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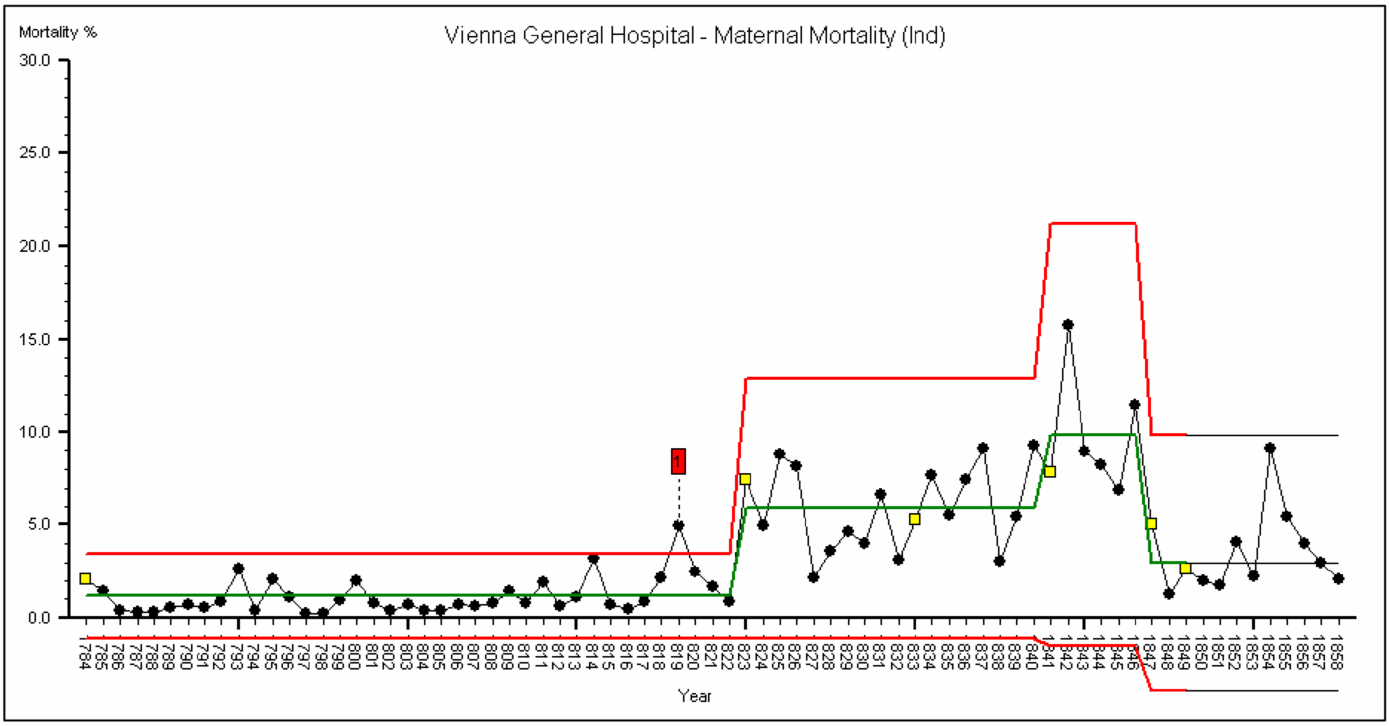
The Unknown Case of Childbed Fever



Summary

Segment	Start	Finish	Mean	Sigma	LCL	UCL	Stable
1	1784	1822	1.166	0.750	-1.08	3.417	No
2	1823	1840	5.906	2.338	-1.11	12.92	Yes
3	1841	1846	9.850	3.787	-1.51	21.21	Yes
4	1847	1849	2.993	2.292	-3.88	9.87	Yes
5	1850	1858	3.726	2.018	-2.33	9.78	Yes

General Notes

Vienna General Hospital Annual Maternal Mortality data
Data for whole hospital until 1833.
Data for the first clinic from 1833.

Data Source

"The aetiology, concept and prophylaxis of childbed fever" Ignaz Semmelweis 1860.
From the translation by K Codell Carter 1983 (ISBN: 0-299-09364-6)

Specific Notes

1784 Vienna Hospital opened.
1823 Practice of pathological anatomy started by Carl Rokitansky.
1833 Separation of obstetrics into two clinics because of rising demand (male and female students).
1841 Male students (doctors) allocated to first clinic and female students (midwives) to second.
1846 Semmelweis worked as locum assistant in first clinic from Jul to Oct.
1847 Semmelweis appointed substantive first assistant in Mar 1847.
1847 Hand washing in chloride of lime started by Semmelweis in May 1847.
1849 Semmelweis leaves Vienna when his two year term as Assistant to the first clinic expires.

