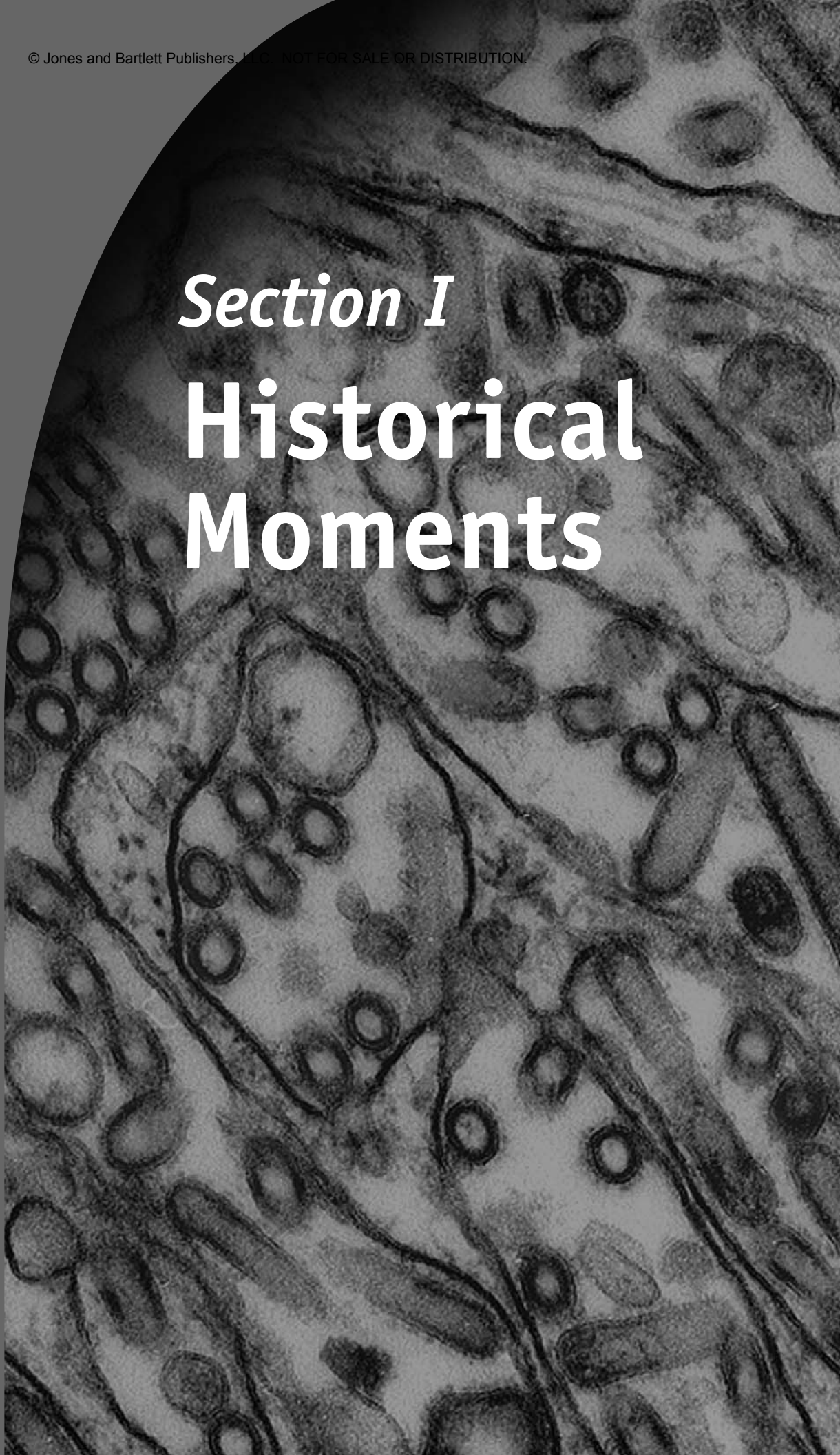
