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The English Sweating Sickness of 1551: an Epidemic Anatomized

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In 1551 there occurred the fifth and last outbreak of the epidemic disease known as the sweating sickness. The malady was characterized by sudden onset, profuse sweating, prostration, and death or recovery within the space of only twenty-four hours; it was certainly confined to the warmer months, was said to be most fatal to healthy young males and, despite some irruptions onto the Continent, was apparently seated in England.[1] The disease has always intrigued medical historians for a number of reasons: it apparently came from nowhere in 1485 and disappeared without trace in 1551; its characteristics as recorded by contemporary observers defy exact identification with any malady described in modern medical literature; and the quantity of information available is ample enough to give rise to a variety of hypotheses but insufficiently substantial to provide any very convincing conclusions. Up to now we have had two main classes of information about this disease: one is an assemblage of references in chronicles, letters and other contemporary literary documents, and the other is the remarkable account provided by Dr John Caius in his *A boke or counseill against the disease commonly called the sweate, or sweatyng sicknesse* of 1552, the earliest extensive treatise on a single disease to be written and printed in English. However there exists another hitherto under-exploited source on which this article is primarily based—the parish register.

Parish Registers

Since they should record the name and date of every burial from the autumn of 1538 onwards, parish registers cover the last outbreak of the sweat in 1551. Unfortunately, the pattern of survival of these early registers over the country is uneven. Of the 10,000 ancient parishes in England in the mid-sixteenth century, about 1,200 are listed as having registers covering that period.[2] The experience of this research would suggest that 10 to

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[1] A brief and up-to-date summary of the subject may be found in R E McGrew, *Encyclopedia of medical history*, London, Macmillan, 1985, pp. 106–8, and in K F Kiple (ed.), *The Cambridge world history of human disease*, Cambridge University Press, 1993, pp. 1023–5. The most recent extended consideration of the disease can be found in J A H Wylie and L H Collier, 'The English sweating sickness (sudor anglicus): a reappraisal', *J. Hist. Med.*, 1981, **36**: 425–45, though one cannot always concur with their interpretation of the historical documentation.

[2] *The national index of parish registers*, London, Society of Genealogists, various dates, is the most detailed national survey, but the most authoritative sources are the lists maintained in each county record office.

20 per cent of the registers listed as covering 1551 do not in fact contain useful information for a variety of reasons, including the upheavals consequent upon the introduction of protestantism during the reign of Edward VI (1547–53).[3] These factors bring down the potentially useful number to about 1,000, which would be sufficient as the basis of a national survey of epidemic mortality in 1551 if they were distributed evenly over the country. However their preservation varies from diocese to diocese, with the highest levels of survival at over 30 per cent of parishes in Worcestershire, Suffolk and London, descending through a general average of 10–20 per cent in much of the country, to less than 10 per cent in parts of the north, Wiltshire and Dorset—and nil in Northumberland. It is especially unfortunate that the heartland of the 1551 epidemic, that is Shropshire and Herefordshire, preserves less than 10 per cent of its 1551 registers, while the whole of neighbouring Wales can show only four surviving (and unhelpful) documents from more than 900 parishes.

The principal reason for this patchy survival was the decision of the ecclesiastical authorities in 1598 to instruct parish officials to copy the original paper registers—already showing signs of wear—into new parchment versions, beginning at their start in 1538 "but especially since the first year of her Majesty's reign" (i.e. 1558/9).[4] Evidently in some dioceses there was no encouragement to go back before 1558 while in others the opposite was the case. Thus a source which in theory should provide us with a mass of information in fact survives in about 10 per cent of parishes; since, as shall be demonstrated below, this epidemic has left some trace in only about a third of the surviving registers in England, we can expect to find some positive information in only about 3 per cent (i.e. a third of the 10 per cent) of the original 10,000 parishes. The purpose of this research was to find most of these 300 registers and to analyse them.

The basis of this survey of parish register evidence demands discussion. An attempt was made to examine a representative sample of registers from every county, using transcripts, printed copies and microform versions.[5] Where a county was very well covered here, or seemed to be little affected by the epidemic, this was regarded as sufficient, but in the case of twenty-five of the historic counties the relevant local repositories were visited and every surviving register examined. The purpose here was to cover a substantial area of the country as fully as surviving sources allowed, and to concentrate on those counties which seemed crucial to an understanding of the epidemic; in addition those counties (usually in the north) were visited which have so few surviving registers that it was essential to see them all.[6] A total of 680 registers with a significant

[3] Wrigley and Schofield find that in their survey of 404 (generally good quality) registers there is a level of 11 per cent of deficient entries for the reign of Edward VI. E A Wrigley and R S Schofield, *The population history of England 1541–1871*, Cambridge University Press, 1989, p. 25.

[4] W E Tate, *The parish chest*, Cambridge University Press, 1960, pp. 45, 288; less than 200 paper registers now survive, and there is a dramatic increase in the number of surviving parchment transcripts beginning in and after 1558.

[5] The principal resource employed here was the excellent collection of printed or transcribed copies, microfilms and microfiches held in the Library of the Society of Genealogists, London; I am most grateful to the staff there for their help.

[6] The counties which were sampled extensively but not examined exhaustively were Bedfordshire, Berkshire, Buckinghamshire, Cambridgeshire, Cornwall, Essex, Hertfordshire, Huntingdonshire, Lincolnshire, Norfolk, Nottinghamshire, Suffolk, Surrey and the West Riding of Yorkshire. Many of these counties were slightly affected or contain many very small parishes which are unlikely to be very helpful, as explained below.

coverage of the year 1551 was examined; if the actual total of useful documents is about 1,000, as suggested above, then this amounts to a coverage of about 70 per cent and should be regarded as a very adequate sample of the total, especially as every surviving register was examined in all the counties which seemed vital to an understanding of the epidemic.

Research on the distribution of epidemics on the basis of mortality variations should develop an objective definition of what is meant by the concept of a period of crisis or disease-related mortality. Wrigley and Schofield demand that a parish experience a "single monthly total that was 3.36 or more standard errors above the forecast trend value for that month"[7]; other less ambitious studies have measured raised mortality against the mean for the surrounding ten years or so, and in the only published study of the sweating sickness using parish register material Wylie and Linn[8] look for parishes in which the August mortality in 1551 was more than three times the average monthly total in the years 1549–53. All these admirable approaches have proved inapplicable to this present study, despite attempts to develop a satisfactorily objective and systematic test.

There are two principal problems here. The first is that sweat mortality as manifested in the registers is unlike that created by most of the epidemic diseases which one expects to find in the register record, diseases such as bubonic plague, influenza, typhus or dysentery; in these cases one may measure their raised mortality levels, broken down by monthly totals, and depend on detecting their presence with reasonable reliability. But the distinguishing feature of the sweat is not the total number of people killed, which is often (though not necessarily) relatively modest, but rather the concentration of burials over a very short period of time, characteristically a week or ten days. This is a peculiarity which it was found impossible to express in a strictly mathematical fashion which allows an objective, definitive test to be applied.

The second problem is that of the small parish. Most parishes contained surprisingly few people in the mid-sixteenth century. The average lowland parish covered three to five square miles and probably contained less than 250 inhabitants; in the case of the diocese of Canterbury for instance, of the total of 279 parishes, 120 had less than 20 households in 1563, and 171—well over half—had 30 households or less. A village with 20 to 30 families would contain about 100 to 150 people at this date and with the generally accepted level of the crude death rate standing at about 26 per thousand around 1550, we could expect an average annual number of burials in normal years of about 2.5 to 4.0.[9] Such very low numbers of events present formidable problems of analysis, for random variation in small samples will lead to bizarre results—for instance a random extra two burials in any year will amount to a 50 per cent increase in the annual rate which may well be devoid of demographic significance. Any systematic monthly analysis is quite vitiated, for in a parish with only three burials per year and so a monthly mean of 0.25, any month with a single "normal" burial in it will appear to suffer a crisis ratio of four times the

[7] Wrigley and Schofield, op. cit., note 3 above, p. 647.

[8] J A H Wylie and I J Linn, 'Observations upon the distribution and spread of the English sweating sickness (sudor anglicus) in Devon in 1551', *Rep. Trans. Devonshire Ass. . . .*, 1980, **112**: 101–15, pp. 104–5.

[9] The 1563 census can be found in British Library Harleian MS 594 ff. 63r–84r. Population totals assume 5.0 people per household (see A Dyer, 'The Bishops' Census of 1563: its significance and accuracy', *Local Popul. Stud.*, 1992, **49**: 19–37). Crude death rate based on Wrigley and Schofield, op. cit., note 3 above, p. 531.

normal level, using conventional methodology. Other studies have tended to avoid the small parish for this reason. Yet the sweating sickness was predominantly rural, and must have manifested itself most commonly in communities of this size.