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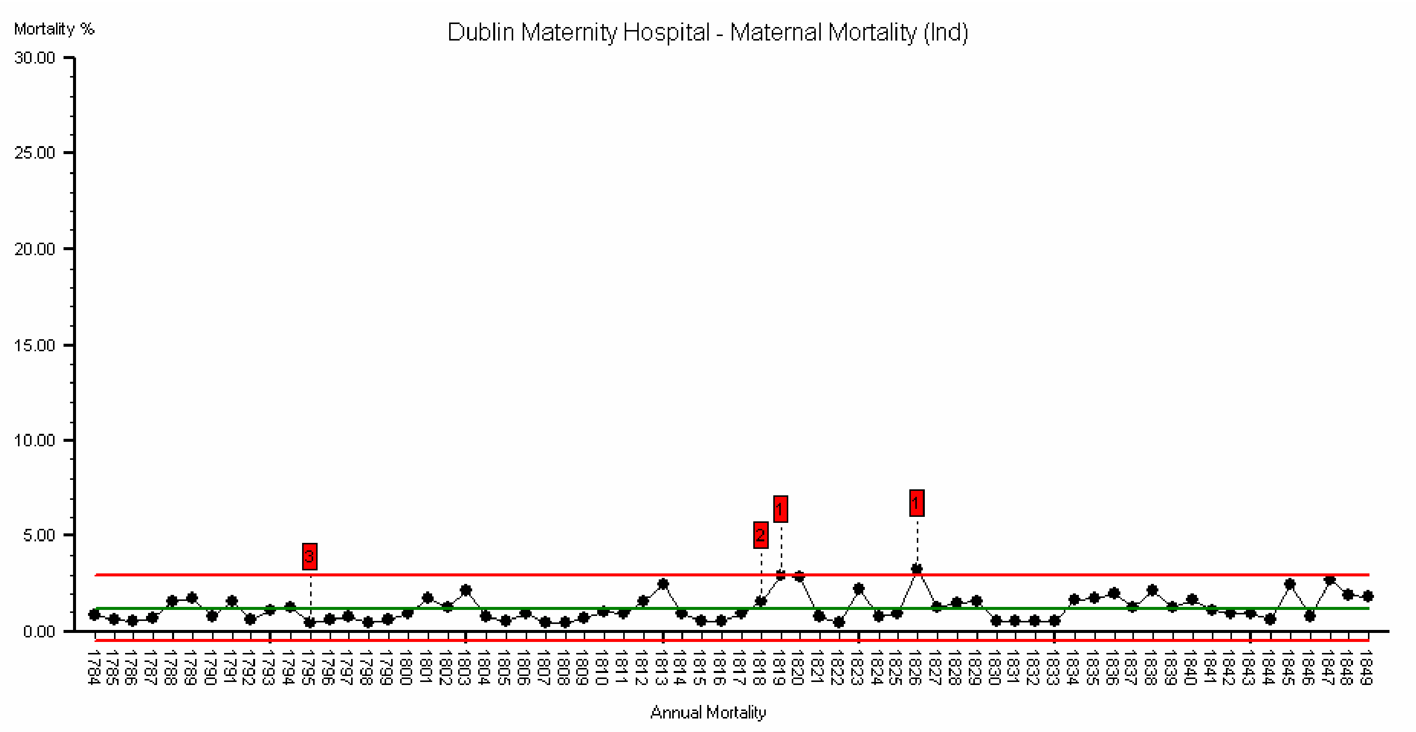

Comparison data from Dublin Maternity Hospital (similar size to Vienna) for the same period.

Summary

Segment	Start	Finish	Mean	Sigma	LCL	UCL	Stable
1	1784	1849	1.239	0.562	-0.448	2.926	No

Summary

The introduction of pathological anatomy combined with the division of the clinics into clinics for male students (doctors) and female students (midwives) is associated with an 8-fold increase in maternal mortality - the majority from childbed fever. This effect was reversed for two years following the introduction of strict antiseptic hand-washing by Ignaz Semmelweis in 1847. The same pattern was not seen in Dublin which was a maternity hospital and did not adopt the practice of pathological anatomy.