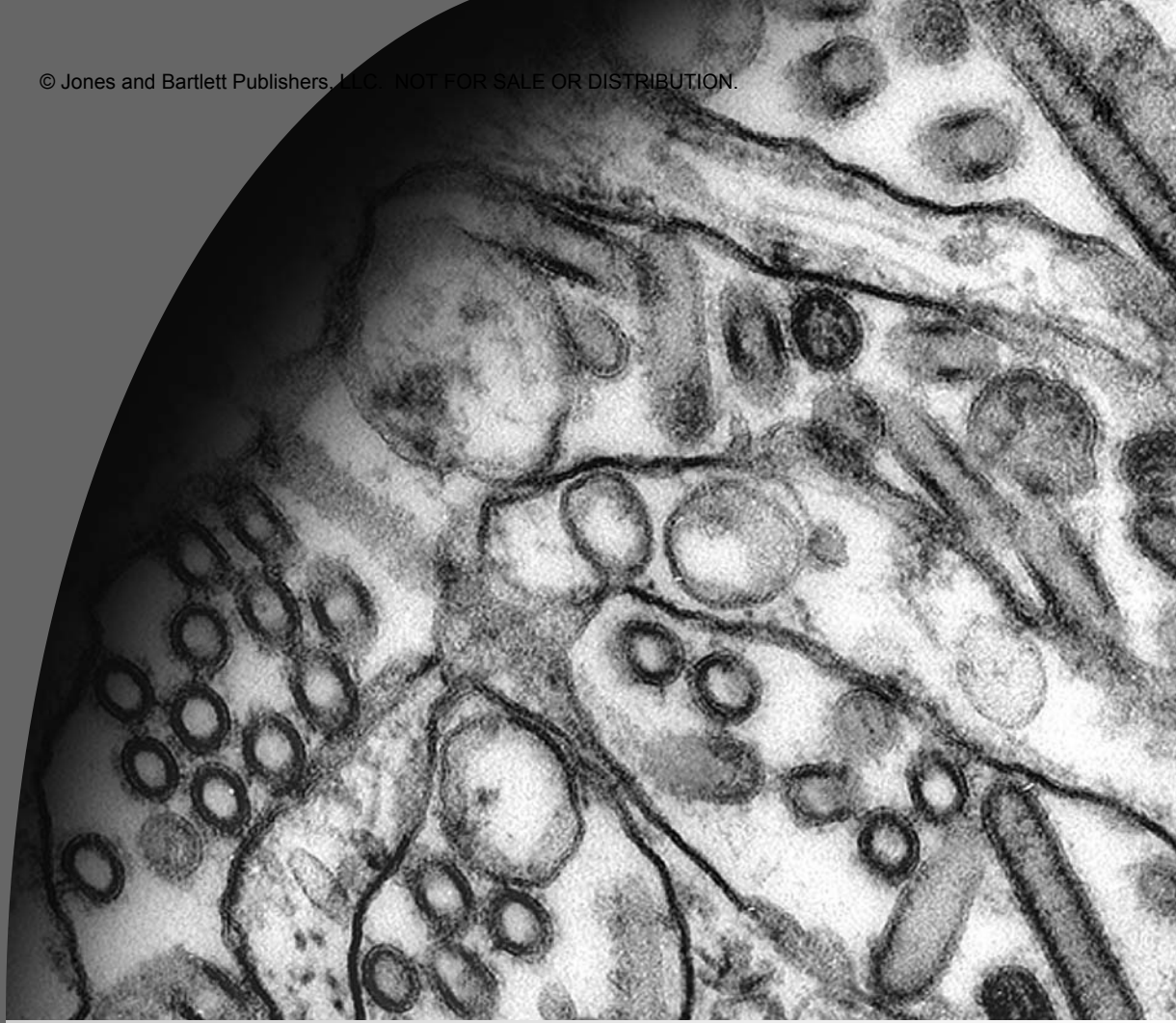