For these reasons a subjective judgement has been used to establish the presence of sweat mortality, derived from the experience of examining very large numbers of registers and based on seasonality, plus a sense of the concentration of events within short periods of time, all assessed by reference to the pattern observed in neighbouring years in the parish in question. It is readily conceded that this method lacks objectivity, but the nature of the evidence forces such an approach; without it, what appear to be many lesser outbreaks in smaller parishes would be excluded from consideration although the major episodes, described below, are sufficiently robust to emerge clearly whatever means of definition were to be applied.

The Pattern of Sweating Sickness Outbreaks

Since we have just claimed that outbreaks of sweating sickness can be recognized by their distinctive pattern, it would be as well at this point to describe that pattern in greater detail. Here we are looking for bursts of burials which last for days rather than weeks, and which reach a climax very rapidly and fall away just as abruptly—sweating sickness does not smoulder, or if it does, we cannot then recognize it in the register record. Some examples will illustrate these characteristics: in the register of Marbury in Cheshire 13 names are enclosed by a line with the comment "dyed of ye sweating sicknes as yt semeth": of these 13, 9 are buried between 14th and 17th July.[10] In Derbyshire the register of Darley records that "nine persons were buried . . . of ye sweatinge sickenes" between July 5th and 10th; when we come to East Down in Devon, 12 burials take place between August 15th and 22nd, with 5 on the 17th alone. In the same county, Uffculme's epidemic, labelled "The hote sicknes called Stupgallant", killed as many as 27 in this small village in the ten days between August 2nd and 11th, with 6 buried on the 5th and 5 on the 6th. In Essex, Thaxted's 11 deaths "ex sudore" (from the sweat) are buried in only four days in July, while at St George Canterbury, 5 burials "in tempore plage sudoris" all take place on one day, July 19th. In the relatively well documented London epidemic, burials from 28 City parishes show 77 per cent were concentrated in the seven days between 10th and 16th July, and an extension to the 20th then includes 90 per cent in eleven days. As one works through the annual pattern of mortality in these places, few of them particularly large, this abrupt avalanche of burials leaps from the page in its unmistakable rarity—and then disappears almost as soon as it has begun. In small settlements the effect must be less obvious, with three or four burials, perhaps the equivalent of the annual total, concentrated in as many days. These patterns might be labelled "classic" instances of sweat mortality, strikingly different from the characteristic disease mortalities in the registers of this date with their extended development over many weeks or months without much or any of a climax.

[10] The location of all individual registers may be assumed to be the record office of the county concerned, unless otherwise stated.

But not all sweat mortalities present themselves in this pattern. A few do suggest a relatively long drawn out incident, such as we see in Halifax in the West Riding. Here the rare original paper register survives and 44 burials "ex sudore" are individually marked as such; 42 victims are buried between August 2nd and 30th, so that despite some concentration of 9 burials on the 8th, this outbreak appears to cover the unusually extended period of twenty-nine days. However, this may be explained by the large size of the parish, which covered 118 square miles with a number of townships centred on the market town of Halifax: fortunately the register gives the place of origin of most of the burials, so that one can see that the figures for the whole parish really conflate several distinct epidemics in separate communities. Halifax town's burials occupy only seven days and the outer townships follow a similarly concentrated pattern, though sometimes with one or two burials outside the main focus: thus Halifax town's epidemic causes burials from 2nd to 8th August, while in the township of Hipperholme, some three miles away, the main spate of burials does not begin until the 14th. Most of these anomalous mortalities which stretch out beyond the week or so of the "classic" cases can be explained by the size of the parish, so that in Alstonfield in Staffordshire the stream of burials sees an initial "classic" concentration of 10 between 4th and 6th July, but there is then an intermittent succession of 17 further interments which stretches over eighteen days, with one three-day and several one-day breaks. Again, Alstonfield is a very large parish, extending over 34 square miles with a number of chapelries and hamlets isolated from the village centre by several miles of difficult terrain: here we have another register providing us with an amalgamation of the experience of a number of distinct communities.

However there is another kind of anomaly in which we appear to have two separate outbreaks in succession in the same parish. In Chelmsford for instance there were two familiar bursts of burials, the first labelled "The swette" in the seven days from July 15th to the 20th and then a gap of fifteen days before another burst of 7 burials in five days. In the same county the Terling register reveals 6 burials in four days in August, then a break of eleven days before another 5 burials in as many days. Such instances seem commoner in southern England—there are similar examples from Tenterden and Woodchurch in Kent, Rotherfield in Sussex and Calne St Mary in Wiltshire. These must be instances of re-infection from neighbouring parishes while the pool of susceptibles is still quite large. We can see this process occurring in northern Staffordshire, where the parish of Audley abuts at one corner the small market town of Betley; by comparing their burial patterns (see Table 1) we can see that the disease appears to infect Betley from Audley, and then a dying outbreak in the first parish is revived from Betley, which is in turn infected a second time from Audley. Of course there must have been other sources of re-infection from the majority of neighbouring parishes whose registers have been destroyed, so that we are trying to understand what was occurring on the basis of very imperfect data, but the patterns revealed in these two parishes do seem to indicate a process of successive re-infection of a population inadequately saturated by the initial experience of a disease which appears to have a very fragile chain of infection. Thus this feature of the mortality experience of a minority of parishes does not invalidate our assertion that the distinguishing feature of sweat epidemics is their unique combination of brevity and intensity.

Table 1

Number of Burials at Audley and Betley Parishes, Staffordshire

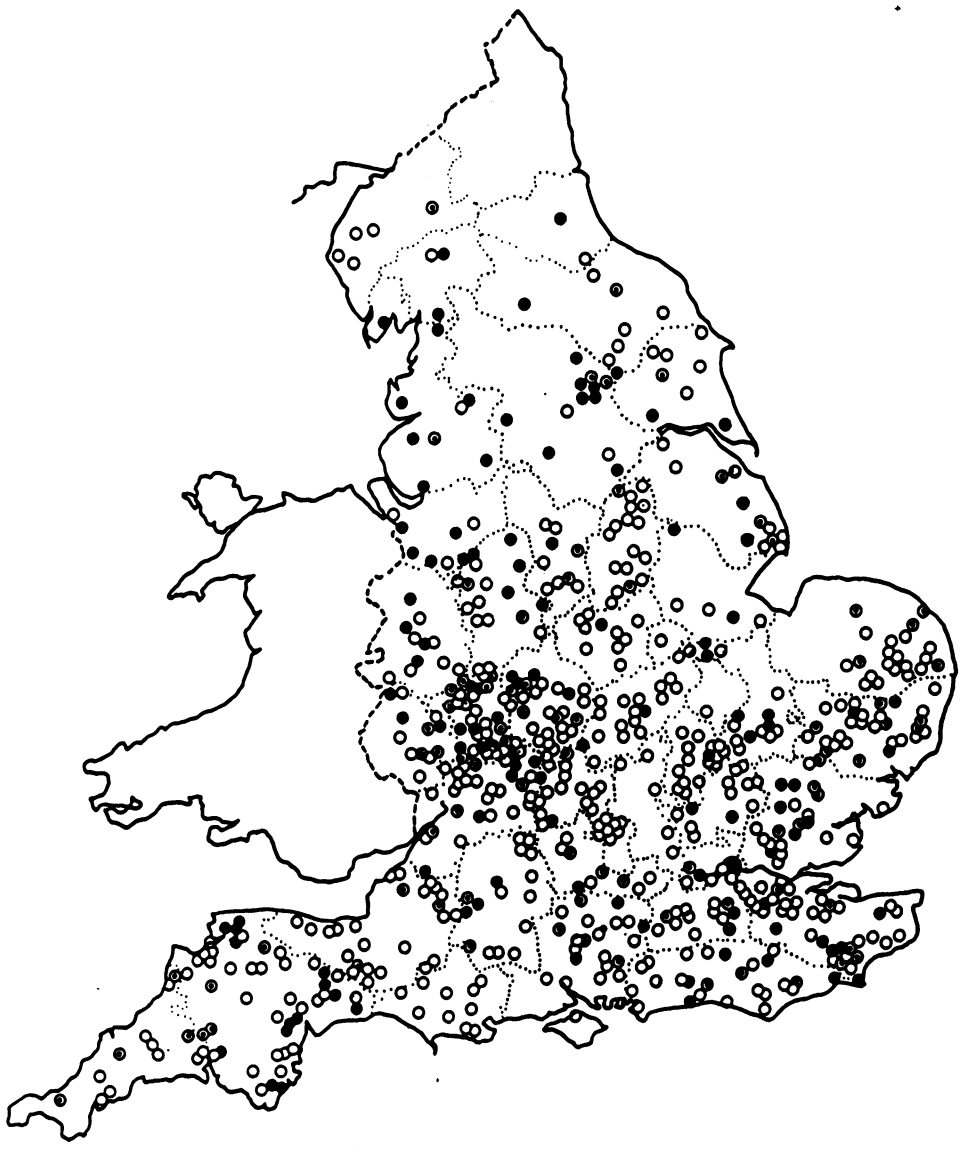
Date: June	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Audley	1	4	3	–	–	2	–	2	–	1	1	1	–	1	1	–
Betley	–	–	–	–	3	1	1	1	–	–	–	–	1	2	–	–

