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Cases vs. Statistics: A Crux in the History of Medicine

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Recommended Citation

Justman, Stewart, "Cases vs. Statistics: A Crux in the History of Medicine" (2021). *Global Humanities and Religions Faculty Publications*. 14.

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Cases vs. Statistics:

A Crux in the History of Medicine

No one wants to be a statistic. When statistics were introduced into medicine 300 years ago, however, they represented both an effort to confirm lives saved and a departure from the all-too-powerful tradition of Humoralism.

Dating to the days of Hippocrates, Humoralism refers to the theories and practices centered on the belief that the balance or imbalance of certain cardinal bodily fluids (“humors”) determines health. (By the same token, contextual factors such as diet and climate which influence these dynamics were important to humoral thinking.) While Humoralism underwrote the general use of evacuative treatments to discharge excesses and pent-up matter, it also complicated the comparison of cases, defined as each of them is by its particularities. The humoral outlook had such staying power that it persisted in one guise or another for millennia, through the successive turns and epochs of medical history.

Here I discuss the first numerical tabulation of medical data on record, a technique contrary to the tradition of Humoralism. The setting was the inoculation debate in England in the 1720s. It was the sheer scale of smallpox mortality that inspired the use of statistics to estimate the toll taken on the population and assess the only available means of prevention.¹

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Following the introduction of inoculation by Lady Mary Wortley Montagu upon her return from Constantinople, and the inoculation of two granddaughters of George I, the procedure began to be performed here and there in England in the early 1720s. Among the first inoculators was the Yorkshire physician Thomas Nettleton. At the outset Nettleton believed that if inoculation were managed carefully enough, there would be no casualties. Realizing that no human work is perfect, however, he soon came to feel that if any should die as a result of inoculation, it would be excusable because inoculation so greatly benefits the public in general. "Whenever any shall happen to miscarry under this operation, that will indeed be very unfortunate and ill, but in this case you will have recourse to the merchant's logic; state the account of profit and loss to find on which side the balance lies with respect to the public, and form a judgement accordingly."² So Nettleton wrote in a private letter, not a pamphlet. No doubt many of his fellow physicians would have balked at the reduction of medical judgment to the lowly art of bookkeeping.

But there is this much to be said for bookkeeping: it uses numbers with care and precision. The inoculation debate saw the wildly erratic use of statistics on both sides. A strident opponent of inoculation, Thomas Howgrave, asserted that only one person dies out of 18 stricken with smallpox (a gross underestimate) and that inoculation itself poses a much greater danger (a gross exaggeration).³ Another critic, Isaac Massey, stoutly maintained that of every 100 inoculations, only 40 induce "true" smallpox, a fact plucked out of thin air.⁴ Voltaire, a proponent of inoculation and great critic of nonsense, asserted nonsensically that 60 of every 100 persons contract smallpox, and of these 60, 20 die and 20 more are scarred for life, so that,

in all. 20% of the population either die of or are disfigured by smallpox.⁵ These debaters seem out of their element using numbers at all. Nettleton, by contrast, meticulously calculated smallpox mortality in his region, if only because inoculation could not be rationally evaluated otherwise. With the novel procedure on trial and local opinion against him, he had to be careful, just as he had to be prepared to explain any case that might go amiss.

Accordingly, though Nettleton mentions the total of his successes (“upwards of forty”) but once in an interim report of April 1722, he delves into the case of a child who died after, but not because of, inoculation. Her brother had just died of smallpox, Nettleton accepted her for inoculation with reluctance (knowing that if she too died, he would be blamed and the inoculation campaign would suffer), and her symptoms emerged much too soon after incision to have arisen from the procedure.⁶ Because the child’s death was not caused by inoculation, Nettleton did not have to argue that it was overbalanced by many successes. Meanwhile, his work continued without incident,⁷ and by December 1722 he could report that none of 61 persons he inoculated died as a result of the procedure, whereas almost one in five who contracted natural smallpox in his vicinity perished.

