire experienced new vulnerabilities to infection in the final decades of the 1500s. The issue was not simply that major "plague" outbreaks became more common but rather that Ottoman populations fell victim to synergies among disease, poverty, flight, and general disorder. The problem often started as famines, epidemics, or banditry drove villagers out in search of food or safety, especially when disaster or depopulation left them unable to meet tax quotas.[65] Diseases would have spread more rapidly and fatally among malnourished populations and amid the unsanitary living conditions of the poor, especially fleeing refugees who could carry epidemics from province to province. In 1579 in Baghdad, for instance, the local *kadı* reported that: "Last year there was famine. [Now] most of the *reaya* have fled and this

year there is also plague [*taun*]."[66] By the 1580s, especially during the severe drought and major military campaigns of 1584 to 1585, natural disaster and rural disorder combined to precipitate significant crises. In those years, provinces from the Balkans to Syria reported serious famine,[67] banditry,[68] and tribal unrest,[69] and it appears likely that malnutrition and refugee movements contributed to major epidemics observed in the capital during those same summers.[70] The Venetian *bailo* reported in 1601 that "the plague, according to the custom in these parts [i.e., Istanbul], has hitherto appeared rather among the lower ranks, who live disorderly and careless lives, than in the other condition of people," but now it was spreading among the whole population.[71]

By that point, the region had entered its worst period of Little Ice Age weather events. In the mid-1590s, a series of freezing winters began, and Ottoman lands were plunged into their longest continuous drought in six centuries. Without delving into the details, there now appears to be a strong connection between the timing of this Little Ice Age episode and the outbreak of a major uprising in Anatolia known as the Celali Rebellion (1596–1610).[72] The intense cold and drought not only destroyed harvests but also left livestock exposed and starving, leading to a major epizootic that decimated sheep and cattle over much of Anatolia, the Crimea, and the Balkans. These disasters came just as the imperial government was already making inordinate demands on these provinces for provisions and animals to supply an ongoing war with the Hapsburgs, aggravating perhaps the worst famine in Ottoman history and pushing a desperate peasantry into revolt.[73] In any event, it has now been fairly well established that the combined impact of starvation and violence left large parts of the empire, particularly Anatolia, severely depopulated by the 1640s.[74] Recurring episodes of severe cold and drought, especially in the so-called "Late Maunder Minimum" phase of the Little Ice Age (1680s–1710s), aggravated by political upheaval and military defeats, produced new mortality crises through the 17th century and beyond, delaying the empire's demographic recovery.[75]

Records from the period are not detailed enough to break down this population loss into specific causes of death, but once again comparison with similar European cases would strongly point to the fatal spread of infection among vulnerable famine refugees. The most detailed studies of weather, prices, and mortality in early modern England, for instance, have found that freezing weather and failed harvests correlated most strongly of all with elevated mortality from typhus—more strongly than deaths from cold-related diseases like pneumonia.[76] Likewise, even during the worst famines in starvation-prone Finland, most mortality emerged from typhuslike infections (probably including typhoid as well).[77] The latter comparison may be particularly apt given the scale of the famine in the Ottoman Empire during the 1590s and 1600s, when climatic disaster and Celali depradations left much of the countryside destitute and drove what Mustafa Akdağ dubbed the "great flight" in Anatolia.[78] Cold, dry weather per se was probably a lesser factor in this mortality: eyewitness accounts such as that of Alexander Russell actually stress the benefits of a freeze in killing off dangerous summer pathogens.[79] Instead, it was most likely the poor conditions of the fleeing refugees that promoted lice-borne and fecal-transmission infections that finished off their weakened constitutions.

This pattern of natural disaster, social disturbance, and infection has been studied in more detail in a recent article on disease in Ottoman Egypt by Alan Mikhail.[80] Taking a severe plague of 1791 as a case study, Mikhail demonstrates the web of causation among that year's earthquake and poor Nile flood, widespread famine, rural disorder, flight,

crowding, and ultimately an infection described as pneumonic plague. The article places the epidemic in its environmental context and illustrates how the climatic irregularities may have created similar incidences of infection across the empire.[81]

In addition to such short-term mortality peaks, the crises of the 1600s may have permanently altered the disease environment of Ottoman lands in two key respects. First, previous efforts to contain epidemics probably broke down with the political upheaval and waning of central authority during the 17th and 18th centuries. There is plentiful evidence that the imperial government lost its ability to contain population movements, especially in times of crisis.[82] As rural population numbers fell and the man–land ratio adjusted accordingly, the peasantry may have achieved new bargaining powers with local landlords and tax collectors through the threat of flight. Repeated attempts to raise the *çift-bozan akçesi*—the fine for unauthorized movements—evidently had little power to keep the *reaya* in place during these troubled times.[83] As vagrants roamed the countryside, they would have carried their infections from province to province, exacerbating the dangers of contagion that earlier Ottoman restrictions had sought to avoid. In addition, as recently argued by Faruk Tabak, the abandonment of farmland in the plains and a retreat to the hills may have aggravated problems of erosion, siltation, and malaria.[84]