Geographical Distribution

The data derived from the parish registers make it possible to map the distribution of sweat mortality over the face of the country (See Maps 1 and 2). Map 1 shows the location of the parishes involved.[11] One notes here how wide are variations in the distribution of the available registers, and how very common are large tracts of country with few or no registers revealing sweat mortality. However such an impression can be misleading for, if we ignore London, 19.3 per cent of the places represented on the map show clear evidence of sweat mortality, and another 13.1 per cent fall into the more provisional division, so that a total of almost one third (32.4 per cent) give some indication of involvement. In addition to these parishes there is the probability that there are many small places which appear to be disease-free because though infected, no-one died; and there are also those with only one or two burials which cannot be reasonably identified as caused by sweat. In Landbeach in Cambridgeshire we have an example of this problem, for there are burials on July 18th and 22nd which would excite no more than suspicion if the first, that of the curate, had not been obligingly labelled by the parish clerk as "pestilenti correptus"—"carried off by pestilence". So the true proportion may well be more than a third, and given the relatively limited timescale of a few months, we are bound to conclude that the proportion of places involved, the speed of that involvement, and the general distribution over much of the country are all remarkably high by early modern standards when limited communications restricted the penetration of most diseases into the countryside. But since our knowledge of the level of movement across rural areas at this date is so fragmentary, the evidence presented here might suggest that people in fact were travelling more frequently than has usually been assumed.

Map 2 summarizes these data, counting provisional and firm identifications together. The regional variation is very clear here, with over 40 per cent of the surviving registers in the heartland of the epidemic and its offshoots displaying some evidence of the presence of the disease, while a curious island of light or absent infection stretches from

[11] One symbol is given for each place, ignoring multiple parishes in towns. Because of the difficulties involved in detecting marginal sweat mortalities in the register record, parishes have been assigned to the three categories of Map 1 on a basis which is partly subjectively judged (including consideration of seasonality) and partly based on the following guidelines: in larger parishes (those with 10 or more burials in an average normal year) a concentration of 5 or more burials in a five-day period rates as "clear" and 5 or more in 10 days as "ambiguous"; in smaller parishes than these, 3 burials in 5 days and 3 in 10 days are the corresponding limits.



Map 1

○ parish without sweat

⊙ parish with ambiguous mortality

● parish with clear sweat mortality

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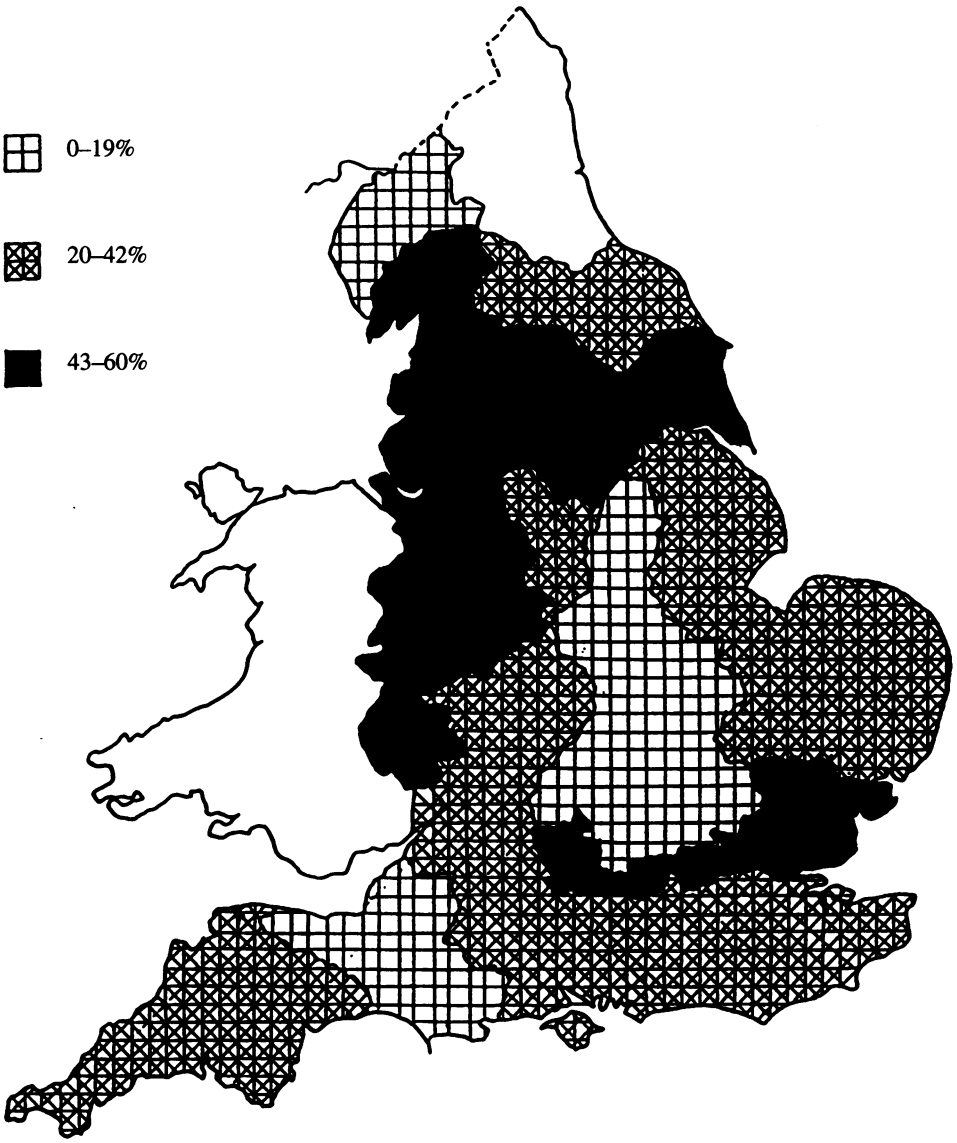

Map 2: English counties: proportion of parish registers with possible sweat mortality.

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the east Midlands to the edge of the capital. Here we should note that the disease did not necessarily spread from parish to neighbouring parish, but was capable of jumping across this thinly affected region to attack London. Perhaps an exaggerated view of the severity of the epidemic in the north is presented here, for many northern parishes were so large that it is quite likely most of them would contain an infected community among the many separate settlements which formed a single parish; this abnormality will be picked up in the parochial burial pattern and the whole parish will be counted as infected, while in the south the same area would be represented as perhaps four (or more) healthy parishes and one infected one.

The parish register data allow us to trace the probable geographical progress of the 1551 epidemic. We already have Caius' account of this: he tells us[12] that it began at Shrewsbury in mid-April and moved via the Welsh border towns of Ludlow and Presteigne to Chester, Coventry and other southern towns on the approach roads to London, where it erupted on July 7th; then it passed from London through eastern England to the north until the end of August when it began to die down, ceasing by the end of September.[13] The pattern produced by the register data confirms Caius' general account, and strengthens our respect for his analytical and observational powers, for the construction of a reliable picture of events scattered all over provincial England at this date must have been extraordinarily difficult.

However the problems of tracing the course of the sweating sickness during its early weeks are very considerable. The town chronicle of Shrewsbury states that the epidemic began in there on March 22nd[14] (rather than Caius' mid-April), though the single surviving register from the town, Holy Cross, gives no indication of any abnormality; it may well have undetected omissions, but in other towns it was not unusual for some

[12] A convenient modern reprint can be found in E S Roberts (ed.), *The works of John Caius M.D. . . .*, Cambridge University Press, 1912, with each work separately paginated; the geographical analysis is found at pp. 11–12. The English text of 1552 was followed by a Latin version in 1555 which contains different material; the latter has been held to state (p. 67) that Caius was present in Shrewsbury during the epidemic but in fact these words are detached from the Shrewsbury references and amount to a general statement that he experienced the epidemic in person, which we should have in any case expected since he was a physician with a house, and almost certainly a practice in the City of London when the sweat epidemic occurred, a circumstance clearly implied in the Epistle which prefaces his English tract. Perhaps Caius had a personal informant with Shrewsbury connections who might have been able to observe at first hand the spreading of the infection in the direction of London. Recent work on Caius includes C Brooke, *A history of Gonville and Caius College*, Woodbridge, Boydell Press, 1985, pp. 55–78; V Nutton, *John Caius and the manuscripts of Galen*, Cambridge Philological Society, 1987.