Section I

**Historical
Moments**





PART I

Public Health, Passion, Persistence

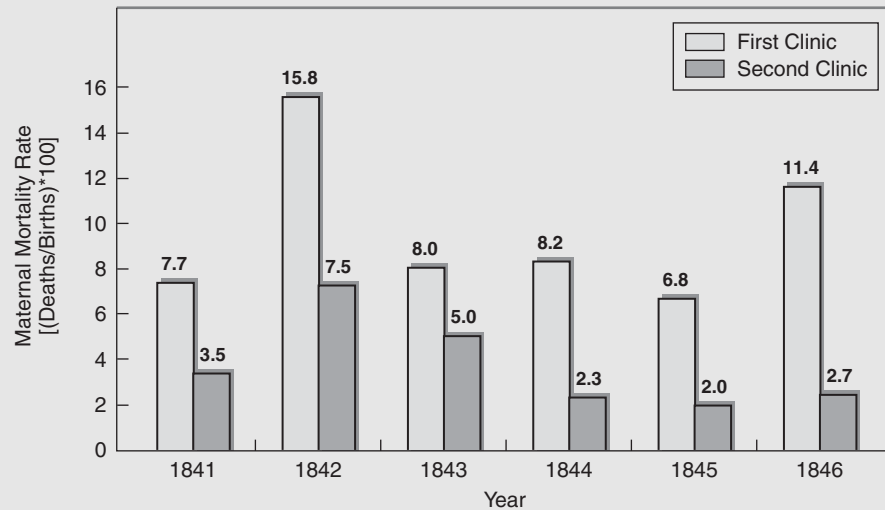
Ignaz Philipp Semmelweis (1818–1865) was a Hungarian obstetrician who studied and practiced medicine with a specialty in obstetrics in Vienna, Austria. It was Semmelweis who was on the forefront of introducing the concept of handwashing into medicine, and who supported the science of contagion with epidemiologic data. This form of antiseptic prophylaxis—lasting to this day as a basic and important tenet in public health and clinical medicine—was at first resisted by Semmelweis’ colleagues. Working in a free maternity clinic, the young physician was appalled by the number of maternal deaths that occurred as a result of puerperal fever, also known as childbed fever. This is a bacterial infection that takes place following birth when Group A *Streptococcus* (GAS, *Streptococcus pyogenes*) bacterium and/or Group B *Streptococcus* (GBS, *Streptococcus agalactiae*) ascend the vaginal canal and endometrial tissue, following labor and delivery. Not treated, bacterial sepsis can result, inducing shock and death in the new mother, with outbreaks in specific hospitals with case-fatality rates of up to 100% in maternity wards in the absence of prevention and treatment. The first recorded epidemic of puerperal fever occurred at the Hôtel-Dieu de Paris in 1646, and even through the 1800s, hospitals throughout Europe and America consistently reported death rates between 20% and 30% of all women giving birth in their wards. Semmelweis was distressed by his inability to stop his patients from dying at what should be a joyous time in their lives. He also questioned the current medical thinking—that imbalance of the four “humours” resulted in most illnesses—and remained skeptical that this could be the case. That women delivering infants at home seldom died of the disease was further evidence against this theory. But it was his observations, that there were different fatality rates on the two different divisions of the hospital, which generated a key comparison of proportions and helped solve what had been a mystery. Semmelweis saw that the two maternity clinics did not have the same mortality rates: The data are shown here. Between 1841 and 1846, the average mortality rate in the first clinic was 9.92 while that of the second was 3.38. What could be the cause of these differing rates? Semmelweis’ data are below:

TABLE 1-1 Annual births, deaths, and mortality rates for all patients at the two clinics of the Vienna maternity hospital from 1841 to 1946.

	First clinic			Second clinic		
	Births	Deaths	Rate	Births	Deaths	Rate
1841	3036	237	7.7	2442	86	3.5
1842	3287	518	15.8	2659	202	7.5
1843	3060	274	8.9	2739	164	5.9
1844	3157	260	8.2	2956	68	2.3
1845	3492	241	6.8	3241	66	2.03
1846	4010	459	11.4	3754	105	2.7
Total	20,042	1989		17,791	691	
Average			9.92			3.38

Data excerpted from *The Etiology, Concept, and Prophylaxis of Childbed Fever*, by Ignaz Semmelweis, translated by K. Codell Carter, Madison; University of Wisconsin Press, 1983, found in Carol Buck, *The Challenge of Epidemiology: Issues and Selected Readings*. Pan American Health Organization, Scientific Publication No. 505. 1989; 46–60.

FIGURE 1-1 Annual births, deaths, and mortality rates for all patients at the two clinics of the Vienna maternity hospital from 1841 to 1946.



Data excerpted from *The Etiology, Concept, and Prophylaxis of Childbed Fever*, by Ignaz Semmelweis, translated by K. Codell Carter, Madison; University of Wisconsin Press, 1983, found in Carol Buck, *The Challenge of Epidemiology: Issues and Selected Readings*. Pan American Health Organization, Scientific Publication No. 505. 1989; 46–60. Graph created by author.