Second, the chronic danger of famine and banditry appears to have driven widespread migration from farms and villages into larger towns and cities able to offer relief and protection. Robert Mantran has noted the significant increase in Istanbul's 17th-century population,[85] and André Raymond has made similar observations for the growth of major Arab cities.[86] Other estimates suggest that many midsized Anatolian towns witnessed significant gains in the Little Ice Age crisis as well, including Konya,[87] Manisa,[88] Bursa,[89] and Ankara,[90] while Izmir mushroomed from a mere village into a major port.[91] It is well known that various draconian attempts to send the migrants back all met with failure, as a desperate peasantry continued to seek food and safety.[92] By the later 1700s the Ottoman Empire had reached an unusually high level of urbanization for a preindustrial society—up to 15 to 20 percent by some estimates[93]—creating new reservoirs and pathways for pathogens. The first refugees from the crisis perished in large numbers from starvation and starvation-related infections,[94] and then the new urban–rural population imbalance elevated overall levels of disease mortality in the long run. Not only did Ottoman towns and cities suffer from the usual preindustrial "urban graveyard" effect of surplus deaths over births, but also they faced particular problems of overcrowding, decaying infrastructure, and breakdowns of water supply and sanitation in these years of rapid migration and political and economic upheaval.[95] Although much research remains to be done, it makes sense to conclude that these conditions aggravated the usual mortality from endemic and epidemic infections ranging from dysentery to smallpox to measles to plague, particularly among new rural arrivals lacking inherited or acquired immunities.

Court records and particularly *tereke defterleri* have also left some significant indications of the demographic impact of this urbanization. Reconstructions of family sizes based on court appearances and probate enquiries have revealed a notable disparity between rural and urban family sizes. For instance, a survey of some 2,705 cases involving families in the Konya court records of the early-18th century has yielded an average of 3.24 children in rural households but 2.24 children for urban households,[96] and studies

across Anatolia have given similar figures of roughly three children per household in the countryside and only about two per household in the cities.[97] The sample sizes in question are small and the exact definition of "household" often uncertain, but these numbers nevertheless imply that Ottoman towns and cities did not reproduce themselves but instead absorbed the natural population growth of the countryside. This is especially so when we factor in the number of single migrants who would have died young, poor, and unmarried. This impression is further supported by immigrant tax records in Aleppo indicating that about a quarter of the city's adult men were migrants from outside the province, which suggests that the city relied on high levels of immigration to support its population.[98] Comparison with contemporary European cities indicates that this urban demographic impact may have been quite profound, actually canceling out most rural growth and thereby severely delaying Ottoman recovery from its 17th-century crisis.[99]

This sort of historical analysis may offer a way to understand shifting patterns of infection and population over the course of Ottoman history. It appears that a particular combination of environmental, social, and political factors combined to make the 16th century an era of growth, the 17th century an era of contraction, and the 18th century an era of stasis in an Ottoman demographic history dominated by disease-related mortality. Furthermore, this analysis suggests that to understand Ottoman population recovery in the 19th century, we should consider not just quarantine and public-health measures but also political, social, and environmental factors. The reimposition of strong central authority, nomad resettlement initiatives, and a revival of agriculture on the plains in the mid- to late 1800s may all have played a role in mitigating losses from infection, just as the war, economic disruption, and mass migration of the 1910s and early 1920s brought another wave of disease mortality in spite of enhanced medical facilities.[100]

CONCLUSION

Although our understanding of disease in Ottoman history is still far from complete, the available evidence and research should nevertheless force us to rethink some common assumptions. Ottomans did often take active measures to confront infection, their disease environment was complex, and infection and mortality interacted dynamically with environmental, political, and social conditions. Although the theories sketched in this article remain preliminary, they may point to new ways of exploring Ottoman disease in all of its historical and ecological complexity. At the least, the arguments and evidence presented here may underline the need for Ottomanists to keep abreast of developments in the often unfamiliar fields of historical demography, epidemiology, and climatology. The ideas raised here may also illustrate how Ottoman history may benefit from a greater attention to and analysis of the dynamic interactions between humans and the natural world. To paraphrase the American environmental historian Alfred Crosby, it helps to bear in mind that before the Ottomans were Turks or Greeks or Muslims or Christians they were first and foremost biological entities. Understanding how they lived and died at the most fundamental level not only provides valuable insights in its own right but also helps lay a critical foundation for understanding other concerns of Ottoman history, from politics to culture to religion.

NOTES

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[1]Jean-Noel Biraben, *Les hommes et la peste en France et dans les pays européens et méditerranéens* (Paris: Mouton, 1975).