[13] The report of the Venetian ambassador states that it started in Wales, but since it was written in 1554, the information may well derive from Caius' work, printed in 1552. *Calendar of state papers Venetian, 1534–1554*, London, 1873, p. 541. At this date the expression "Wales" may well include parts of the English border counties too. Wriothesley's chronicle claims that it began in Shropshire, though this may again be derived from Caius. (W D Hamilton (ed.), *A chronicle of England . . . by Charles Wriothesley*, London, Camden Society, 1878, New Series 20, p. 49.

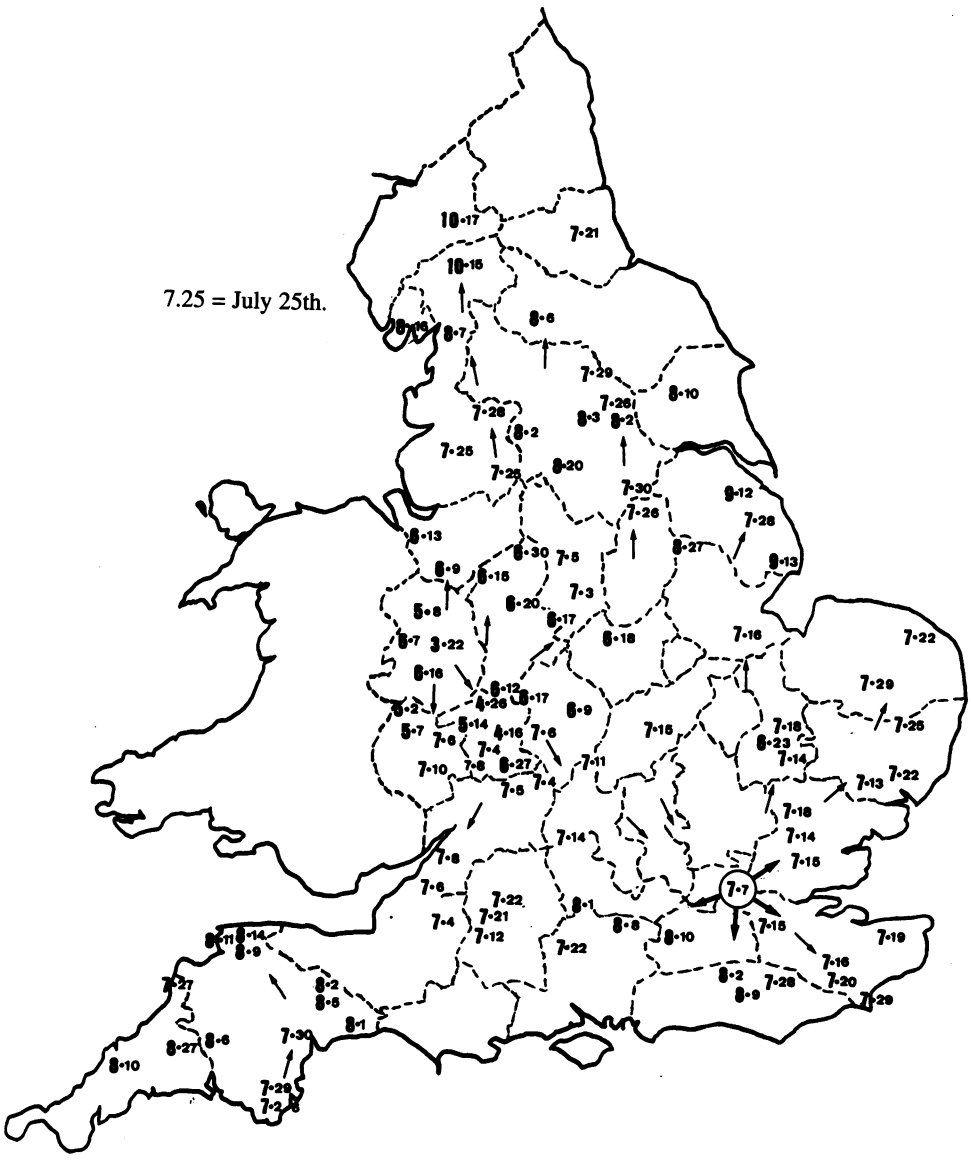
[14] W A Leighton, 'Early chronicles of Shrewsbury 1372–1603', *Trans. Shropshire Archaeol. Nat. Hist. Soc.*, 1880, **3**:240–353, p. 260; town chronicles were compilations which were copied and re-copied over long periods of time, so that it is impossible to be sure where this information came from, but it could well be a contemporary record or reflect a local oral tradition. Stow gives April 15th as the commencement of the Shrewsbury outbreak, the date given in the Latin version of Caius' work; the chronicler lists Caius' name in the margin at this point as the authority for his account of the 1551 sweat. (J Stow, *Annales, or a generall chronicle of England*, London, 1631, p. 605.)

parishes to be affected and others not. Throughout the Border region are registers which reveal sharp bursts of mortality in the early spring of 1551. In Herefordshire Bromyard sees an epidemic in later February and again in early April affecting a mixture of adults and children with some concentration in successive days; in Shropshire Leebotwood has three burials together on March 27th (about the annual average total) and in Worcestershire there are small concentrations of April burials in Chaddesley Corbet, Feckenham, Great Comberton and Worcester St Martin. All of these incidents are suggestive, but none follows a full "classic" pattern, perhaps because climatic conditions were not yet ripe. In early May in Leintwardine (Herefordshire) there is a small but concentrated outbreak killing children only and in Myddle (Shropshire) a rather too extended epidemic for classic sweat, yet with some patches of concentration, and a tendency to kill both children and members of the same family. In Worcestershire, Astley sees four burials (its annual average) between May 14th and 17th, all children and including a pair of siblings—a very characteristic feature of classic sweat. In Devon too there were May epidemics in Bere Ferrers and Buckland Monachorum, while in Lancashire, significantly also on the western side of the country, Kirkham and Chorley were similarly affected by outbreaks which look suspicious without bearing all the characteristics of sweat. Taking the register and literary evidence together it seems likely that the disease was manifesting itself in a limited fashion from late March onwards, possibly in Devon and Lancashire as well as the Welsh border counties, without causing a generalized epidemic with significant mortality.

During the month of June the crucial breakout from the heartland takes place and the generally disseminated epidemic begins, as is plain from Map 3.[15] While sporadic incidents continued to occur in the counties provisionally identified as the heartland of the disease, Shropshire, Herefordshire and Worcestershire, many mortalities are now recorded in a sector stretching to the north and east, embracing Cheshire, Staffordshire and Warwickshire, with a significant episode as far east as Loughborough in Leicestershire and sporadic incidents in Lancashire (not mapped).[16] It must also be significant that the June epidemics mostly display "classic" characteristics, as if either rapid transmission or certain climatic conditions were essential for these aspects to develop fully. By early July the disease had crossed Gloucestershire to Bristol (St Nicholas) and eastwards to Derbyshire. The crucial development was the infection of London, on July 7th according to Caius and other literary sources, though there is a slight upswing in burial numbers before the 7th, and the register of St Dionis Backchurch records a burial "of ye sweate" on the 5th. If we relied solely on the register totals, as we do almost everywhere else, then the epidemic proper appears to begin on the 10th. The register evidence does not make clear the probable origin of the infection of the capital, since the counties to the immediate north-west of London show little trace of the disease, but some location further to the

[15] Dates on the map show the first day when a clear concentration of burials is evident, so that where epidemics begin rather slowly, dating may be a little late. All dates are derived from register evidence with the exception of Shrewsbury and London (referred to in the text) and Chester, where in the absence of register data, the town chronicle records the date of onset (P R Hunter, 'The English sweating sickness, with particular reference to the 1551 outbreak in Chester', *Reviews of Infectious Diseases*, 1991, **13**: 303–6, p. 305.

[16] The Loughborough facts are somewhat unclear, since the available register copies and transcripts give both June 18th and 24th as the date of onset.



Map 3: Date of start of individual outbreaks of sweating sickness.

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north-west in the Midlands such as Warwickshire or Leicestershire seems a strong possibility.