Historical Context

At this time, in Europe it was believed that childbed fever was an epidemic illness and caused by external influences out of the control of the doctors and authorities. In England it was believed that it was a contagious illness that spread from patient to patient and could be controlled with existing methods.

Semmelweis disagreed with both of these hypotheses - he believed it was an endemic illness with a specific cause that was transferred to patients on the hands of their carers and that strict chemical cleaning precautions were required to control the incidence - handwashing in chloride of lime. Unfortunately Semmelweis did not publish his epidemiological data at the time and his message was only spread by some of his colleagues, his students and by letters to the heads of other obstetric units in Europe. There was no programme of laboratory studies conducted to characterise and identify the putative agent and it was not until Robert Koch in Germany and Louis Pasteur in France later demonstrated that the agents were living organisms (germs) that the rational use of strict aseptic surgical techniques was pioneered by the surgeon Joseph Lister in Scotland - later Lord Lister.

Conclusion

The story provides a timely reminder of the importance of longitudinal quality outcome data and the value of the use of process behaviour charts and the principles and techniques of Improvement Science.

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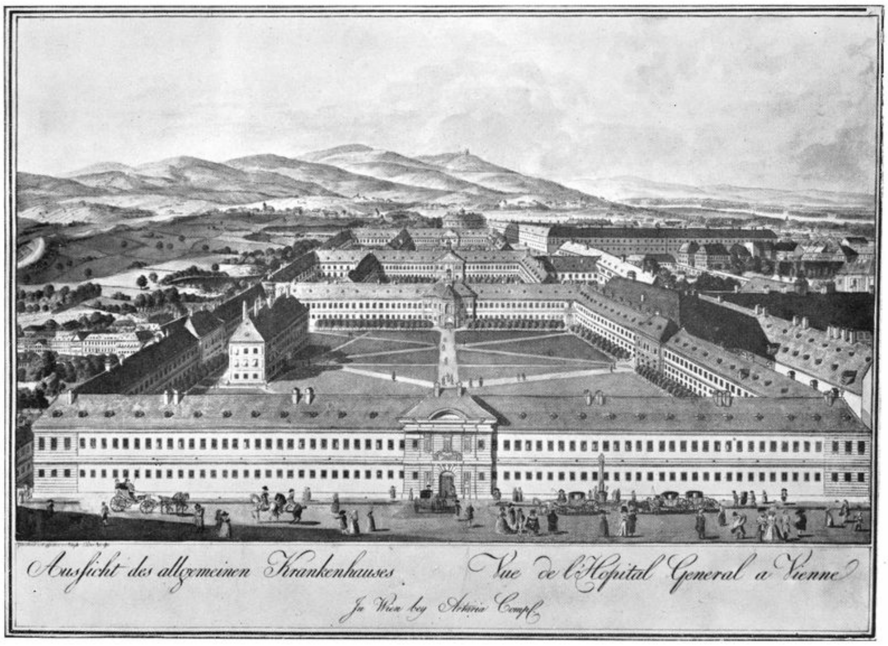
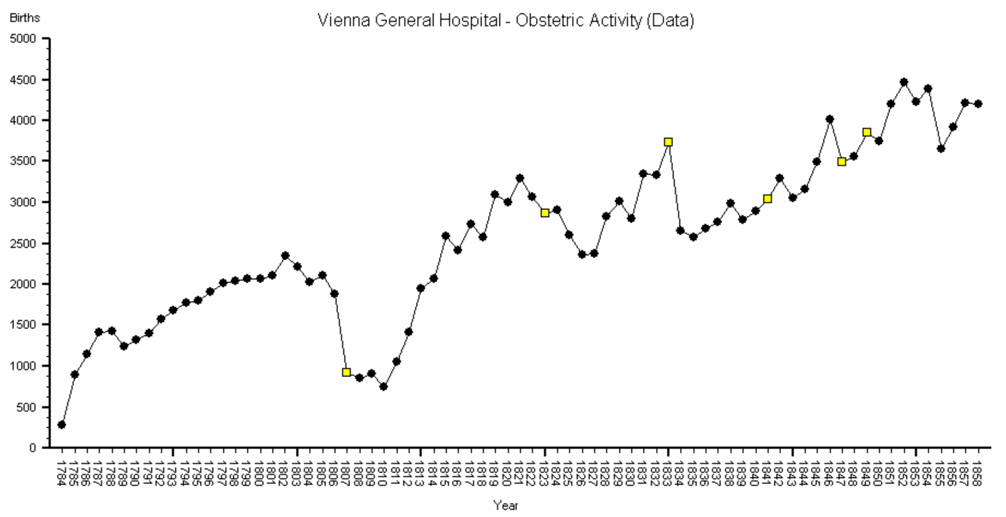


Vienna General Hospital

Opened August 16, 1784. The hospital was responsible initially only for the attendance of patients; the remaining tasks of the hospitals were separate.