[2]Lawrence Conrad, "The Plague in the Early Medieval Near East" (PhD diss., Princeton University, 1981); idem, "Ta'un and Waba Conceptions of Plague and Pestilence in Early Islam," *Journal of the Economic and Social History of the Orient* 25 (1982): 268–307; idem, "Epidemic Disease in Formal and Popular Thought in Early Islamic Society," in *Epidemics and Ideas: Essays on the Historical Perception of Pestilence*, ed. Terence Ranger and Paul Slack (Cambridge: Cambridge University Press, 1992).

[3]Michael Dols, *The Black Death in the Middle East* (Princeton, N.J.: Princeton University Press, 1977); "Geographical Origins of the Black Death," *Bulletin of the History of Medicine* 52 (1978): 112–20; and idem, "The Second Plague Pandemic and Its Recurrences in the Middle East," *Journal of the Economic and Social History of the Orient* 22 (1979): 162–89.

[4]Daniel Panzac, *La peste dans l'Empire ottoman* (Leuven, Belgium: Peeters, 1985) and various articles later collected in *Population et santé dans l'Empire ottoman* (Istanbul: Isis, 1996).

[5]Heath Lowry, "Pushing the Stone Uphill: The Impact of Bubonic Plague on Ottoman Urban Society in the Fifteenth and Sixteenth Centuries," *Osmanlı Araştırmaları* 23 (2003): 93–132.

[6]See, for example, Sheldon Watts, *Epidemics and History: Disease, Power, and Imperialism* (New Haven, Conn.: Yale University Press, 1997), 25–39, where the author argues that Muslims lacked the "ideology of order" that was the prerequisite for quarantine. On the 19th-century quarantine and popular resistance in Ottoman lands, see also Michael Low, "Empire and the Hajj: Pilgrims, Plagues, and Pan-Islam under British Surveillance, 1865–1908," *International Journal of Middle East Studies* 40 (2008): 269–90; Gülden Sarıyıldız, "Karantina Meclisi'nin Kuruluşu ve Faaliyetleri," *Belleten* 28 (1994): 329–76; and Nuran Yıldırım, "Osmanlı Coğrafyasında Karantina Uygulamalarına İsyanlar: 'Karantina İstemezük!'" *Toplumsal Tarih* (2006): 18–27. On the imposition of quarantine and public health in 19th-century Egypt, see Laverne Kuhnke, *Lives at Risk: Public Health in Nineteenth-Century Egypt* (Berkeley, Calif.: University of California Press, 1990).

[7]For various estimates of relative population in the period, see, for example, Kemal Karpat, *Ottoman Population 1830–1914* (Madison, Wisc.: University of Wisconsin Press, 1985); Justin McCarthy, "Factors in the Analysis of the Population of Anatolia, 1800–1878," *Asian and African Studies* 21 (1987): 33–63; and Bruce McGowan, "The Age of the Ayans, 1699–1812," in *An Economic and Social History of the Ottoman Empire*, ed. Halil İnalcık and Donald Quataert (New York: Cambridge University Press, 1994).

[8]Uli Schamiloglu, "The Rise of the Ottoman Empire: The Black Death in Medieval Anatolia and Its Impact on Turkish Civilization," in *Views from the Edge: Essays in Honor of Richard Bulliet,* ed. Neguin Yavari et al. (New York: Columbia University Press, 2004).

[9]This demographic trend has been the subject of scores of regional studies in the Ottoman cadastral surveys (*tahrir defterleri*). For an overview of *tahrir* research, see Erhan Afyoncu, "Türkiye'de Tahrir Defterlerine Dayalı Olarak Hazırlanmış Çalışmalar Hakkında Bazı Görüşler," *Türkiye Araştırmaları Literatür Dergisi* 1 (2003): 267–86. For examples of this particular demographic pattern, see esp. L. Erder and S. Faroqhi, "Population Rise and Fall in Anatolia 1550–1620," *Middle East Studies* 15 (1979): 322–45; and Oktay Özel, "Population Changes in Ottoman Anatolia during the 16th and 17th Centuries: The 'Demographic Crisis' Reconsidered," *International Journal of Middle East Studies* 36 (2004): 183–205.

[10]For example, Feda Arık, "Selçuklular Zamanında Anadolu'da Veba Salgınları," *Tarih Araştırmaları Dergisi* 15 (1991): 27–57; Halil Berktay, "Salgın Hastalıklar," *Toplumsal Tarih* 4 (1995): 17–25; İlhan Pınar, "İzmir'de Veba," *Toplumsal Tarih* 1 (1994): 22–25.

[11]For example, Ronald Jennings, "Plague in Trabzon and Reactions to It According to Local Judicial Registers," in *Humanist and Scholar: Essays in Honor of Andreas Tietze*, ed. Heath Lowry and Donald Quataert (Istanbul: Isis, 1993); Alan Mikhail, "The Nature of Plague in Late Eighteenth-Century Egypt," *Bulletin of the History of Medicine* 82 (2008): 249–75; Rhoads Murphey, "Ottoman Medicine and Transculturalism from the Sixteenth through the Eighteenth Century," *Bulletin of the History of Medicine* 66 (1992): 376–403; Amy Singer, "Ottoman Palestine (1516–1800): Health, Disease, and Historical Sources," in *Health and Disease in the Holy Land*, ed. Manfred Wasserman and Samuel Kottek (Lewiston, N.Y.: Edwin Mellen Press, 1996).