It is very easy to trace in the register record Caius' point about London first infecting its own region and then the north and east. In about a week after July 7th, spearheads of the sickness were spreading into Kent, Essex, Suffolk and Cambridgeshire. It is now hard to say whether central southern England was reached from London or from the original centre in the Midlands via Bristol or Oxfordshire. Similarly it is not at all clear whether the north was reached from London or the Midlands, Durham being attacked by July 21st, perhaps too early to have come from London. Lancashire, after a series of obscure and limited earlier mortalities, may have been generally re-infected by a fresh wave from either source: we can certainly see the sweat here moving northwards in later July until it reaches the extreme north of the county in August. The possibility of infection carried by coasting vessels between ports is a factor which should be considered in the north, but generally ports seem to be infected no more frequently than other categories of town, pointing to the likelihood of overland transmission as the most common way in which the disease was distributed. Identifying sweat outbreaks in Yorkshire is made difficult by the presence of bubonic plague in York and some other places in the county from July or August onwards.[17] Normally plague mortality may be identified by its long drawn out character and repeated deaths in limited numbers of families, but in some Yorkshire parishes where one or both diseases present themselves in an atypical guise the distinction is more difficult to make, especially when the two may have overlapped each other;[18] these parishes have been ignored.

In the south-west we seem to be dealing with a detached sweat epidemic, for the largely unaffected counties of Somerset and Dorset appear to have acted as a *cordon sanitaire* which discouraged overland transmission. But we have seen above the possibility of sporadic outbreaks in Devon very early in the summer; quite possibly the infection was re-introduced by ship, and to more than one place simultaneously, with Cornwall affected in consequence. The Devon epidemic is relatively well documented because of the number of surviving registers and the clear-cut nature of many of the outbreaks.[19]

Our only quarrel with the general view given by Caius lies in his assertion that the epidemic was over by the end of September. Perhaps the later outbreaks no longer made news in London, but even in southern England there were minor episodes grumbling away in late October, as in Southill (Bedfordshire), Winchester St Maurice (Hampshire) and in several Kent and Norfolk parishes, while in the north the late arrival of the disease and, possibly, a slower speed of transmission due to less frequent travel made September and October outbreaks not uncommon. As with the spring episodes, mortality was generally light and many of these minor outbreaks remain difficult to identify as sweat with relative certainty. Some towns, such as Louth (Lincolnshire) in October and Rye (Sussex) in

[17] D M Palliser, 'Epidemics in Tudor York', *North. Hist.*, 1973, **8**: 45–63. York civic officials admitted that what was happening in the city by October was "nowe perceyved to be a kynd of plague and swyttyng" (ibid., p. 50).

[18] Howden and York St Olave are two good examples.

[19] Our portrayal of the Devon epidemic differs in detail from Wylie and Linn (op. cit., note 8 above, pp. 104–5, 106–11); they miss the two earliest outbreaks at the end of July in the southern villages of Blackawton and Stoke Fleming, and so see the epidemic as beginning in the east in August.

November and December, suffered quite heavy mortalities which fell severely on children, but which appear to be some disease other than sweat, possibly an enteric infection associated with the failed harvests of 1550–1 and the economic consequences of currency manipulation which together made this a period of general distress for the poor.

The Victims

The registers allow us to analyse sweat mortality by sex and age, and thus to test the impressions recorded by contemporaries. Caius noted that the old and children escaped lightly, but that the well-fed rich and drunken poor were more likely to die; the most susceptible group was "theim of the middle age, beste luste, and theim not moch under that". It is not easy to state with confidence what exact age Caius meant by this expression, but the concept of middle age probably began earlier in the sixteenth century than now, perhaps as early as the thirties.[20] In the Latin version of his treatise, published in 1555, Caius extends these notions to allege that women and the lower orders escaped lightly while the rich suffered.[21] Certainly Stow, probably reliant on information from Caius, states that victims were male, and of the "best age, as betweene 30 and 40", with few women, children or old men being involved.[22] Henry Machyn, who was certainly an eye-witness resident in London, noted "mony marchants and grett ryche men and women, and young men . . .".[23] Other impressions of groups hit hard included "the towards youthe . . . in theyre best tyme", Wriothesley's "young men and women", and in London, "rich young men and other". [24] The accumulated wisdom of earlier epidemics was that men were more susceptible than women, and early adulthood the most dangerous age, with children and the elderly being spared; but the rich were hit harder than the poor.[25] Of associated interest are the popular names for the disease, for the Loughborough register calls it "stoupe knave and know thy master" and the Uffculme clerk calls it "stupgallant". Both terms seem to refer to the self-confidence of youth and good social position being deservedly humbled.[26] No more evidence is required to allow one to observe that these impressions will reflect the fact that those in the prime of life and in superior social positions are both highly conspicuous and less likely to die in many of the familiar

[20] Caius, op. cit., note 12 above, English text, pp. 17–19.

[21] Ibid., Latin text, p. 65. As a devoted student of Galen and the Greek humoral theory of disease, Caius has much to say about the connection between diet and susceptibility to sweat. These prejudices would have led him to expect high mortality amongst the well-fed.

[22] Stow, op. cit., note 14 above, p. 605. Stow seems to rely more on the Latin than the English version of Caius' work (see notes 12 and 14).

[23] J G Nichols (ed.), *The diary of Henry Machyn . . .*, London, Camden Society, 1848, vol. 42, p. 7.

[24] Shrewsbury chronicle, op. cit., note 14 above, p. 260. "Towards" in this context probably means "promising". Wriothesley, op. cit., note 13 above, p. 50; the editor, Nichols states (op. cit., note 23 above, p. 50) that King Edward's journal mentions the susceptibility of young men of strong constitution, but I can find no such reference in the modern edition (W K Jordan (ed.), *The chronicle and political papers of King Edward VI*, London, Allen and Unwin, 1966).

[25] Wylie and Collier, op. cit., note 1 above, p. 426. M B Shaw, 'A short history of the sweating sickness', *Ann. med. Hist.*, 1933, **5**: 246–74, p. 256.

[26] To stoop could mean to acknowledge another's superiority; a knave is male and usually young and regarded with disapproval; a gallant is a man of fashion and pleasure (O.E.D.), presumably young and well-off. The possibly related "trousse-galant" of the Continent reflects a similar idea (F G Crookshank, 'The "trousse-galants" of 1528–29 and 1545–46', *Proc. R. Soc. Med.*, 1921–2, **15**: 27–34).

epidemics of the period which would affect the poor, the very young and the old; any disease which was spread approximately uniformly amongst all social groups and ages would appear to contemporary observers as unusually hard on just those groups which sweat was said to target.

The evidence of the registers can be applied to these notions. It can give no guidance to social position, and any assessment of this aspect must be given up for lack of systematic evidence. Two prominent members of the nobility to die were the young sons of Charles Brandon, Duke of Suffolk; significantly, they were aged 14 and 16.[27] But, unlike earlier epidemics, we hear nothing of the deaths of the mayors of cities or of the infection of ministers and courtiers, beyond the two relatively unimportant members of Edward's court whose death prompted the young king's retreat from the capital, and a handful of other aristocrats listed by Strype.[28]

The quantity of information on individuals which is provided by registers at this date varies widely. The least helpful simply list the names of the dead, which allows only a view of the sex ratio of mortality; much better are those which distinguish children by the expression "son of . . ." etc., while indicating adult status by simply giving the name of the deceased. There are two snags here: the first is that in the pressure of such an epidemic the practice of providing unnecessary detail seems sometimes to have briefly lapsed in a way which is very difficult to detect with any certainty, so that some of those who appear to be adults were in fact children. Secondly, the age of children can be calculated only up to the age of thirteen because baptismal records are available only from the beginning of the registers in the autumn of 1538. However this possibility of linking baptismal and burial records is a valuable one, especially as there is insufficient material to make a full-scale demographic reconstitution exercise worthwhile. People appear to be designated as "son of . . ." or "daughter of . . ." when their father is alive and they remain unmarried, so that some may well have reached their twenties or even their thirties when they died. Some rare registers provide a label of some sort for everyone, such as "young girl", "householder" or "widow": here alone can we be quite sure that "sons" and "daughters" are not in fact grown up and that scribal omission has not disguised children as adults.

The upshot of this analysis is difficult to present because it is so diverse: all that one can say in brief is that the experience of different communities varied greatly, suggesting that the crucial factor in the distribution of mortality was not the nature of the disease itself, but rather the way in which it was transmitted and varying levels of immunity. The sex ratio of mortality is easiest to deal with. Here the case of London appears to confirm contemporary comment, for there was a very distinct male preponderance in the burials. Of 22 parishes within the City proper, not a single one has a majority of female burials and the total male figure is markedly higher—115 males to 33 females; and at St Margaret Westminster the disproportion is similar, with 29 males to 8 females. There may well have been a preponderance of males in the population of the capital as a whole, with its large contingent of male apprentices and migrant workers, but this cannot adequately explain away this phenomenon, for in Westminster the burials for the remainder of the

[27] Machyn, op. cit., note 23 above, p. 318; S J Gunn, *Charles Brandon Duke of Suffolk c. 1484–1545*, Oxford, Blackwell, 1988, p. 94.