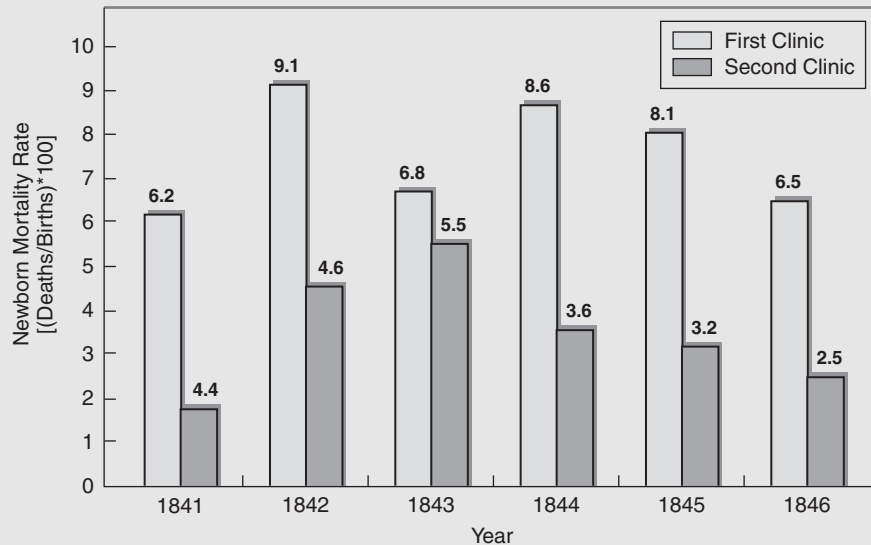
Semmelweis also noted that many of the newborns of women who died of childbed fever also died, and died with the same types of lesions and symptoms as did their mothers. In fact the rates, parallel those in each clinic:

TABLE 1-2 Annual births, deaths, and mortality rates for newborns at the two clinics of the Vienna maternity hospital from 1841 to 1946.

	First clinic			Second clinic		
	Births	Deaths	Rate	Births	Deaths	Rate
1841	2813	177	6.2	2252	91	4.04
1842	3037	279	9.1	2414	113	4.06
1843	2828	195	6.8	2570	130	5.05
1844	2917	251	8.6	2739	100	3.06
1845	3201	260	8.1	3017	97	3.02
1846	3533	235	6.5	3398	86	2.05
Total *	18,329	1397		16,390	617	

Data excerpted from *The Etiology, Concept, and Prophylaxis of Childbed Fever*, by Ignaz Semmelweis, translated by K. Codell Carter, Madison; University of Wisconsin Press, 1983, found in Carol Buck, *The Challenge of Epidemiology: Issues and Selected Readings*. Pan American Health Organization, Scientific Publication No. 505. 1989; 46–60.

FIGURE 1-2 Annual births, deaths, and mortality rates for newborns at the two clinics of the Vienna maternity hospital from 1841 to 1846.



Data excerpted from *The Etiology, Concept, and Prophylaxis of Childbed Fever*, by Ignaz Semmelweis, translated by K. Codell Carter, Madison; University of Wisconsin Press, 1983, found in Carol Buck, *The Challenge of Epidemiology: Issues and Selected Readings*. Pan American Health Organization, Scientific Publication No. 505. 1989; 46–60. Graph created by author.

(Semmelweis also points out an interesting factor in his writing: that the estimates of mortality for the first clinic probably underestimated the true mortality rate, because women who progressed rapidly with infection were maintained in the clinic ward; others who died subsequently on the general ward were not counted in the first clinic's death counts. In the second clinic, these transfers did not occur. This point illustrates the importance of understanding clinic flow when conducting a study. Had he not known the nature of the clinic flow and its documentation, he would not have been able to describe or estimate the direction of the bias found in his data.)

In addition to the difference in mortality rates between the first and second clinics, Semmelweis was troubled by a variety of other characteristics of the deaths, all which suggested an infectious cause “endemic” to the clinic setting, yet not contagious directly from woman to woman. In searching for the reason behind the difference in mortality between the two clinics, he examined a variety of clinical characteristics between the clinics. Looking to the cause, he noted that “in both clinics these must be equally harmful or harmless and they cannot, therefore, explain the appalling difference in mortality between the clinics.” So he was searching for the *predictive* characteristic that could be a clue to what the cause was, as he refused to believe that this was just chance or due to the prevailing medical theories of the day. What did he find? Of women with prolonged periods of dilation (as the cervix opens), nearly all became ill either during the birth process or within 24 or 36 hours after the birth; these women died quickly after developing childbed fever. But the salient factor here was that the same period of dilation in the second clinic was not dangerous. This was a clue. Semmelweis noted many clues about the women, about their deliveries, and his thinking process is impeccable as he reasoned out what could be the cause of these deaths—which he viewed to be preventable, though he did not yet know why.