[12]Orhan Kılıç, *Genel Hatlarıyla Dünya'da ve Osmanlı Devleti'nde Salgın Hastalıklar* (Elazığ, Turkey: Fırat Üniversitesi Ortadoğu Araş. Mer., 2004).

[13]Coşkun Yılmaz and Necdet Yılmaz, eds., *Osmanlılarda Sağlık* (Istanbul: Biofarma, 2006).

[14]Birsen Bulmuş, "The Plague in the Ottoman Empire, 1300–1838" (PhD diss., Georgetown University, 2008); Nukhet Varlık, "Disease and Empire: A History of Plague Epidemics in the Early Modern Ottoman Empire (1453–1600)" (PhD diss., University of Chicago, 2008); and Aaron Shakow, "Marks of Contagion: The Plague, the Bourse, the Word and the Law in the Early Modern Mediterranean, 1720–1762" (PhD diss., Harvard University, 2009).

[15]Alan Mikhail, "The Nature of Ottoman Egypt: Irrigation, Environment, and Bureaucracy in the Long Eighteenth Century" (PhD diss., University of California, Berkeley, 2008); and Sam White, "Ecology, Climate, and Crisis in the Ottoman Near East" (PhD diss., Columbia University, 2008).

[16]Miri Shefer-Mossensohn, *Ottoman Medicine: Healing and Medical Institutions, 1500–1700* (Binghamton, N.Y.: State University of New York Press, 2009).

[17]Jennings, "Plague in Trabzon"; Haim Gerber, *Economy and Society in an Ottoman City: Bursa 1600–1700* (Jerusalem: The Hebrew University, 1988); and Abraham Marcus, *The Middle East on the Eve of Modernity: Aleppo in the 18th Century* (New York: Columbia University Press, 1989).

[18]See, for example, Ömer Lütfi Barkan, "Edirne Askeri Kassamı'na Âit Tereke Defterleri," *Belgeler* 3 (1966): 1–479; Ali Aktan, "Kayseri Kadı Sicillerindeki Tereke Kayıtları Üzerinde Bazı Değerlendirmeler (1738–1749)," in *II. Kayseri ve Yöresi Tarih Sempozyum Bildirileri* (Kayseri, Turkey: Kayseri ve Yöresi Tarih Araştırmaları Merkezi Yayınları, 1998); Colette Establet and Jean-Paul Pascual, *Familles et fortunes à Damas* (Damascus: Institut français de Damas, 1994); Hüseyin Özdeğer, *1463–1640 Yılları Bursa Şehir Tereke Defterleri* (Istanbul: İstanbul Üniversitesi Edebiyat Fakültesi Yayınları, 1988); and Said Öztürk, *Askeri Kassama Ait Onyedinci Asır İstanbul Tereke Defterleri* (Istanbul: Osmanlı Araştırmaları Vakfı, 1995).

[19]For a sample of this now extensive body of literature, see John Landers, *The Field and the Forge: Population, Production and Power in the Pre-Industrial West* (Oxford: Oxford University Press, 2003); John Post, *Food Shortage, Climatic Variability, and Epidemic Disease in Preindustrial Europe* (Ithaca, N.Y.: Cornell University Press, 1985); and John Walter and Roger Schofield, eds., *Famine, Disease and Social Order in Early Modern Society* (Cambridge: Cambridge University Press, 1989).

[20]William McNeill, *Plagues and Peoples* (New York: Anchor Books, 1976).

[21]Peter Christensen, *The Decline of Iranshahr* (Copenhagen: Museum Tusculanum Press, 1993); and Stuart Borsch, *The Black Death in Egypt and England* (Austin, Tex.: University of Texas Press, 2005).

[22]John Covel, "Extracts from the Diaries of John Covel, 1670–1679," in *Early Voyages and Travels in the Levant*, ed. James Bent (New York: Norton, 1972), 244. The comment about "fortunes . . . wrote on their forehead" probably refers to the description of Edward Grimston, "A Continuation of this Present History," in Richard Knolles, *The Turkish History, from the Original of that Nation to the Growth of the Ottoman Empire*, 6th ed. (London: T. Basset, 1687), 901.

[23]Archivio di Stato di Venezia, Dispacci-Costantinopoli, filza 59. For further discussion of Ottoman Muslims including muftis fleeing from epidemics, see Shefer-Mossensohn, *Ottoman Medicine*, 173–75.

[24]Varlık, "Disease and Empire," 192–204, discusses the contagion theories and their implications in the works of İlyas bin İbrahim and Taşköprüzade. Bulmuş, "Plague in the Ottoman Empire," chap. 2, focuses particularly on the work of İdris-i Bitlisi and Hamdan bin al-Merhum and cites numerous references to contagion and flight in hadith and plague literature. Shefer-Mossensohn, *Ottoman Medicine*, 173–75, also describes a fatwa by Ebu Su'ud condoning flight from epidemics. All three authors stress that motivation was a key issue, whether those fleeing were actively seeking health and safety or only evading their proper duties.