Knowing that his work needed to be replicated, Nettleton relayed these figures to the secretary of the Royal Society, the mathematician and physician James Jurin,⁸ who in turn solicited reports from inoculators in the four corners of the kingdom. The public advertisement Jurin first placed in 1723 does not inquire about the condition of the subject, a topic of traditional concern to medicine.

All persons concerned in the practice of inoculating the small pox are desired to keep a register of the names and ages of every person inoculated, the place where it is done, the manner of the operation, the days of sickening and of the eruption, the sort of small pox that is produced, and the event [that is, outcome].⁹

Even while asking inoculators to keep careful records, Jurin seeks no information about the constitution or health of the inoculee. In the event an inoculee dies following the procedure, he does ask his correspondents to send “a particular relation of the case”—a sort of narrative post mortem—so that he, in turn, can set the facts before the public. But such cases turned out to be rare, while, conversely, the successes were too many to allow a detailed account of each and every one. Being surgeons and apothecaries, not physicians,¹⁰ most of the “persons concerned in the practice of inoculating the small pox” in England at the time were not really the party to provide a medical history or commentary anyway. In some instances recorded by Jurin, inoculation was performed by women—an echo of the practice originally imported into England.

A few years before Jurin issued his call for data, a letter to the Royal Society reported that inoculation as practiced in Constantinople for 40 years not only protects against smallpox, but does so regardless of the subject’s “temperament” and “even in the worst constitution of the air,” quite as if the procedure cut through the daunting complexities of humoral medicine.¹¹ Also by report, this practice was conducted by a certain Greek woman. At the end of an impressive statistical argument for inoculation published in 1723, Jurin celebrates the work of

this anonymous heroine who personally inoculated “many thousands” in and around Constantinople without so much as a single casualty.¹²

Though Jurin’s own numbers can’t equal this record, he does find inoculation far less dangerous than smallpox per se, even with unselected subjects. “Of persons of all ages taken ill of natural small pox, there will die of that distemper, *one in five or six, or two in eleven,*” while “of persons of all ages inoculated, without regard to the healthiness or unhealthiness of the subject, as was practiced in New England, there will die *one in sixty.*”¹³ (The corresponding figure for England, where inoculation is performed more judiciously, is one in 91.) Note the neutralizing of the very issue a physician would usually concentrate on: the state of the subject. While Jurin does suggest that fatalities in New England may be owing to the practice of inoculating the weak and the strong alike, he isn’t about to construct separate tables for less hardy and more hardy inoculees. The technique of tabulation itself works against the use of such fuzzy categories. But while the statistics may be as precise as Jurin can make them, figures like one in 60 (or one in 91) should be taken with a sprinkling of salt. Not only do they refer to suspected, not verified, inoculation fatalities, but they are subject to change from one year to the next, and given the paucity of even alleged fatalities, even a slight change will dramatically alter the ratio itself, as Jurin well knew. (Two fewer alleged fatalities in New England at the time Jurin gathered his statistics would have reduced the ratio there from one in 60 to one in 100.)

Where Nettleton came to believe that inoculation was of great benefit to humanity even if some subjects happened to die, Jurin computed as best he could the magnitude of that general benefit. Evidently he felt that while the interpretation of a handful of troubling cases

might be open to dispute, the overall verdict in favor of inoculation was numerically self-evident.¹⁴ A critic at the time might have argued that although Jurin signs himself MD, he writes not as a physician but merely as a calculator (as we now say, a bean-counter). The foremost critic of inoculation, the physician William Wagstaffe, went on the attack even before Jurin had collected his data, reaffirming all the traditional considerations ignored in a table in the interest of numerical clarity.¹⁵ Wagstaffe contests the inoculators' reports in detail and on every point, leaving the distinct impression that if each inoculation tabulated as a success were well looked into, most and possibly all would be found not to be success stories at all. The proper way to analyze cases is *as* cases, not in aggregate. In all, Wagstaffe deems inoculation not a safeguard against smallpox, but a lethal danger to the subject and the community. It is only by good luck, he asserts, that the royal family suffered no loss by subjecting two of its own to inoculation.