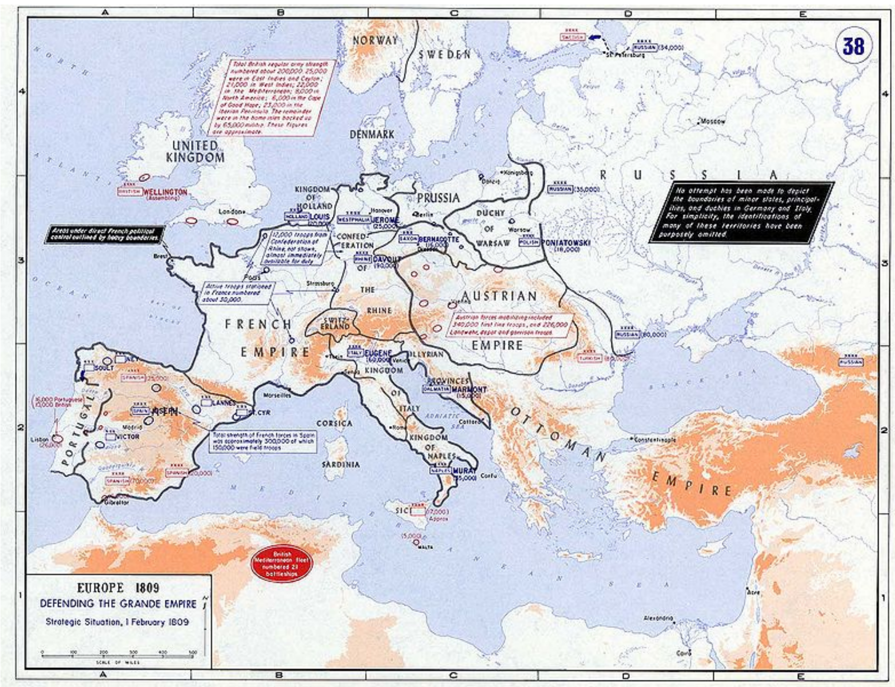
Particularly in the 19th century, Vienna General Hospital was the centre of the Viennese Medical School and one of the centres of medical research.

The obstetric clinic was attached to the general hospital and very sick patients were transferred to the general hospital.



The process behaviour chart shows the obstetric activity of the Vienna Hospital (From 1833 the clinics were split and only the first clinic data is shown which accounts for the apparent drop in activity at this point in time).

The low activity between 1806 and 1813 is associated with the Napoleonic occupation.



In 1809 most of Europe was under Napoleonic Rule, including the Austrian Empire.

The period 1790 to 1850 coincided with the first industrial revolution, the development of steam power, factories, improved transport by canal and railway.

There was a shift of the population to urban centres and an increase in the population that correlates with the steady rise in the obstetric activity.

Pop. 1800 = 250,000
Pop. 1850 = 500,000

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Historical Context

Carl von Rokitansky (1804-1878)
As a young professor, he recognized that the still little noted discipline of pathological anatomy could be of great service to clinical work in the hospital, because it could offer new diagnostic and therapeutic possibilities to the bed-side physician. With this Rokitansky released a veritable scientific "revolution" and with the establishment of the second Vienna School, a paradigm shift went into effect, led by Rokitansky, Josef Škoda and Ferdinand von Hebra, from the notion of medicine as a nature-philosophical subject, to the more modern, scientifically-oriented medicine. In this way the Vienna School achieved worldwide reputation.

Claude Bernard (1813-1878)
Claude Bernard's aim, as he stated in his own words, was to establish the use of the scientific method in medicine. He dismissed many previous misconceptions, took nothing for granted, and relied on experimentation. Unlike his contemporaries, he insisted that all living creatures were bound by the same laws as inanimate matter.