[25]For a comparative analysis of Muslim and Christian ideas of divine and natural causation in outbreaks of plague, see Marie-Hélène Congourdeau and Mohammed Melhaoui, "La perception de la peste en pays chrètien byzantine et musulman," *Revue des études byzantines* 59 (2000): 95–124. Anna Akasoy, "Islamic Attitudes to Disasters in the Middle Ages: A Comparison of Earthquakes and Plagues," *The Medieval History Journal* 10 (2007): 387–410, has advanced a similar argument concerning parallel religious and scientific discourses on natural disasters.

[26]*The Negotiations of Sir Thomas Roe, in his Embassy in the Ottoman Porte, from the Year 1621 to 1628 Inclusive* (London: Society for the Encouragement of Learning, 1740), 459–60.

[27]See Paul Slack, *The Impact of Plague in Tudor and Stuart England* (London: Routledge, 1985), chap. 2 and 9.

[28]*Başbakanlık Arşivi Mühimme Defterleri* folder 12/ document 534 (hereafter, MD) and MD 14/120.

[29]Halil Sahillioğlu and Ekmeleddin İhsanoğlu, *Topkapi Sarayi Arşivi H. 951–952 Tarihli ve E-12321 Numarli Mühimme Defteri* (Istanbul: IRCKA, 2002), documents 311 and 369.

[30]For more on Salonica and its plague outbreaks, see Mark Mazower, *Salonica: City of Ghosts* (London: Harper Collins, 2004), 108–13.

[31]MD 7/1626, MD 7/1828, MD 19/417, MD 36/738.

[32]For example, MD 3/172.

[33]On Ottoman disease etiology, see Shefer-Mossensohn, *Ottoman Medicine*, 177–78 et passim. Mohammed Melhaoui, *Peste, contagion et martyre: Histoire du fléau en Occident musulman medieval* (Paris: Publisud, 2005), 78, notes that experience with epizootics at least would have familiarized Muslims with contagion and points to hadiths mentioning contagion of animal diseases.

[34]Quoted in Necdet Yılmaz and Coşkun Yılmaz, "Evliya Çelebi'nin Seyahatnâmesi'ne Göre Osmanlılarda Sağlık Hayatı," in *Osmanlılarda Sağlık*, ed. Necdet Yılmaz and Coşkun Yılmaz, 2 vols. (Istanbul: Biofarma, 2006). Unfortunately, it is not clear just what diseases are meant here or in other references to "leprosy." On the difficulty of diagnoses and the practice of leper colonies in general, see Watts, *Epidemics and History*, chap. 2.

[35]Jennings, "Plague in Trabzon."

[36]MD 5/1334.

[37]Yılmaz and Yılmaz, *Osmanlılarda Sağlık*, 2:document 188.

[38]This idea has also been raised in Kılıç, *Genel Hatlarıyla Dünya'da ve Osmanlı Devleti'nde Salgın Hastalıklar*, 83–84.

[39]MD 7/1706.

[40]*Ottoman Medicine*, 178–79. Compare, for example, Slack, *Impact of Plague*, chap. 11 on the socially divisive effects of quarantine and isolation measures in contemporary England.

[41]Shakow, "Marks of Contagion," chap. I.6.

[42]On this debate, see esp. Samuel Cohn, "The Black Death: End of a Paradigm," *American Historical Review* 107 (2002): 703–38; and John Theilman and Frances Cate, "A Plague of Plagues: The Problem of Plague Diagnosis in Medieval England," *Journal of Interdisciplinary History* 37 (2007): 371–93.

[43]For example, Süheyl Ünver, "Türkiye'de Veba (Taun) Tarihçesi Üzerine," *Tedavi Kliniği ve Laboratuarı* 5 (1935): 70–88.

[44]See esp. "Ta'un and Waba Conceptions of Plague," 271–73 et passim. The author argues that although Arab doctors could diagnose bubonic plague from other ailments, most writings did not actually use the term so carefully or specifically.

[45]Selânikî Mustafa Efendi, *Tarih-i Selânikî*, ed. Mehmet İpşirli (Ankara, Turkey: Tarih Vakfı, 1999), 759.

[46]Ibid., 768.

[47]Ibid., 178–79, 229; Hasan Bey-zâde Ahmed Paşa, *Hasan Bey-Zâde Târîhi*, ed. Şevki Nezihi (Ankara, Turkey: Tarih Vakfı, 2004), 491, also appears to mention a *taun* that was apparently not bubonic plague.

[48]For example, MD 7/974.

[49]"The Memoirs of Sir Paul Rycaut containing the History of the Turks," in Richard Knolles, *The Turkish History,* 2:111.