Presumably because many followed the royal example, Wagstaffe regards inoculation as a fashion, and, mindful as he is of the complex determinants of health, he takes a highly skeptical view of this behavioral trend. As if laying down a principle, he asserts in the first few sentences of his pamphlet that without conducting repeated trials "on persons of different ages, sexes, and constitutions, in different seasons of the year, and in different climates," it is impossible to establish the safety and efficacy of inoculation. (The mention of climate, a traditional humoral topic, appears to be an allusion to the Turkish origins of the British practice.) In and of itself, the author's emphasis on all these variables declares his opposition to statistical generalities. Wagstaffe would never agree to vacate the entire conceptual

framework of Humoralism in order to produce a stark numerical comparison resembling a merchant's balance sheet.¹⁶

Wagstaffe proceeds to argue that it is reckless to inoculate without knowing “the state of the humours” of the individual subject—reckless if only because the constitution of each one of us has a point of vulnerability, an Achilles heel. “For as there is no man but has some imbecility, some little weakness more in one part than another, so distempers . . . often prove fatal by finding out the foible of our constitution, and attacking us in the most unguarded places.” Only the conscientious practitioner of humoral medicine can properly watch out for the fatal flaw that is part of every constitution. The heedless empiric who inoculates people in lots, disregarding their particularities as Jurin does in tabulating cases (to say nothing of the Greek woman who inoculates by the thousand), will only sow death.

In rebuttal of the claim that inoculation confers immunity to smallpox, Wagstaffe refers to a case known to him in which a girl of twelve contracted the disease some months after being inoculated. He comments, “One example of this kind destroys the certainty of inoculation's preventing the small pox, as much as a thousand.” If one case equals a thousand, then of course statistics have no meaning. Fittingly, Wagstaffe cites almost no statistics over the course of a formidable argument rich in cases.¹⁷ Whereas Jurin is willing to let certain cases count against him because the statistics still speak overwhelmingly in favor of inoculation, Wagstaffe grants nothing and argues over everything. But while he may have won the debate rhetorically, in other respects he lost. As the decades passed and it became clear that inoculation did in fact protect against the terrible scourge of smallpox (the only such safeguard known until the advent of vaccination), the practice found growing acceptance. More

fundamentally, Jurin (and Nettleton) anticipated the increasing use of statistics later in the 18th century to order medical knowledge,¹⁸ a development that not only marked progress but held the potential for more. A statistical summary by Jurin is something like a 21st-century summary of medical findings 300 years before the fact.

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In the public and private correspondence between Jurin and Nettleton, the analysis of cases and the compilation of statistics seem to run in opposite directions, with disturbing cases revealed upon examination as spurious or questionably relevant, and inoculation statistics becoming ever more general and compelling. Similarly, in Jurin's annual reports on the state of inoculation, cases give rise to involved discussion and chains of documents, while statistics illuminate. Yet the case remained the unit of medicine. Too securely established to be shaken even by so momentous a feat as the prevention of smallpox, Humoralism stood as before.

Just as inoculation was an empirical practice with no connection to humoral medicine and no support in medical theory, so it caught on without prejudice to Humoralism. A physician who corresponded with Jurin thought one of his inoculees, a man "of sanguine constitution," would have passed through his case of induced smallpox more easily if he had "been bled and vomited in the beginning."¹⁹ The surgeon Charles Maitland, the first to perform inoculation in England, argued that inducing a preventive case of smallpox ought to be no more objectionable than bleeding and other evacuations; in effect, it is simply an extension of customary practice.²⁰ Nettleton himself, Jurin's original informant, mentions diet and climate, bleeding and purging in

his first public account of inoculation—though he also notes that many inoculees had “no preparation at all,” that he “very rarely saw occasion for any medicines in the course of the distemper,” and that differences of constitution had little or no effect on the eruption of pox.²¹