[28] Jordan, op. cit., note 24 above, p. 71. J Strype, *Ecclesiastical memorials . . .*, Oxford, Clarendon Press, 1822, vol. 2 (i), pp. 93–4.

year show that the balance between the sexes in the burial register was normally fairly equally matched. This pronounced male susceptibility in the capital may well have impressed commentators who were based there, such as Caius, but it is not maintained to the same degree in the provinces. Here a sample of 53 substantial outbreaks shows that where there is a difference, in 29 males predominate and in 21 females; however in 31 cases the extent of the imbalance was modest, and in the remaining 22 parishes which were distinctly imbalanced, 17 were heavily male-biased as against only 5 in the female direction. Thus male preponderance did exist in a significant number of parishes, but it was not a general phenomenon. Not enough demographic research has been done on the sixteenth century to allow a firm statement on the sex ratio, but it seems possible that there was often a female majority in the countryside and a male one in the towns; however, the degree of imbalance between the sexes in local populations could not often have been sufficiently pronounced to explain the marked disparities described above.[29]

Some insight into the factors moulding this situation may be derived from another conspicuous feature of these mortalities, which is that, in some parishes, long runs of burials are dominated by one sex or the other. Thus at Biddenden (Kent) of the first 14 burials, 11 are male and of the following 24, 17 are female. At Alstonfield (Staffordshire) 6 male burials are followed by 13 more, of whom 10 are female; 4 males and then 4 females complete the sequence. At Evesham All Saints a run of 5 male burials which begins the series is followed by 7 females out of the next 9. In East Down (Devon) where only 3 of the 14 burials are female, they are bunched together on a single day. Generally speaking, these sequences are begun as often by females as males. Examples of bunching of a less extreme kind are common throughout the register record, and generally seem too pronounced and too frequent to be due to random variation. If we are to attempt an explanation of this phenomenon we must assume, in the absence of any direct information, that sweating sickness was not generally transmitted by an insect vector but rather through close personal contact. The length of the incubation period was probably short, but this must remain conjectural. The mortality pattern suggests that groups of villagers must have been infected virtually simultaneously; thus social gatherings would have been the chief means by which infection could have been spread so quickly, and these assemblies would frequently have been made up of one sex or the other at this date, especially when younger unmarried folk are involved. These gatherings could be created by leisure or working pursuits, and might be indoor or outdoor, so that where the village was infected via the alehouse there is a male bias in the mortality, and when it occurs while the dairy herd was being milked, then there will be a preponderance or sequence of female burials. Stow describes a group of seven London male householders who "did sup together, and before eight of the clocke in the next morning, five of them were dead".[30] Patterns of burial will closely reflect the timing of infection when interment usually followed death within a day or so, and when the sweat seems to have run its course in only twenty-four hours. Perhaps the general male preponderance among the burials reflects relative female isolation in the farmhouse or home while men mixed more with their fellows, both at work and leisure.

[29] J Barry (ed.), *The Tudor and Stuart town*, London, Longman, 1990, p. 23. Most of the outbreaks in provincial towns do show a marked male bias, such as Durham, Bristol, Chelmsford, Rye and Evesham, and all the parishes with a clear female bias lay in the countryside.

[30] Stow, op. cit., note 14 above.

The age structure of mortality is much more difficult to summarize, partly because information is lacking in the many cases where the register gives no details beyond the name of the victim, but also because it appears to vary from community to community. One clear class is provided by parishes whose mortality is dominated by those in their teens and twenties. At Alstonfield (Staffordshire) the 28 dead consist of 6 adults and as many as 22 who are described as "son of . . ." or "daughter of . . .". The baptismal register appears to be complete and contains no record of any of these young people, so all (with the possible exception of migrants from other parishes) must have been baptised before the registers begin in the autumn of 1538, but not yet married. Thus they must be aged between twelve and the usual time for marriage at this date, the mid to late twenties or early thirties. Of the 12 victims in nearby Marbury in Cheshire, the register describes 6 as young, another as the sister of two of these, one as a child and one as "lately married", suggesting a very similar pattern. In Wensley (Yorkshire) 9 of the 10 victims are sons or daughters, but 5 do appear amongst the baptisms, aged 1, 1, 2, 2, and 12. Five of the six victims at Bisley (Gloucestershire) are children, but mostly aged two and under. At Kingsland (Herefordshire), Whittington (Lancashire), Kingsthorpe (Northamptonshire), Myddle (Shropshire), Glemsford (Suffolk), Balcombe (Suffolk), Rye (Sussex), Astley and Worcester St Swithin (Worcestershire) all, or most are "children" as defined by the "son of . . ." terminology, though in some cases the children are very young, the easiest people to trace in the registers because their parents have had least time to move between parishes.

Another, smaller class is provided by parishes where the mortality seems distributed generally between all detectable age groups; for instance in Tenterden the first phase of the epidemic kills three husbands, one widow, two servants and three daughters, while in Braunton (Devon) of the 11 victims 9 appear to be married or adult and in Bromyard (Herefordshire) the July epidemic claims three adult men, one adult female, an infant, a "child" and a "girl". Some mortality which appears to be largely adult—such as Halifax—must be distorted by a common failure to give full details of parentage in the heat of the epidemic, but the case of London seems to supply a genuine case of predominantly adult mortality, as the literary sources suggest, though many of the victims are described as "servant" and could be aged anywhere from ten to mature adult; however, very few appear to be children as defined by the "son of . . ." formula, though in some cases ignorance of the family circumstances of the victim might have led to the omission of the parental name. As with the gender bias, London's experience may well have misled contemporary observers, for the provincial evidence does not support the assertion that young children were generally spared. However, widows are very rarely specified, which might support the literary assertion that the old escaped and that it was younger adults who bore the brunt. Regarded nationally then, the mortality seems often to be biased towards youth, though within that broad category it is much more difficult to be specific. One last point may be mentioned here—a tendency for multiple mortalities within families. This does not approach the levels found in epidemics of bubonic plague, but is significant. Siblings are most likely to be involved, as in Marbury where three sisters were buried, or Woodchurch in Kent where a householder, his son and a servant were buried over a period of four days; of the eight deaths in Myddle, two are siblings and another two are mother and son. The higher risk of infection from the close contacts of

family life is clearly a factor here. It may be significant that no case has been noticed of both members of a married couple dying: this might suggest that by this age it was unlikely that both parties would be susceptible.

Two further general points of interest remain to be covered. The first is that the sweat is very clearly a rural rather than an urban phenomenon, unlike most epidemic diseases which were more prominent in towns. Urban settlements had a much higher population density and more frequent contacts with the outside world, which encouraged the introduction and spread of infection, exacerbated by environmental factors such as readily polluted water supplies. Certainly sweat often seems to have been transmitted through towns on main roads, as the term "posting sweat"[31] suggests: the example of Loughborough comes to mind when this market town and road centre seems to be the only place in its county to be significantly affected. And Oxford, as we know from a local doctor's reminiscences, was infected, though the register record indicates that there was no significant penetration into the countryside of the county.[32] Much the same phenomenon would probably be seen in the post towns along the roads out of London in the second half of July, since the epidemic could not have spread so widely so quickly in any other way but by being carried by travellers from the capital. But death rates in the affected towns are not high (although the greater size of towns may produce large burial totals) and even more significant are the low rates in London, with a mortality rate roughly half that of the average infected village, and the very limited contribution made by the major provincial cities in the story of this epidemic—Norwich without any significant involvement, only one Bristol parish with an outbreak of any size, and only one or two Worcester parishes slightly affected.

The second feature of the register record is that it allows us to question the received wisdom that the sweat had not occurred since its last general epidemic in 1528 and was never seen again after 1551—both intrinsically unlikely propositions when seen against the general background of the behaviour of epidemic diseases. The detection in burial registers of possible sweat epidemics in years other than 1551 is fraught with difficulty since there is no instance of a written statement identifying the cause of death as sweat in the registers[33] and we are forced back on an analysis of patterns of mortality at a time when many rather obscure diseases seem to be circulating. However in Newbury, Berkshire, there is a burst of burials in September 1552 which would have been unhesitatingly identified as sweat had it occurred twelve months earlier, and in Wantage, in the same county, there is another, but less pronounced concentration. If it is correct to identify the Welsh borders as the origin of the 1551 epidemic, then it would be especially significant if minor outbreaks of the disease were detected in this region in the years before 1551. In Ashperton, Herefordshire, there is a spate of burials in July 1545 which

[31] Used by Hancock in 1554 (Strype, op. cit., note 28 above, vol. 3 (i), p. 111.