[50]Archivio di Stato di Venezia, *Dispacci-Costantonopoli*, filza 41 (August 1595).

[51]Mustafa Âlî, *Künhü'l-Ahbâr*, ed. Faris Çerçi (Kayseri: Erciyes Üniversitesi Yayınları, 2000), 693–94. Anthrax outbreaks in both animal and human populations were of ancient provenance in the Mediterranean—see Robert Sallares, *Ecology of the Ancient Greek World* (Ithaca, N.Y.: Cornell University Press, 1991), 288.

[52]*Künhü'l-Ahbâr*, 675–77. This murrain is also attested in both the *mühimme defterleri* (e.g., MD 72/6) and a Venetian dispatch, Archivio di Stato Venezia, Dispacci-Costantinopoli, filza 47 (13 June 1598).

[53]For the original history of this disease and its association with Ottoman lands, see Hans Zinsser, *Rats, Lice and History* (New York: Little, Brown, & Co., 1935). See also, for example, Frederick F. Cartwright, *Disease in History* (London: Rupert Hart-Davis, 1972), 83–85.

[54]Shakow, "Marks of Contagion," xx and chap. I.4 passim.

[55]See, for example, Hrand Andreasyan, ed., *Polonyalı Simeon'un Seyahatnamesi, 1608–1619* (Istanbul: İstanbul Üniversitesi Edebiyat Fakütesi Yayınları, 1964), 110; and Constantin-François Volney, *Travels through Egypt and Syria, in the Years 1783, 1784 & 1785* (New York: G. G. J. and J. Robinson, 1798), chap. 18.

[56]McCarthy, "Factors in the Analysis of the Population of Anatolia," 39.

[57]Panzac, *La peste dans l'Empire ottoman*, 370–71. Note the error in table 42—the text makes it apparent that the numbers for "maladies gastro-intestinales" have been switched with those for "maladies infectieuses."

[58]See 17ff. for sources. For the best discussion of this seasonal phenomenon, see Establet and Pascual, *Familles et fortunes à Damas*, chap. 2.

[59]Panzac, *La peste dans l'Empire ottoman*, 378–80; Biraben, *Les hommes et la peste*, 194–96, 227–30.

[60]This phenomenon is discussed in Biraben, *Les hommes et la peste*, 189 and chap. 4 passim. For an Ottoman example, see, for example, Marcus, *Middle East on the Eve of Modernity*, 200–201.

[61]Varlık, "Disease and Empire," chap. 2.

[62]As mentioned previously, there has been an extensive literature on this subject. For the most complete picture of nutrition and disease in history, see Massimo Livi-Bacci, *Population and Nutrition* (New York: Cambridge University Press, 1991). For a detailed comparative analysis of vagrancy and disease, see esp. Post, *Food Shortage, Climatic Variability, and Epidemic Disease*.

[63]White, "Ecology, Climate, and Crisis," chap. 6.

[64]The question of population pressure in the later 1500s has sparked some debate since the original work of Fernand Braudel and later M. A. Cook on the subject decades ago. Generally, *tahrir* research has supported earlier finds of declining land–man ratios and rapidly shrinking per capita grain production, esp. in central Anatolia. See esp. Osman Gümüşçü, *Tarihî Coğrafya Açısından bir Araştırma: XVI. Yüzyıl Larende (Karaman) Kazasında Yerleşme ve Nüfus* (Ankara, Turkey: Türk Tarih Kurumu Yayınları, 2001); and Oktay Özel, "Nüfus Baskısından Krize: 16–17. Yüzyıllarda Anadolu'nun Demografi Tarihine Bir Bakı," in *VIIIth International Conference on the Economic and Social History of Turkey (1998)*, ed. Nurcan Abacı (Morrisville, N.C.: Lulu Press, 2006). The original research on vagrancy and its attendant problems comes from the work of Mustafa Akdağ, esp. *Celâlî İsyanları* (Ankara, Turkey: Ankara Üniversitesi Yayınevi, 1964), and appears to be largely confirmed in the various works of Suraiya Faroqhi on late 16th- and 17th-century Ottoman social history—see, for example, "Crisis and Change," in *An Economic and Social History of the Ottoman Empire*, ed. Halil İnalcık and Donald Quataert (New York: Cambridge University Press, 1994), 438–47.

[65]For example, MD 14/499. For a further discussion of late 16th-century natural disasters, see Sam White, *The Climate of Rebellion in the Early Ottoman Empire* (New York: Cambridge University Press, forthcoming).

[66]MD 40/296.

[67]See, for example, MD 52/604, MD 52/752, MD 52/800, MD 55/118, MD 55/191, MD 55/253, MD 55/346, MD 55/409, MD 58/309, MD 58/441, MD 58/602, MD 58/642, MD 58/643, MD 58/736, MD 58/746, MD 58/752, MD 58/791, MD 59/182, MD 60/93, MD 60/112, MD 60/131, MD 60/498, MD 60/579, MD 61/9, MD 61/16, MD 61/70, MD 61/71, MD 61/138, MD 61/262.