Semmelweis' experience of mulling all of the information, without epiphany is profound:

I was convinced that the greater mortality rate at the first clinic was due to an endemic but as yet unknown cause. That the newborn, whether female or male, also contracted childbed fever convinced me that the disease was misconceived. I was aware of many facts for which I had no explanation. Delivery with

prolonged dilation almost inevitably led to death. Patients who delivered prematurely or on the street almost never became ill, and this contradicted my conviction that the deaths were due to endemic causes. The disease appeared sequentially among patients in the first clinic. Patients in the second clinic were healthier, although individuals working there were no more skillful or conscientious in their duties. The disrespect displayed by the employees toward the personnel of the first clinic made me so miserable that life seemed worthless. Everything was in question; everything seemed inexplicable, everything was doubtful. Only the large number of deaths was an unquestionable reality.

Semmelweis also made an important observation that strengthened his impression that there was an infectious cause of the deaths that was intrinsic to the clinic and not passed patient to patient but through some alternate mode. The way the Viennese clinic was structured, women did not have to pay for their care there, provided they submitted to be “available for open instructional purposes, and that those fit to do so serve as wet nurses for the foundling home.” Those infants not born at the clinic could not be entered into the foundling home. But a provision was made for women who, in trying to reach the clinic, delivered on the street—they were allowed the privileges of those women who delivered at the hospital. To avail themselves of this access, many women would deliver outside of the hospital, with a midwife or others in attendance, and then immediately after go to the hospital. But despite this situation that could not have been easy on a body or a baby, these women did far better than those women delivered at the first clinic:

As I have noted, women who delivered on the street contracted childbed fever at a significantly lower rate than those who delivered in the hospital. This was in spite of the less favorable conditions in which such births took place. Of course, in most of these cases delivery occurred in a bed with the assistance of a midwife. Moreover, after three hours our patients were obliged to walk to their beds by way of the glass enclosed passageway. However, such inconvenience is certainly less dangerous than being delivered by a midwife, then immediately having to arise, walk down many flights of stairs to the waiting carriage, travel in all weather conditions and over horribly rough pavement to the maternity hospital, and there having to climb up another flight of stairs. For those who really gave birth on the street, the conditions would have been even more difficult.

To me, it appeared logical that patients who experienced street births would become ill at least as frequently as those who delivered in the clinic. I have already expressed my firm conviction that the deaths in the first clinic were not caused by epidemic influences but by endemic and as yet unknown factors, that is, factors whose harmful influences were limited to the first clinic. What protected those who delivered outside the clinic from these destructive unknown endemic influences? In the second clinic, the health of the patients who underwent street births was as good as in the first clinic, but there the difference was not so striking, since the health of the patients was generally much better.

Semmelweis left Vienna for Venice, hoping that “Venetian art treasures would revive my mind and spirits, which had been so seriously affected by my experiences in the maternity hospital.” Then arrived the sad news that one of Semmelweis’ mentors, Professor Kolletschka, had died. This ushered in an epiphany, an “ah-ha” moment, that catalyzed all of Semmelweis’ data. This epiphany allowed him to integrate the data he had collected, yield an interpretation, and lead to a hypothesis. Professor Kolletschka was conducting an autopsy and cut his finger. He became ill with diffuse infection that resembled exactly that of the women (and newborns) with childbed fever. Because they knew the source of his mentor’s infection—the cadaverous particles—he was able to at last link it to childbed fever:

Because of the anatomical orientation of the Viennese medical school, professors, assistants, and students have frequent opportunity to contact cadavers. Ordinary washing with soap is not sufficient to remove all adhering cadaverous particles. This is proven by the cadaverous smell that the hands retain for a longer or shorter time. In the examination of pregnant or delivering maternity patients, the hands, contaminated with cadaverous particles, are brought into contact with the genitals of these individuals, creating the possibility of resorption. With resorption, the cadaverous particles are introduced into the vascular system of the patient. In this way, maternity patients contract the same disease that was found in Kolletschka.

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This hypothesis provided Semmelweis with an intervention:

Suppose cadaverous particles adhering to hands cause the same disease among maternity patients that cadaverous particles adhering to the knife caused in Kolletschka. Then if those particles are destroyed chemically, so that in examinations patients are touched by fingers but not by cadaverous particles, the disease must be reduced. This seemed all the more likely since I knew that when decomposing organic material is brought into contact with living organisms it may bring on decomposition.

To destroy cadaverous matter adhering to hands I used *chlorina liquida*. This practice began in the middle of May 1847; I no longer remember the specific day. Both the students and I were required to wash before examinations. After a time, I ceased to use *chlorina liquida* because of its high price, and I adopted the less expensive chlorinated lime. In May 1847, during the second half of which chlorine washings were first introduced, 36 patients died—this was 12.24 percent of 294 deliveries. In the remaining seven months of 1847, the mortality rate was below that of the patients in the second clinic.