[32] C Creighton, *A history of epidemics in Britain*, Cambridge University Press, 1891, vol. 1, p. 260.

[33] The only exception to this statement is one reference to "the sweat" during the influenza epidemics of the late 1550s (J R Taylor, 'Population, disease and family structure in early modern Hampshire, with special reference to the towns', PhD thesis, University of Southampton, 1980, pp. 330–1).

looks very like sweat: of 15 burials between July 14th and 30th, 5 take place on the 26th and the first 11 are all female; 12 are children, as defined by the "daughter of . . ." formula, and most are aged over the six years which is the limit imposed by the beginning of the register in autumn 1538. In the same county in 1546 in Bromyard there is another intense burst of burials in May, though this time divided between adults and those described as "girl" or "boy". Similarly, in Pontesbury, Shropshire, a brief outbreak in May of 1550 looks suspicious. Lack of surviving registers in this region limits the examples quoted here. The burden of probability points to the likelihood of isolated outbreaks in non-epidemic years and the examples quoted are similar enough to the classic instances of 1551 to arouse strong suspicions.

Demographic Effects

It has already been suggested that as a very broad generalization, perhaps a third of English parishes produced detectable sweat mortality. What proportion of the English population died of the disease? London is the clearest case, for we have the figures collected and made public by the City government. Caius records a total mortality from sweat in London (excluding the suburbs) of 903 from July 9th to 30th, not including the uncounted total from the first two days of the outbreak, the 7th and 8th; register evidence suggests that this was not high, and that 1,000 would be a fair maximum estimate for the death toll in the capital.[34] The population in 1560 of the area covered by this estimate has been plausibly calculated as 80,000, so the epidemic must have killed about 1.25 per cent of the people of the capital.[35] A survey of 24 City parishes with straightforward register records reveals a sweat mortality of 188 in an area with a population of about 15,620 in 1548; this produces a rate of 1.2 per cent, which is remarkably close to the first assessment, and encourages some confidence in the validity of this approach.[36] In the provinces we can use the 1563 Bishops' Census as a base for calculating the total population of affected parishes in the dioceses for which it survives.[37] In a survey of both the probable and more doubtful sweat mortalities in a sample of 69 parishes in 12 counties a mean of 2.2 per cent mortality was reached, and a median of 1.7 per cent.[38] This was a rather an artificial exercise in that parishes which recorded only one burial, or two which

[34] Caius, op. cit., note 12 above, English text, p. 11. Machyn gives 872 *of all diseases* between the 8th and the 19th (Machyn, op. cit., note 23 above, p.8) while a private letter reports that 938 have died from the sweat between the 7th and the 20th (*idem*, p. 319, quoting British Library, Harleian MS 353 f.107). Evidently all these figures derive from the same official source; the surviving parish registers make clear that most of the mortality was concentrated between the 10th and the 16th, with only a dribble after the 20th.

[35] A L Beier and R Finlay, *London 1500–1700: the making of the metropolis*, London, Longman, 1986, p. 45.

[36] Total population estimate based on chantry certificate returns of communicants in 1548, multiplied by 1.5 to bring them up to total populations (C J Kitching, *London and Middlesex chantry certificates 1548*, London Record Society, 1980, p. 16). Individual parishes recorded surprisingly consistent levels, ranging between 0.5 per cent and 2.3 per cent. Only two parishes scored more than 1.7 per cent.

[37] British Library, Harleian MS 594–5. A multiplier of 5.0 has been used to convert households to total population, a higher one than is often suggested but justified, one trusts, by the arguments in Dyer, op. cit., note 9 above.

[38] The counties covered by this sample were Cambridge, Chester, Derby, Gloucester, Kent, Lancaster, Shropshire (north), Stafford, Warwick, Westmorland, Worcester, Yorkshire (parts); where a parish showed two separate bursts of mortality, both were generally counted if the interval was not too long.

were not very closely related, could not be identified as infected, so that average mortality levels would be even lower if such parishes were included in the survey. Only four parishes recorded more than 5 per cent mortality, with the highest encountered being the 10.2 per cent of Farnworth in Lancashire; most of the higher mortalities were located in the north-west. The toll of hard-hit parishes would need to be extended if we had 1563 population figures for counties such as Devon: the Uffculme outbreak killed three times its annual average mortality, which suggests a sweat mortality of at least 7 per cent.

These figures may be put in a different context by considering that where the mortality was concentrated on a restricted age-range, then the impact was proportionally much greater. Thus in Alstonfield, where 29 deaths in an estimated population of 465 give a total mortality of 6.1 per cent, the impact on the 13 to 30 age-group was much higher since, as suggested above, 22 of the victims came from this cohort, which probably contained about 30 per cent of the population of the parish; thus about 16 per cent of this group died, and if some of the other victims who are recorded as married were also under thirty, as seems likely, then the proportion must be around 20 per cent.[39] Returning to our mean of 2.2 per cent mortality in affected parishes, which we have suggested comprise only one-third of the total, we might estimate a maximum theoretical mortality of about 0.5 to 0.7 per cent in England as a whole, which would account for perhaps 15,000 to 20,000 deaths in a population of rather more than three million.[40] Since urban levels were lower than 2.2 per cent, we might put the likely national level at the lower end of the suggested range, that is 0.5 per cent and 15,000 deaths. This figure might imply a raising of the death rate by about 15 to 20 per cent for the year. But in an age when devastating epidemics were common, the demographic effects of the 1551 sweat must be seen as relatively minor; compared with the crushing effects of the influenza of 1557–9 or even with the bubonic plague of 1563, these estimates for the sweating sickness must be seen as quite modest.[41]

Contemporary Perceptions of the Disease

However, the moral effect was much greater, and helps to account for the prominent position given to the sweat by contemporaries—if the disease was well to the forefront of contemporary minds, that endowed it with an importance not related to the numbers that it killed. Perhaps Paul Slack was too dismissive of the sweat in what is still one of the main analyses of sixteenth-century disease mortalities[42]—for he evaluates only its

[39] Wrigley and Schofield, op. cit, note 3 above, p. 528, estimates the age-structure at this date.

[40] Ibid., p. 531. Though they note that the July mortality was doubled and so rates as a crisis, Wrigley and Schofield suggest that the increase in mortality for the whole year was modest—very much less than the 15,000 that we suggest here (pp. 337–8, 496, 531), though their figures for July and August 1551 would suggest an excess mortality of perhaps 10,000, obscured in the annual total by some low values for the remaining months of the year—p. 511). However the sample of registers on which their 1551 figures are based is only about 76, and has a regional bias at this date, so it would be quite fortuitous if this happened to provide an accurate sample of the experience of the country as a whole.

[41] Wrigley and Schofield figures would suggest a loss of over 30,000 in the plague and over 200,000 during the three main influenza years (ibid., p. 496).

[42] P Slack, 'Mortality crises and epidemic disease in England 1485–1610', in C Webster (ed.), *Health, medicine, and mortality in the sixteenth century*, Cambridge University Press, 1979, pp. 25–7.

demographic effect (here suggested to be rather more than he assumed). Epidemics frequently have an impact which stretches far beyond the demographic phenomena, and rarely more than in this period when disease was seen as an instrument of divine correction. Some epidemics, such as bubonic plague, struck very hard in a restricted number of places and among the poor, so that the nervous could console themselves with the thought that social status, flight, or prior residence in a safe place would protect them, but the sweat seemed to spread at such a pace that nowhere was safe. The terror induced by the rapidity and violence with which the epidemic developed and the speed with which the afflicted died is impossible to measure in numerical terms. We get some idea of this from the report of the Venetian ambassador, who claimed that in London there was a general panic and evacuation, shops were closed, and all business was suspended.[43] Stow's account of the London epidemic states that it was "so terrible, that the people being in best health, were sodainly taken, and dead in foure and twenty houres, and twelve, or lesse", and later that it was "a terrible time in London, for many [a] one lost sodainly his friends".[44] He goes on to refer to the impression that the disease singled out Englishmen abroad, as if this aspect were particularly alarming (perhaps because it pointed to divine retribution directed at the English in response to their religious behaviour): "wherefore this nation was much afeard of it, for the time began to repent and remember God, but as the disease relented, the devotion decayed".