It is worth emphasizing just how sharply the new way of statistics diverged from case-medicine. A physician in Kent wrote Jurin asking “whether you would admit of [inoculation] on persons that are of an hot constitution, are apt to fevers, inflammations, hæmorrhages, erysipelas, herpes &c such as are asthmatic, consumptive, scrofulous, gouty, such as have weak nerves, are hysteric, hypochondriac, or have bad eyes; & others you may think of.”²² Statistics cut a path through this thicket. But the answer Jurin returned to his correspondent is that he would not inoculate “in any of these circumstances . . . unless the danger from the infection in the natural way be very great & pressing.”²³ Apparently, while Jurin as a statistician was willing to suspend consideration of the subject’s condition, he had no intent to do so in clinical practice. A man with a pragmatic turn of mind, he was concerned to validate a specific procedure of potentially great importance, not throw into question the foundations of medicine. The first aim was consistent with the ends of the Royal Society, of which he was an officer; the second not. But one wonders how many would qualify for inoculation if all were excluded who had the wrong constitution or suffered from an ill-defined condition like weak nerves or had bad eyes.

While Jurin proposed these limitations to the practice of inoculation in a private letter, he implied quite as much in a public pamphlet. Whereas Nettleton emphasized the careful medical management of inoculation even while admitting that many patients appear to need

no preparation beforehand and no medicine afterward, Jurin urged strict medical control of inoculation even though his tables suggest that it has few casualties no matter who performs it:

Great care ought to be taken to inoculate none but persons of a good habit of body, and free, not only from any apparent, but, as far as can be judged, from any latent disease; for which reason, every prudent person will, in this case, have the advice and opinion of his own physician, whether the subject to be inoculated, be in a fit condition to undergo the small pox; that so [sic] he may not have that distemper, and a bad constitution, or perhaps another disease, to struggle with at the same time; of which there have been several fatal instances, through the neglect of this caution.²⁴

Inoculation should be managed case by case, it seems. Emphasizing the necessity of careful medical supervision and the dangers of inoculating indiscriminately, Jurin reaffirms the focus on the individual patient and his or her constitution and state. He now sounds like a physician concerned to reconcile a novel procedure with customary theory and practice, or to rein in a procedure often carried out by unsupervised surgeons or miscellaneous freelancers (including some, known to him by report, who simply inoculated themselves).²⁵ Can this be the same author who so recently held up the example of a certain matron in the Middle East who inoculated untold thousands without loss of life? For that matter, does Jurin really mean that people guilty of “luxurious living and drinking to excess” are in no state to be inoculated, as he appears to say in his last report to the public? And if judicious medical oversight is so

important, then why have “so few” died of inoculation despite the general disregard of medical precautions, as he emphasizes paradoxically in the same passage?²⁶

Recall that in 1723 Jurin posited that if people are inoculated “without regard to the healthiness or unhealthiness of the subject,” as in New England, one in 60 can be expected to die, whereas in England the figure is one in 91. While inoculation mortality in New England seems surprisingly low considering “how rashly our patients, even whole families together, rushed into this practice,”²⁷ the lesson appears to be that it will go even lower if discerning physicians (or perhaps responsible surgeons acting as their surrogates) exclude unfit subjects. However, the leading inoculator in England at the time, Nettleton, whose record was excellent,²⁸ gives no indication that he screens subjects case by case; rather, our impression is that people seek him out.²⁹ In any case, it was only for the sake of argument that Jurin gave the figure of one in 60, his original point being that even on the construction of the evidence most unfavorable to inoculation, the practice is still many times less dangerous than natural smallpox. The source of Jurin’s information about the smallpox epidemic in New England actually maintains that *no one* in New England died as a result of inoculation.