In these seven months, of the 1841 maternity patients cared for, 56 died (3.04 percent). In 1846, before washing with chlorine was introduced, of 4010 patients cared for in the first clinic, 459 died (11.4 percent). In the second clinic in 1846, of 3754 patients, 105 died (2.7 percent). In 1847, when in approximately the middle of May I instituted washing with chlorine, in the first clinic of 3490 patients, 176 died (5 percent). In the second clinic of 3306 patients, 32 died (0.9 percent). In 1848, chlorine washings were employed throughout the year and of 3556 patients, 45 died (1.27 percent). In the second clinic in the year 1848, of 3219 patients 43 died (1.33) percent. . . .

In March and August 1848 not a single patient died. In January 1849, of 403 births 9 died (2.23 percent). In February, of 389 births, 12 died (3.08 percent). March had 406 births, and there were 20 deaths (4.9 percent). On 20 March Dr. Carl Braun succeeded me as assistant.

Because of Semmelweis' interventions—which unfortunately were not carried on “conscientiously” by Dr. Braun, who did not subscribe to his theory—the mortality rate in the first clinic (where he was stationed) fell below that of the second. The intervention worked.

As for the newborns, the chlorine washings reduced their mortality as well. Infants whose mothers had died were taken immediately to the “foundling home”; many of these infants there died. As another demonstration of the efficacy of the handwashing, once instituted, newborns ceased to die of childbed fever (i.e., sepsis). In fact, the head of the Imperial Foundling Home in Vienna wrote: “Sepsis of the blood of newborns has become a great rarity. For this we must thank the consequential and most noteworthy discovery of Dr. Semmelweis, emeritus assistant of the Viennese first maternity clinic. His work fortunately explained the cause and the prevention of the formerly murderous ravages of puerperal fever.”

Practitioners of the time resisted Semmelweis' simple method (handwashing) and understanding of puerperal fever for some years. However, before his death at age 47, he and his work were accepted by the medical establishment in Hungary, where he was from, where he also replicated his success at reducing maternal mortality. It was only after Louis Pasteur's work regarding germ theory, after Semmelweis' death, did his understanding and its implications have widespread impact on public health.

Semmelweis was not the first to consider the cause of childbed fever and imagine it preventable. Other authors, notably among them Oliver Wendell Holmes (1804–1894), also argued for a similar etiology. The year before and an ocean away—though Semmelweis evidently was unaware of Holmes' writings—Holmes used what he had seen to think it through logically. In his essay, *The Contagiousness of Puerperal Fever*, Holmes notes the denial of current medical practitioners that an infection could be the root cause of childbed fever: “In the last edition of Dewees' Treatise on the ‘Diseases of Females’ it is expressly said, “In this country, under no circumstance that puerperal fever has appeared hitherto, does it afford the slightest ground for the belief that it is contagious.” His essay attends his thesis: “The practical point to be illustrated is the following: *The disease known as Puerperal Fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses.*”

Holmes sets forth a numbered list of “incidental questions” that skillfully produce logic that also relates to the general cause of disease as well as puerperal fever in specific:

1. It is granted that all the forms of what is called puerperal fever may not be, and probably are not, equally contagious or infectious. I do not enter into the distinctions which have been drawn by authors, because the facts do not appear to me sufficient to establish any absolute line of demarcation between such forms as may be propagated by contagion and those which are never so propagated. This general result I shall only support by the authority of Dr. Ramsbotham, who gives, as the result of his experience, that the same symptoms belong to what he calls the infectious and the sporadic forms of the disease, and the opinion of Armstrong in his original Essay. If others can show any such distinction, I leave it to them to do it. But there are cases enough that show the prevalence of the disease among the patients of a single practitioner when it was in no degree epidemic, in the proper sense of the term. I may refer to those of Mr. Robertson and of Dr. Peirson, hereafter to be cited, as examples.
2. I shall not enter into any dispute about the particular *mode* of infection, whether it be by the atmosphere the physician carries about him into the sick-chamber, or by the direct application of the virus to the absorbing surfaces with which his hand comes in contact. Many facts and opinions are in favour of each of these modes of transmission. But it is obvious that, in the majority of cases, it must be impossible to decide by which of these channels the disease is conveyed, from the nature of the intercourse between the physician and the patient.
3. It is not pretended that the contagion of puerperal fever must always be followed by the disease. It is true of all contagious diseases that they frequently spare those who appear to be fully submitted to their influence. Even the vaccine virus, fresh from the subject, fails every day to produce its legitimate effect, though every precaution is taken to insure its action. This is still more remarkably the case with scarlet fever and some other diseases.
4. It is granted that the disease may be produced and variously modified by many causes besides contagion, and more especially by epidemic and endemic influences. But this is not peculiar to the disease in question. There is no doubt that smallpox is propagated to a great extent by contagion, yet it goes through the same records of periodical increase and diminution which have been remarked in puerperal fever. If the question is asked how we are to reconcile the great variations in the mortality of puerperal fever in different seasons and places with the supposition of contagion, I will answer it by another question from Mr. Farr's letter to the Registrar-General. He makes the statement that "*five* die weekly of smallpox in the metropolis when the disease is not epidemic," and adds, "The problem for solution is—Why do the five deaths become 10, 15, 20, 31, 58, 88, weekly, and then progressively fall through the same measured steps?"
5. I take it for granted that if it can be shown that great numbers of lives have been and are sacrificed to ignorance or blindness on this point, no other error of which physicians or nurses may be occasionally suspected will be alleged in palliation of this; but that whenever and wherever they can be shown to carry disease and death instead of health and safety, the common instincts of humanity will silence every attempt to explain away their responsibility.