The epidemic struck in an era of religious turmoil, and the temptation to see it in moral terms, as a punishment for the sins of youth (as in the term Stoopgallant), or as divine retribution for abandoning the traditional church—or failing to abandon it— would have been irresistible. The early protestant Thomas Hancock was accused by conservatives in 1554 of referring to three plagues: the sweating sickness, which was sent as a warning, the death of Edward VI, and the Marian withdrawal of the English Bible and service.[45] In 1551 the royal government instructed the bishops to propagate the theory that God had sent the epidemic to punish those who rebelled against His will (and so by implication those who defied God's servants, i.e. the bishops and the royal government).[46] The epidemic seems to have burned itself into the collective memory, for when the registers were copied in 1598, a number of clerks added some reference to the burial records of 1551 which shows that they expected to find large mortalities in this year and remembered the reason for them, even if the original record made no comment; and in the case of Knockolt in Kent the copyist states with a hint of disappointment "this y[ea]r was the great sweat, but it seemeth that it made not the like wrack in Nockholt as in other places". However it would still be possible to exaggerate the impact of the sweat on routine life in 1551: one foreign visitor spent June and July in Oxford, visited Gloucester and reached London just as the epidemic began there on July 7th, yet apart from observing that the king had left for Hampton Court to escape infection, his travel notes contain no reference to the disease at all.[47]

[43] *State papers Venetian*, op. cit., note 13 above, p. 542.

[44] Stow, op. cit., note 14 above.

[45] Strype, op. cit., note 28 above, vol. 3 (i), p. 111.

[46] *Calendar of state papers domestic series, Edward VI*, rev. ed., London, HMSO, 1992, p. 198.

[47] W D Robson-Scott, 'Joseph Maler's visit to England in 1551', *Mod. Lang. Rev.*, 1950, **45**: 346–51.

A Possible Source of Sweating Sickness

We shall end by reviewing those characteristics of the sweating sickness as revealed by this analysis which might be relevant to a provisional identification of the organism responsible for it. The confinement to the summer season, already firmly established in the literary evidence, is supported, with no generally disseminated outbreak before June and little surviving evidence after October. The national epidemic displays a disease capable of very rapid movement at certain times, consistent with distribution by travellers. Yet when examined at parish level we see a chain of infection which appears to be very fragile, easily broken to terminate the outbreak or to await further re-infection from outside. Large areas of the country are relatively free of infection which might point either to the presence of a high level of previous exposure to the causative organism, or to a disease which found the invasion of some districts very difficult for reasons which we do not understand. Some concentration in families might point to the need for close contact before infection, a point re-inforced by the sex bias of some mortalities, if we have interpreted this aspect aright. The concentration on younger victims, if supported by the pattern of infection of survivors, of which we are ignorant, would support an interpretation dependent on the importance of immunity derived from previous exposure. The previous national epidemics in 1528, 1517 and 1508 could have bestowed immunity on those aged over 23, 34 and 43 respectively in 1551, and though not everyone would have been affected by one of the previous outbreaks, the three together might have immunized much of the older population; there may have been unreported regional outbreaks in other years and a level of inapparent but effective infection which can only be a matter of speculation.

It may be significant that Thomas Forestier, our best contemporary authority on the first epidemic in 1485, denies any age factor and refers to "young and old and of all manner of ages" as victims.[48] One might assume that immunity was low or non-existent at all age levels in 1485 when the disease is said to have first appeared, but that sweat's apparent preference for the young was built up as successive epidemics established a high level of immunity in older people. Such a thesis of differential immunity acquired by previous exposure might provide a reason for the patchiness of the distribution of the disease within communities and over the kingdom as a whole; it would explain how a disease which was apparently highly infectious judging by its ability to spread so widely so quickly, was still incapable of causing an extensive epidemic in some regions, or of creating a heavy mortality in the capital. The weakness of its effect in towns would be explained by their susceptibility to previous infection, and the concentration of heavy mortality on out-of-the-way villages in areas such as Devon or the north-west would be due to their isolation from previous exposure. However, we cannot be sure that the infection did create either temporary or life-long immunity—Cardinal Wolsey allegedly suffered four attacks in one month in 1517 and caught it again in 1528.[49]

The thesis of an organism similar to an arbovirus as the causative agent, already advanced by Wylie and Collier,[50] fits very well into this line of argument. If the virus retreated to an animal host between epidemics and during the winter and was then passed

[48] British Library, Additional MS 27582 f. 70v.

[49] P Gwyn, *The king's cardinal: the rise and fall of Thomas Wolsey*, London, Barrie and Jenkins, 1990, pp. 58, 440.

[50] Op. cit., note 1 above.

to humans by some arthropod vector during the spring as both host and vector multiplied and became generally more active, it might well be that the disease reservoir lay in western England and particularly that area of the Welsh marches which seems to have been the origin of the 1551 outbreak. It could be significant that the first epidemic in 1485 seems to have started in much the same region,[51] but our evidence from the other sweat epidemics is too fragmentary to support any theory as to their origin, except that they all affected London (and perhaps we only know of those which did reach the capital); but one of the very few provincial places recorded as infected in 1508 was Chester, on the border of the suggested reservoir area.[52]

The great difficulty with this thesis is that most arboviruses cause human epidemics through the direct agency of arthropod bites, such as the mosquito-transmitted St Louis encephalitis, yellow fever, Japanese encephalitis, and Murray Valley encephalitis, or the tick-borne louping ill (still present in Britain) and Crimean hemorrhagic fever.[53] In none of these classic arthropod-borne diseases well-known to modern medical science are human beings generally considered capable of transmitting the disease organism to each other, yet very rapid transmission by travellers along the road system is clearly the agency by which the sweat epidemic of 1551 was spread from June onwards, although this may not have been the case in the spring. Neither can we imagine that the explosive spread of the disease through intra-mural London could have been secured by any means other than human-to-human transmission, even if rural Shropshire could have originally been infected by tick bites transmitting virus from a vertebrate host such as a vole. However there are occasional references in the medical literature to the possibility that these diseases, once begun by arthropod vectors, are capable of transmission between humans, chiefly by means of airborne droplets.[54] Most arboviruses and the diseases they cause are naturally restricted to particular geographical regions, presumably because of the relative immobility of their animal hosts and the delicate web of interrelationships and environmental conditions which sustain the chain of circumstances essential to the continuation of these infections: this factor too would fit in very well with the apparent fact that the sweating sickness was firmly based in England, and possibly endemic in only one region, even if it was capable of occasional crossings of the Channel. It would also help to explain its apparent disappearance after 1551, aided by the spread of immunity

[51] Henry Tudor's army passed through Shrewsbury on its way to Bosworth, and there is a long tradition that the disease was carried to London in the train of the new king. The alternative argument is that the disease was already generally known by name by 1485 and already present in Lancashire or its general area in the weeks before the battle of Bosworth, though not perhaps established as an epidemic killer nationwide; both positions would support our thesis. (L Attreed, 'Beggarly Bretons and faynte-harted Frenchmen: age- and class-specific mortality during London's sweating sickness of 1485', *The Ricardian*, 1978, **4**: 2–16, p. 7).

[52] G Ormerod, *History of the county palatine and city of Chester*, 2nd ed., London, Routledge, 1882, vol. 1, p. 234. This gives the date as 1507, presumably because the town chronicle is organized by the usual municipal year which covers part of two calendar years, 1507–8 in this case.

[53] Kiple, op. cit., note 1 above, pp. 587–95; P E C Manson-Bahr and F I C Apted, *Manson's tropical diseases*, London, Baillière Tindall, 1982, pp. 254–74; J Steele (ed.), *CRC handbook series in zoonoses*, Boca Raton (Florida), CRC Press, 1981, section B vol 1.

[54] Manson-Bahr and Apted, op. cit., note 53 above, pp. 260, 269; Steele, op. cit., note 53 above, pp. 291, 412.

through exposure, but brought about by the rupturing of that chain of environmental circumstances in some way, possibly by the woodland clearance and marsh drainage symptomatic of that general process of agrarian change which was a feature of the mid to late sixteenth century, not least in the Shropshire region.[55]

The sweating sickness epidemic of 1551 should emerge from this study as less enigmatic than was once the case. Sweating sickness is clearly not the mysterious, anomalous phenomenon defying categorization or comprehension which it has tended to become in the literature. Although there must be aspects of the disease which will always elude full understanding due to inadequate documentation and absence of scientifically proven fact, its various manifestations may be fitted into the established spectrum of disease behaviour. If the sweating sickness must be assigned a lowly position in the hierarchy of serial killers, it does have an importance in the history of disease, of medicine and of the sixteenth century which is quite independent of its demographic aspect, an undeniable intrinsic fascination of its own.

[55] Victoria history of the counties of England, *A history of Shropshire*, vol. 4, *Agriculture*, Oxford University Press, 1989, pp. 119–68.