That source is Cotton Mather, himself a member of the Royal Society. As Jurin duly notes, Mather in a letter dated March 10, 1721 avows that while “five or six” New Englanders died after inoculation, not one died as a result of it. Excerpted in and appended to Maitland’s pamphlet of 1722 in defense of inoculation, the text of the letter contains the following passage flagged by Maitland as remarkable:

How many lives might have been saved, if our unhappy physicians had not poisoned and bewitched our people with a blind rage . . . against the method of relief and safety in the way of the small pox inoculated? I prevailed with one physician to introduce the practice; and the experiment has been made upon almost three hundred subjects in our neighbourhood, young and old, from one year to seventy; weak and strong, male and female, white and black; in midsummer, in autumn and winter: and it succeeds to admiration. I cannot learn that anyone has died of it, though the experiment has been made under various and marvelous disadvantages. Five or six have died upon it or after it; but from other accidents.³⁰

To the extent that a single locality could, the New England story meets Wagstaffe's demand for repeated trials under different conditions. And on this showing, zero mortality—that is, the absence of any death caused by inoculation itself, as opposed to a pre-existing condition or subsequent “accident”—was achieved with the inoculation of all comers, pell mell, amidst the desperation of an epidemic: an outcome that would seem to cast doubt on the need for physicians to select inoculees with the utmost caution. Why does “great care” need to be taken in the choice of inoculees if a miscellaneous company of some 300 souls not screened in any way were inoculated without a single fatality specific to the procedure?

In his first report to the public on the practice of inoculation (1724), Jurin reviews each of the nine English cases in which someone was suspected to have died as a result of inoculation over the years 1721-23. He then tabulates the chance of death from inoculation, given the number of these fatalities the reader deems actually due to the procedure. (Thus, if

the reader believes seven of the nine resulted from inoculation, the hazard ratio will be one in about 63; but with only two of the nine, the ratio shrinks to one in about 221.) By the time Jurin published this breakdown, he had already received a copious letter from Mather discussing, among other things, the misattribution of the cause of death in the “five or six” New England cases.³¹ But in the 1724 report Jurin doesn’t mention those cases, notwithstanding that (a) a table in the same report shows high smallpox incidence and mortality in Boston; (b) more inoculation was done in Boston than any town in England, including London, according to another table; and (c) Jurin states categorically that he has included “every person, as far as I have been able to learn, that has either by the friends, or adversaries, to this practice [that is, inoculation], been suspected to have died of inoculation.” The fact is that Jurin knew in some detail about five or six alleged fatalities—no trivial number in this context—absent from his analysis.

Why this omission? Possibly because reviewing the New England cases and proposing them one by one for reclassification (as with their English counterparts) would jeopardize the principle that inoculees must be chosen with “great care” and limited to persons in “perfect health,” as Jurin puts it in the same pamphlet.³² The raw statistics themselves at this point (in 1724) suggest no appreciable difference in inoculation mortality between England and New England. If we use Mather’s higher figure of six alleged fatalities and the total of 300 inoculations in New England used by Jurin in 1723, we get a ratio of one in 50. In Jurin’s 1724 report on inoculation, the corresponding figures for England are nine alleged deaths in a total of 477 inoculations, or one in 53. This near-identity is not what we would expect if the New England way of non-selective inoculation made the procedure significantly more dangerous.

The difference between practices of inoculation on either side of the Atlantic can be overstated. For one thing, as England became more familiar with inoculation over the course of the 1720s, many seem to have sought out the procedure without bothering to get medical advice at all.³³ It could no longer be said that inoculation was discriminating in England and the opposite across the sea. Furthermore, it's probable that on both sides of the Atlantic parents begged to have their children inoculated and physicians (or others) complied, regardless of Jurin's or anyone else's strictures and precepts. As Maitland puts it,

If a person, from the experience of the fatality of the small pox in general, or in his own family in particular, should resolve to engraft his child, any physician who should dissuade him from it might, in a great measure, be chargeable with the fatal consequences of the neglect of a method which the parent had proposed as the only means to save his child's life.³⁴