[68]There are literally scores of reports, mostly in MD 44.

[69]For example, MD 55/253.

[70]See, for example, *Tarih-i Selânikî*, 148, 173–74.

[71]Archivio di Stato diVenezia, Dispacci-Costantinopoli, filza 53 (3 May 1601).

[72]This connection was first proposed in William Griswold, "Climatic Change: A Possible Factor in the Social Unrest of Seventeenth Century Anatolia," in *Humanist and Scholar: Essays in Honor of Andreas Tietze*, ed. Heath Lowry and Donald Quataert (Istanbul: Isis, 1993).

[73]For details and sources, see Sam White, "The Little Ice Age Crisis in the Ottoman Empire: A Conjuncture in Middle East Environmental History," in *Water on Sand: Environmental Histories of the Middle East and North Africa*, ed. Alan Mikhail (New York: Oxford University Press, forthcoming).

[74]See esp. Özel, "Population Changes in Ottoman Anatolia."

[75]For further examples of natural disaster, famine, and disorder in the Late Maunder Minimum (a period of low sun-spot activity), see esp. Elena Xoplaki et al., "Variability of Climate in Meridional Balkans During the Periods 1675–1715 and 1780–1830 and Its Impact on Human Life," *Climatic Change* 48 (2001): 581–615. For a contemporary Ottoman description, see, for example, Silahdar Fındıklı Mehmed Ağa, *Silahdar Tarihi,* 2 vols. (Istanbul: Devlet Matbaası, 1928), 2:243.

[76]John Landers, "London's Mortality in the 'Long Eighteenth Century': A Family Reconstitution Study," in *Living and Dying in London*, ed. W. F. Bynum and Roy Porter (London: Wellcome Institute, 1991); and idem, "Mortality and Metropolis: The Case of London 1675–1825," *Population Studies* 41 (1987): 59–76.

[77]Timo Myllyntaus, "Summer Frost: A Natural Catastrophe with Fatal Consequences in Pre-Industrial Finland," in *Natural Disasters, Cultural Responses: Case Studies Toward a Global Environmental History*, ed. Christof Mauch and Christian Pfister (Lanham, Md.: Lexington Books, 2009).

[78]Accounts of the famine and starvation fill the Venetian dispatches and chronicles of the period, with perhaps the most detailed and graphic depictions in the recently translated Armenian chronicle *The History of Vardapet Arak'el of Tabriz*, trans. and ed. George Bournoutian (Costa Mesa, Calif.: Mazda Publishers, 2005).

On the great flight, see Mustafa Akdağ, "Celâli İsyanlarından Büyük Kaçgunluk," *Tarih Araştırmaları Dergisi* 2 (1964): 1–49.

[79]Note that observations of European bubonic-plague outbreaks seem to confirm that the disease was more likely to flare up in hot, humid weather and die down in times of cold and drought—see, for example, Biraben, *Les hommes et la peste*, chap. 3, and H. H. Lamb, *Climate, History, and the Modern World,* 2nd ed. (New York: Routledge, 1995), 312–13. Modern studies on rodent-borne bubonic plague also reveal a weak but statistically significant correlation between precipitation and plague cases, because drought tends to reduce overall rat populations—see R. R. Parmenter et al., "Incidence of Plague Associated with Increased Winter-Spring Precipitation in New Mexico," *American Journal of Tropical Medicine and Hygiene* 61 (1999): 814–21.

[80]Mikhail, "Nature of Plague in Late Eighteenth-Century Egypt."

[81]For similar cases of synergy among drought, famine, and epidemics, see, for example, André Raymond, "Les grandes épidémies de peste au Caire aux XVIIe et XVIIIe siècles," *Bulletin d'études orientales* 25 (1973): 203–10; and Mesut Aydıner, "Küresel Isınma Tartışmalarına Tarihten Bir Katkı: Arşiv Belgeleri Işığında XVIII. Yüzyılın İkinci Yarısında Diyarbekir ve Çevresinde Meydana Gelen Büyük Kıtlık ve Alınan Tedbirler," *Ankara Üniversitesi Osmanlı Tarihi Araştırma ve Uygulama Merkezi Dergisi* 19 (2006): 123–38.

[82]The development is discussed throughout Suraiya Faroqhi, *Towns and Townsmen of Ottoman Anatolia* (New York: Cambridge University Press, 1984).

[83]On the regulation of population movements and the *çift-bozan akçesi*, see, for example, Amy Singer, "Peasant Migration: Law and Practice in Early Ottoman Palestine," *New Perspectives on Turkey* 8 (1992): 49–65. On peasant flight in this period, see, for example, Rhoads Murphey, "Population Movements and Labor Mobility in Balkan Contexts: A Glance at Post-1600 Ottoman Social Realities," in *Southeast Europe in History: The Past, the Present and the Problems of Balkanology*, ed. M. Delilbaşı (Ankara, Turkey: Ankara University Press, 1999).