He then quotes the Treatise of a Dr. Gordon, who wrote in 1795,

This disease seized such women only as were visited or delivered by a practitioner, or taken care of by a nurse, who had previously attended patients affected with the disease. I had evident proofs of its infectious nature, and that the infection was as readily communicated as that of the smallpox or measles, and operated more speedily than any other infection with which I am acquainted. I had evident proofs that every person who had been with a patient in the puerperal fever became charged with an atmosphere of infection, which was communicated to every pregnant woman who happened to come within its sphere. This is not an assertion, but a fact, admitting of demonstration, as may be seen by a perusal of the foregoing table.

Referring to a table of seventy-seven cases, in many of which the channel of propagation was evident, he adds: "It is a disagreeable declaration for me to mention, that I myself was the means of carrying the infection to a great

number of women." He then enumerates a number of instances in which the disease was conveyed by midwives and others to the neighboring villages and declares that "these facts fully prove that the cause of the puerperal fever, of which I treat, was a specific contagion, or infection, altogether unconnected with a noxious constitution of the atmosphere." But his most terrible evidence is given in these words: "I arrived at that certainty in the matter that I could venture to foretell what women would be affected with the disease, upon hearing by what midwife they were to be delivered, or by what nurse they were to be attended, during their lying-in: and almost in every instance my prediction was verified." (Note how similar these last words are to Semmelweis: "I often pointed out to my students that because these blossoming, vigorously healthy young women had extended periods of dilation, they would die quickly from puerperal fever either during delivery or immediately thereafter. My prognoses were fulfilled.")

Following an in-depth investigation into the works of multiple physicians and midwives that supported his argument, Holmes cites a story similar to that of Semmelweis' mentor, Dr. Kollerschka:

The first patient, it is stated, was delivered on the 20th of March. "On the 19th Dr. C. made the autopsy of a man who had died suddenly, sick only forty-eight hours; had oedema of the thigh and gangrene extending from a little above the ankle into the cavity of the abdomen." Dr. C. wounded himself very slightly in the right hand during the autopsy. The hand was quite painful the night following, during his attendance on the patient No. 1. He did not see this patient after the 20th, being confined to the house, and very sick from the wound just mentioned, from this time until the 3rd of April. Several cases of erysipelas occurred in the house where the autopsy mentioned above took place, soon after the examination. There were also many cases of erysipelas in town at the time of the fatal puerperal cases which have been mentioned.

And later, "I need not refer to the case lately read before this Society, in which a physician went, soon after performing an autopsy of a case of puerperal fever, to a woman in labor, who was seized with the same disease and perished. The forfeit of that error has been already paid."

Holmes' closes his essay with essential words:

No tongue can tell the heart-breaking calamity they have caused; they have closed the eyes just opened upon a new world of love and happiness; they have bowed the strength of manhood into the dust; they have cast the helplessness of infancy into the stranger's arms, or bequeathed it, with less cruelty, the death of its dying parent. There is no tone deep enough for regret, and no voice loud enough for warning. The woman about to become a mother or with her new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden or stretches her aching limbs. The very outcast of the streets has pity upon her sister in degradation when the seal of promised maternity is impressed upon her. The remorseless vengeance of the law, brought down upon its victim by a machinery as sure as destiny, is arrested in its fall at a word which reveals her transient claim for mercy. The solemn prayer of the liturgy singles out her sorrows from the multiplied trials of life, to plead for her in the hour of peril. God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, unadvisedly, or selfishly!