With respect to the inoculation of children, the physician is in no position to be selective; and according to one of Jurin's tables, children under ten made up more than half of the inoculees in England by 1724. (After all, the older you are, the more likely you have already been exposed to smallpox.) Most of the nine deaths Jurin identifies as possibly misattributed to inoculation happen to involve children. It was because parents "very desirous . . . to preserve" their three surviving children prevailed on Nettleton to inoculate them after the fourth had died of smallpox that he consented to inoculate the child who, in the event, died after but not because of the procedure.³⁵

While Nettleton suggests but does not emphasize that he treated all who sought him, Mather emphasizes with considerable flair the inclusivity of the work of the “one physician” in Boston he was able to enlist. By 1724, Zabdiel Boylston had already inoculated no fewer than 247 persons (to Nettleton’s 80). Inundated with pleas for inoculation, he gave the treatment to a virtual cross-section of humanity, including not only whites and blacks (as Mather notes) but Indians. And despite not choosing inoculees as advised by Jurin, Boylston—like Nettleton—often found no need for preparations before or medicines after. We cannot say how many New Englanders would have been denied inoculation if Boylston had limited himself to candidates in perfect health, but it happens that a dozen whom he successfully inoculated did suffer from one condition or another—hysteria, inflammation, asthma, poor constitution—that under Jurin’s rules would specifically bar inoculation, except in a dire emergency. Who knows but that some of the inoculees were also guilty of luxurious living.

Mather evidently conferred with Boylston before sending his account of the “five or six” disputed deaths to Jurin, as it roughly agrees with the account given by Boylston in his own pamphlet in defense of inoculation. But even though Jurin was well aware of Mather’s informed claim that the inoculation of all and sundry in New England caused not one death, even though he celebrates the perfect record of the Greek woman of Constantinople, and even though he concedes that the rush to inoculate in England itself—regardless of the condition of the subject—has resulted in very few casualties, still he will not go so far as to exempt inoculation from the physician’s oversight.³⁶ Only the physician has the knowledge and experience necessary to identify and veto unfit subjects—on the basis of an open-ended list of

disqualifiers. Though Jurin endows statistics with power, they do not have the power to override the case-by-case practice of medicine.

Jurin advanced a statistical method of assessing the practice of inoculation while remaining a case-minded physician steeped in medical tradition. In his last report to the public (1727), he laments that many race to get themselves inoculated “without any preparation for it, whether by evacuations or a temperate regimen,” and without considering the season. There speaks the tradition of Hippocrates. At the time, inoculation was described as a kind of engrafting, and we might say that proponents like Jurin engrafted the procedure itself onto their customary modes of thinking and doing. In Jurin’s case the transplant was particularly awkward, in that inoculation had already broken through the limitations he imposed on it by the time he picked up his pen. Significantly, the next turn of the statistical argument following the 1727 report was the use of Jurin’s ratios to estimate the lives that would be saved if inoculation were practiced across the board—440 in the town of Bury alone, given the inoculation of everyone who has not already had smallpox. Though the author, David Hartley (a physician), mentions his discussions with Jurin, nothing could be further from his intentions than to restrict inoculation to a cohort of screened subjects.³⁷

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¹ Cf. David Spadafora, “Mortality Data, Risk Probability, and the Psychology of Assent in the Enlightenment Smallpox Debate,” *Hektoen International*, Winter 2021.

² Jan. 24, 1723 letter from Nettleton to James Jurin, in *The Correspondence of James Jurin*, ed. Andrea Rusnock (Amsterdam, 1996), 126. Spelling regularized.

³ Francis Howgrave, *Reasons Against the Inoculation of the Small-Pox* (London, 1724).

⁴ Isaac Massey, *A Short and Plain Account of Inoculation* (London, 1722).

⁵ See Letter XI of Voltaire's *Philosophical Letters*.