[84]Tabak, *The Waning of the Mediterranean* (Baltimore, Md.: Johns Hopkins University Press, 2008), 193–94 et passim.

[85]Robert Mantran, *Istanbul dans la seconde moitié du XVII^e siècle* (Paris: Maisonneuve, 1962), 44–50.

[86]André Raymond, *Cairo* (New York: Cambridge University Press, 2000), chap. 11; idem, *Grandes villes arabes à l'époque ottomane* (Paris: Sindbad, 1985), 57; and idem, "The Population of Aleppo in the Sixteenth and Seventeenth Centuries According to Ottoman Census Documents," *International Journal of Turkish Studies* 16 (1984): 447–60.

[87]Hüseyin Muşmal, "XVII. Yüzyılın İlk Yarısında Konya'da Sosyal ve Ekonomik Hayat (1640–50)" (PhD diss., Selçuk Üniversitesi, 2000), 66–68; and Yusuf Oğuzoğlu, "17. Yüzyılda Konya Şehrindeki İdari ve Sosyal Yapılar," in *Konya*, ed. F. Halıcı (Ankara: Güven Matbaası, 1984).

[88]Cem Behar, *Osmanlı İmparatorluğu'nun ve Türkiye'nin Nüfusu 1500–1927* (Ankara, Turkey: Türkiye İstatistik Kurumu Yayınları, 1996), 16.

[89]Gerber, *Economy and Society in an Ottoman City*, chap. 1.

[90]Suraiya Faroqhi, *Men of Modest Substance: House Owners and House Property in Seventeenth-Century Ankara and Kayseri* (New York: Cambridge University Press, 1987), 32–33; and Hülya Taş, *XVIII. Yüzyılda Ankara* (Ankara: Türk Tarih Kurumu, 2006), 111.

[91]On the development of Izmir in this period, see, for example, Daniel Goffman, *Izmir and the Levantine World* (Seattle, Wash.: University of Washington Press, 1990).

[92]See, for example, Hrand Andreasyan, "Celâlilerden Kaçan Anadolu Halkının Geri Gönderilmesi," in *İsmail Hakkı Uzunçarşılı'ya Armağan* (Ankara: Türk Tarih Kurumu, 1976); and M. Münir Aktepe, "XVIII. Asrın İlk Yarısında İstanbul'un Nüfus Mes'elesine Dâir Bâzı Vesikalar," *Tarih Dergisi* 9 (1958): 1–30, for original sources on the population problem and attempted expulsions.

[93]See, for example, Roger Owen, *The Middle East in the World Economy* (New York: I. B. Tauris, 1993), 24–25.

[94]Contemporary Venetian dispatches have left particularly graphic depictions—see, for example, Archivio di Stato di Venezia, Dispacci-Costantinopoli, filza 62 (10 September 1605).

[95]For examples, see Marcus, *Middle East on the Eve of Modernity*, 263, 299–301; Raymond, *Grandes villes arabes*, 148–51; and Robert Mantran, "Réflexions sur les problèmes de l'eau à Istanbul du XVI^e au XVIII^e siècle," in *IIIrd Congress on the Economic and Social History of Turkey, Princeton 24–26 August 1983*, ed. Heath Lowry and Ralph Hattox (Istanbul: Isis, 1990). These impressions are also confirmed in the

accounts of many Western travelers—see the examples in Gülgün Üçel-Aybet, *Avrupalı Seyyahların Gözünden Osmanlı Dünyası ve İnsanları (1530–1699)* (Istanbul: İletişim, 2003), chap. 4.

[96]Hayri Erten, *Konya Şer'iyye Sicilleri Işığında Ailenin Sosyo-Ekonomik ve Kültürel Yapısı (XVIII. Yüzyıl İlk Yarısı)* (Ankara, Turkey: T. C. Kültür Bakanlığı, 2001), 98. Note that all the numbers given here only concern married couples appearing in court and not the considerable population of bachelors we would also find in cities.

[97]See, for example, Alan Duben, "Turkish Families and Households in Historical Perspective," *Journal of Family History* 10 (1985): 75–97; Taş, *XVIII. Yüzyılda Ankara*, 225; Ömer Düzbakar, "XVII. Yüzyıl Sonlarında Bursa'da Ekonomik ve Sosyal Hayat" (PhD diss., Ankara Üniversitesi, 2003), 169–71; and Muşmal, "XVII. Yüzyılın İlk Yarısında Konya'da Sosyal ve Ekonomik Hayat," 73–74.

[98]Bruce Masters, "Patterns of Migration to Ottoman Aleppo in the 17th and 18th Centuries," *International Journal of Turkish Studies* 4 (1987): 75–89.

[99]For example, Landers, "London's Mortality," 1, suggests that London alone absorbed about 400,000 rural births from 1700 to 1750.

[100]See, for example, Oya Dağlar, *War, Epidemics, and Medicine in the Late Ottoman Empire (1912–1918)* (Haarlem, The Netherlands: SOTA, 2008).