There may be some among those whom I address who are disposed to ask the question, What course are we to follow in relation to this matter? The facts are before them, and the answer must be left to their own judgment and conscience. If any should care to know my own conclusions, they are the following; and in taking the liberty to state them very freely and broadly, I would ask the inquirer to examine them as freely in the light of the evidence which has been laid before him.

1. A physician holding himself in readiness to attend cases of midwifery should never take any active part in the post-mortem examination of cases of puerperal fever.
2. If a physician is present at such autopsies, he should use thorough ablution, change every article of dress, and allow twenty-four hours or more to elapse before attending to any case of midwifery. It may be well to extend the same caution to cases of simple peritonitis.
3. Similar precautions should be taken after the autopsy or surgical treatment of cases of erysipelas, if the physician is obliged to unite such offices with his obstetrical duties, which is in the highest degree inexpedient.

4. On the occurrence of a single case of puerperal fever in his practice, the physician is bound to consider the next female he attends in labor, unless some weeks at least have elapsed, as in danger of being infected by him, and it is his duty to take every precaution to diminish her risk of disease and death.
5. If within a short period two cases of puerperal fever happen close to each other, in the practice of the same physician, the disease not existing or prevailing in the neighborhood, he would do wisely to relinquish his obstetrical practice for at least one month, and endeavor to free himself by every available means from any noxious influence he may carry about with him.
6. The occurrence of three or more closely connected cases, in the practice of one individual, no others existing in the neighborhood, and no other sufficient cause being alleged for the coincidence, is *prima facie* evidence that he is the vehicle of contagion.
7. It is the duty of the physician to take every precaution that the disease shall not be introduced by nurses or other assistants, by making proper inquiries concerning them, and giving timely warning of every suspected source of danger.
8. Whatever indulgence may be granted to those who have heretofore been the ignorant causes of so much misery, the time has come when the existence of a *private pestilence* in the sphere of a single physician should be looked upon, not as a misfortune, but a crime; and in the knowledge of such occurrences the duties of the practitioner to his profession should give way to his paramount obligations to society.

DISCUSSION QUESTIONS

1. There may be a couple of questions worth asking about the data provided in Semmelweis' table, apart from the hypothesis at hand (i.e., what was causing the elevated death rates in the first clinic?). For example, what was going on in 1842, when the rates at both clinics are about twice their usual? Is there a difference in environmental conditions? Maternal health in the community? Any changes in trends in treatment approaches? Changes in assessment of deaths or their documentation? What else could have made this increase in rates? Give two examples each of a true cause of increase and an artifactual cause.
2. Use the data in narrative form from the excerpt of Semmelweis to create your own table. Then graph these data as you see above, making sure to label each axis. What other information would you like to know?
3. Use the data in Tables 1-1 and 1-2 and construct another graph, one to depict both maternal and newborn mortality rates by year and by clinic all on one graph. What does this tell you?
4. Compare and contrast the endeavors of Holmes and Semmelweis, where one uses logic and one uses data. How can these two approaches work together? What do they do the same? What do they do that differs? What are the differences in how each of these may be general-

ized to other situations? How are they different in the ways in which they may persuade people of different professions and approaches to the problem? What else might you want to know or add to either of their arguments?

SOURCES

- Costa CM. The contagiousness of childbed fever: a short history of puerperal sepsis and its treatment. *Medical Journal of Australia* 2002;177: 668–671.
- Elek SD. Semmelweis and the Oath of Hippocrates. *Proceedings of the Royal Society of Medicine* 346–52.
- Holmes OW. *The Contagiousness of Puerperal Fever*. Vol. XXXVIII, Part 5. The Harvard Classics. New York: P.F. Collier & Son, 1909–14; Bartleby.com, 2001. www.bartleby.com/38/5/. [Accessed 12/25/07].
- Loudon I. Deaths in childbed from the eighteenth century to 1935. *Med History* 1986;30: 1–41.
- Wertz RM, Wertz DC. *Lying-In: A History of Childbirth in America*. New York: New York Free Press, 1977.
- Buck C. *The Challenge of Epidemiology: Issues and Selected Readings*. Pan American Health Organization, Scientific Publication No. 505. 1989;46–60. Excerpted from *The Etiology, Concept, and Prophylaxis of Childbed Fever*, by Ignaz Semmelweis, translated by K. Codell Carter, Madison: University of Wisconsin Press, 1983.
- http://en.wikipedia.org/wiki/Ignaz_Semmelweis#_note-Mind103 [Accessed 1/20/07].