John Snow (1813-1858)
Snow was a sceptic of the then-dominant *miasma* theory that stated that diseases such as cholera or the Black Death were caused by pollution or a noxious form of "bad air". The germ theory was not widely accepted by this time, so Snow was unaware of the mechanism by which the disease was transmitted, but evidence led him to believe that it was not due to breathing foul air. He first publicized his theory in an essay *On the Mode of Communication of Cholera* in 1849. In 1855 a second edition was published, with a much more elaborate investigation of the effect of the water-supply in the Soho, London epidemic of 1854.

Ignaz Semmelweis (1818-1865)
Puerperal fever (or childbed fever) was common in mid-19th-century hospitals and often fatal, with mortality at 10%–35%. Semmelweis postulated the theory of washing with "chlorinated lime solutions" in 1847 while working in Vienna General Hospital's First Obstetrical Clinic, where doctors' wards had three times the mortality of midwives' wards. In 1860 he published a book of his findings in childbed fever in *Etiology, Concept and Prophylaxis of Childbed Fever*. Despite various publications of results where hand-washing reduced mortality to below 1%, Semmelweis' practice only earned widespread acceptance years after his death, particularly when Louis Pasteur confirmed the germ theory.

Rudolph Virchow (1821-1902)
Virchow is credited with multiple important discoveries. Virchow's most widely known scientific contribution is his cell theory, which built on the work of Theodor Schwann. He was one of the first to accept the work of Robert Remak who showed that the origins of cells was the division of pre-existing cells. This Virchow encapsulated in the epigram *Omnis cellula e cellula* ("every cell originates from another existing cell like it.") which he published in 1858.

Robert Koch (1843-1910)
Probably as important as his work on tuberculosis, for which he was awarded a Nobel Prize (1905), are Koch's postulates, which say that to establish that an organism is the cause of a disease, it must be:

- found in all cases of the disease examined,
- prepared and maintained in a pure culture,
- capable of producing the original infection - even after several generations in culture,
- retrievable from an inoculated animal and cultured again.

Florence Nightingale (1820-1910)
Florence Nightingale had exhibited a gift for mathematics from an early age and excelled in the subject under the tutorship of her father. Later, Nightingale became a pioneer in the visual presentation of information and statistical graphics. Among other things she used the pie chart, which had first been developed by William Playfair in 1801. Florence Nightingale is credited with developing a form of the pie chart now known as the polar area diagram, or occasionally the Nightingale rose diagram, equivalent to a modern circular histogram to illustrate seasonal sources of patient mortality in the military field hospital she managed. Florence Nightingale's most famous contribution came during the Crimean War, which became her central focus when reports began to filter back to Britain about the horrific conditions for the wounded. On 21 October 1854, she and a staff of 38 women volunteer nurses, trained by Nightingale and including her aunt Mai Smith, were sent (under the authorization of Sidney Herbert) to Turkey, about 545 km across the Black Sea from Balaklava in the Crimea, where the main British camp was based. Nightingale arrived early in November 1854 at Selimiye Barracks in Scutari (modern-day Üsküdar in Istanbul). She and her nurses found wounded soldiers being badly cared for by overworked medical staff in the face of official indifference.

Medicines were in short supply, hygiene was being neglected, and mass infections were common, many of them fatal. There was no equipment to process food for the patients.

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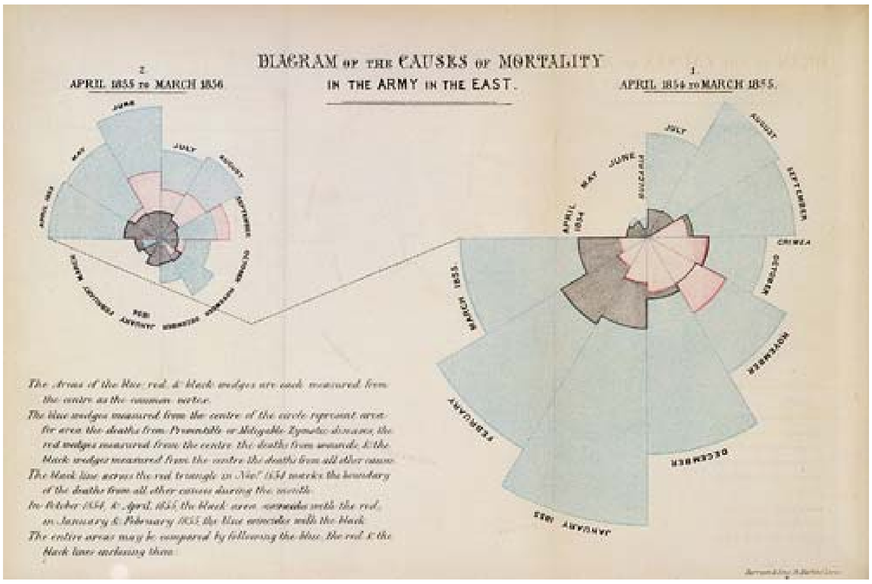