⁶ Apr. 3, 1722 letter from Nettleton to Dr. Whitaker;
<https://wellcomecollection.org/works/fqd7ddky/items?canvas=5>

⁷ June 16, 1722 letter from Nettleton to Jurin;
<https://royalsocietypublishing.org/doi/pdf/10.1098/rstl.1722.0009>

⁸ Dec. 16, 1722 letter from Nettleton to Jurin; <https://www.jameslindlibrary.org/nettleton-t-1722/> On the uptake of inoculation see Arthur Boylston, "Smallpox Inoculation: Prelude to Vaccination," *Hektoen International*, Fall 2014.

⁹ Andrea Rusnock, "Case Histories, Medical Statistics and Smallpox Inoculation," in *Medicine in the Enlightenment*, ed. Roy Porter (Amsterdam, 1995), 293.

¹⁰ See Jurin's *Account of the Success of the Inoculating the Small Pox in Great Britain* (1724);
<https://iif.wellcomecollection.org/pdf/b30361230>

¹¹ John Woodward, extracting from Emanuel Timonius, "An Account, or History, of the Procuring the Smallpox by Incision; As It Has for Some Time Been Practised at Constantinople," *Philosophical Transactions of the Royal Society of London* 29 (1714): 72-82. However, the inoculator is careful to take the infected matter itself from a boy of "a sound healthy temperament."

¹² 1723 Letter to Dr. Cotesworth;
<https://royalsocietypublishing.org/doi/pdf/10.1098/rstl.1722.0038> (misdated). This claim is not as farfetched as it may seem. In 1736 Jurin's predecessor as secretary of the Royal Society, Hans Sloane, wrote that when Princess Caroline undertook to have two of her children inoculated, he asked a certain Dr. Terry of Endfield, who had practiced in Turkey, about the procedure; and Dr. Endfield had replied "that he had seen the practice there by the Greeks encouraged by their patriarchs; and that not one in eight hundred had died of that operation." Hans Sloane, "An Account of Inoculation," *Philosophical Transactions of the Royal Society* 49 (1755-56), 516-20.

¹³ Letter to Dr. Cotesworth. Reportedly, inoculation mortality ran at first at about 2% but "with refinement of the practice" was reduced to .3%. See Robin Weiss and José Esparza, "The Prevention and Eradication of Smallpox: A Commentary on Sloane (1755) 'An Account of Inoculation,'" *Philosophical Transactions of the Royal Society B: Biological Sciences* B 370 (2015): 20140378.

¹⁴ What if an inoculee becomes a spreader? Jurin does not discuss that risk. But if it behooves anyone with smallpox, whether induced or natural, not to communicate the disease, then perhaps the recklessness of an inoculee should not be charged to the inoculator. On inoculation itself as a vector of smallpox see David Wooton, *Bad Medicine: Doctors Doing Harm Since Hippocrates* (Oxford, 2006). In the discussion of a case in his 1724 *Account of the Success of the Inoculating the Small Pox in Great Britain*, Jurin refers to a “long tedious confinement” following inoculation.

¹⁵ William Wagstaffe, *Letter to Dr. Freind; Shewing the Danger and Uncertainty of Inoculating the Small Pox* (1722); <https://wellcomecollection.org/works/zjv2gx4k>

¹⁶ Andrea Rusnock, “‘The Merchant’s Logick’: Numerical Debates over Smallpox Inoculation in Eighteenth-Century England,” in *The Road to Medical Statistics*, eds. Eileen Magnello and Anne Hardy (Amsterdam, 2002), 37-54.

¹⁷ “As [inoculation] has been practised commonly upon children, it scarce amounts to a fair trial; since hardly one in an hundred have died of the natural sort in this season.” If we prefer, we can call this a statistic.

¹⁸ Ulrich Tröhler, *‘To Improve the Evidence of Medicine’: The 18th Century British Origins of a Critical Approach* (Edinburgh, 2000).

¹⁹ July 22, 1725 letter from John Huxham to Jurin in the latter’s *Correspondence*, 310.

²⁰ Charles Maitland, *Mr. Maitland’s Account of Inoculating the Small Pox Vindicated, from Dr. Wagstaffe’s Misrepresentations of that Practice* (London, 1722).

²¹ 1722 letter from Nettleton to Dr. Whitaker. In his first annual report (1724), Jurin too concedes that the candidate for inoculation often needs no special preparation.

²² Feb. 13, 1726 letter from Thomas Fuller to Jurin in *Correspondence of James Jurin*, 324.

²³ Feb. 19, 1726 letter from Jurin to Fuller in *Correspondence of James Jurin*, 328.

²⁴ See Jurin’s 1724 *Account of the Success of Inoculating the Small Pox in Great Britain*. Of the nine cases detailed in this pamphlet, at least two fall into the category of inoculees who died as a result of a “latent” condition: a child who died of smallpox most likely contracted before she was inoculated, and a youth of 17 with a history of fevers who died of a fever several months after inoculation. In both instances the death was tallied as an outcome of inoculation, though in all likelihood neither would have been averted by a physician’s veto of the procedure.

²⁵ Letter from Perrott Williams to Jurin, March 19, 1723 in *Correspondence of James Jurin*, p. 139.

²⁶ After noting that the initial reluctance to inoculate soon gave way to a rage for the procedure—all too often performed in reckless disregard for the fitness or unfitness of the subject—Jurin concludes, “I think nothing shows so much the safety of this operation, as that, with all these disadvantages, so few have yet died of it.” *Account of the Success of Inoculating the Small Pox in Great Britain* (1727).

²⁷ Preface to Zabdiel Boylston, *Account of the Small-Pox Inoculated in New England, Upon All Sorts of Persons, Whites, Blacks, and of All Ages and Constitutions* (London, 1726).

²⁸ By 1733 Nettleton appears to have inoculated 119 persons, with one fatality. See David Hartley, *Reasons Why the Practice of Inoculation Ought to be introduced into the Town of Bury at Present* (Bury St. Edmunds, 1733).

²⁹ “. . . afterwards, several, seeing with how much ease these got through the distemper, were desirous to have the same done to themselves or their children; so that there are now upwards of forty here, who have received the small pox by incision.” Letter from Nettleton to Whitaker, Apr. 3, 1722.

³⁰ Letter from Mather to Maitland appended to the latter’s *Account of Inoculating the Small Pox Vindicated, from Dr. Wagstaffe’s Misrepresentations of that Practice*. Jurin paraphrases this passage in his public letter to Dr. Cotesworth.

³¹ Mather to Jurin, May 21, 1723. *Correspondence of James Jurin*, 150-63, especially 161.

³² Jurin enjoins the physician not to inoculate anyone with “a bad constitution”; the title of Boylston’s defense of inoculation (published two years later) is *Account of the Small-Pox Inoculated in New England, Upon All Sorts of Persons, Whites, Blacks, and of All Ages and Constitutions*.

³³ Jurin, *Account of the Success of Inoculating the Small Pox in Great Britain* (1727).

³⁴ *Mr. Maitland’s Account of Inoculating the Small Pox Vindicated, from Dr. Wagstaffe’s Misrepresentations of that Practice*.

³⁵ Nettleton, letter to Dr. Whitaker.

³⁶ By contrast, while Boylston would prefer inoculation to be managed by physicians, he would rather have nurses administer it than let smallpox run unchecked. See Preface to *Account of the Small-Pox Inoculated in New England*.

³⁷ Hartley, *Reasons Why the Practice of Inoculation Ought to be introduced into the Town of Bury at Present*. At the population level, very little of inoculation’s potential had been realized. According to Hartley, Jurin counted a total of 724 inoculations in the whole of England during

his tenure as secretary to the Royal Society. By Hartley's estimate, four times that figure were necessary to protect Bury alone against smallpox.