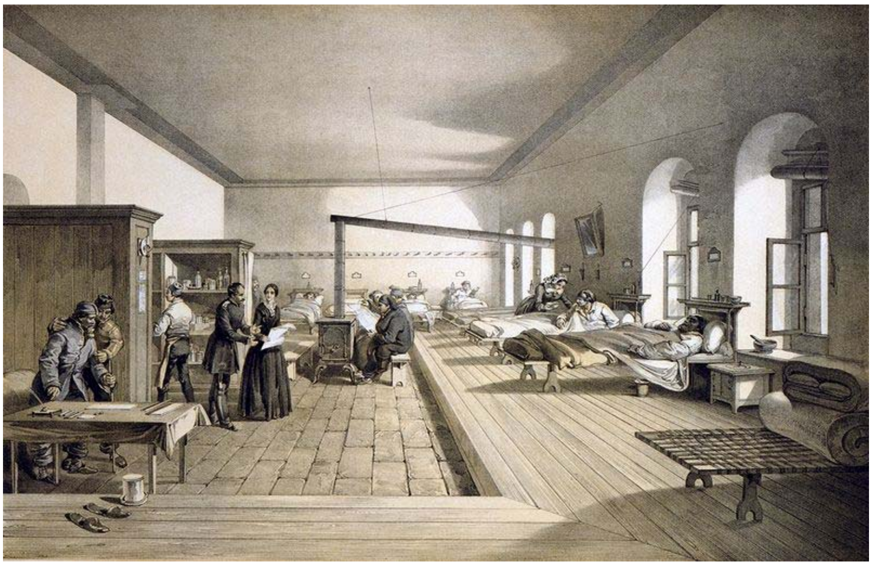
Blue = preventable deaths;
Red=deaths from wounds;
Dark = deaths from other causes.

Death rates did not drop; on the contrary, they began to rise. The death count was the highest of all hospitals in the region. During her first winter at Scutari, 4,077 soldiers died there.

Ten times more soldiers died from illnesses such as typhus, typhoid, cholera and dysentery than from battle wounds.

Conditions at the temporary barracks hospital were so fatal to the patients because of overcrowding and the hospital's defective sewers and lack of ventilation.

A Sanitary Commission had to be sent out by the British government to Scutari in March 1855, almost six months after Florence Nightingale had arrived, and effected flushing out the sewers and improvements to ventilation



Picture: A ward of the hospital at Scutari where Nightingale worked, from an 1856 lithograph.

One of Florence Nightingale's major contributions to medicine and the development of the nursing profession was the use of robust data and visual representations other than tables of numbers to demonstrate objectively the reality of the situation.

These concepts survive with tools such as the vitals signs chart that is on the end of every patients bed.

Louis Pasteur (1822-1895)
He is remembered for his remarkable breakthroughs in the causes and preventions of disease. His experiments supported the germ theory of disease and he was best known to the general public for inventing a method to stop milk and wine from causing sickness, a process that came to be called pasteurization. In his triumphal lecture at the Sorbonne in 1864, Pasteur said "Never will the doctrine of spontaneous generation recover from the mortal blow struck by this simple experiment" (referring to his swan-neck flask experiment wherein he proved that fermenting micro-organisms would not form in a flask containing fermentable juice until an entry path was created for them). In 1879 Pasteur showed that streptococcus was present in the blood of women with puerperal fever. By the turn of the century, the need for antiseptic techniques was widely accepted, and their practice along with the mid-century introduction of new antibiotics greatly diminished the rate of death during childbirth.

Joseph Lister (1827-1912)
In 1854, Lister became both first assistant to and friend of surgeon James Syme at the University of Edinburgh in Scotland. Lister demonstrated the successful use of carbolic acid as an antiseptic, such that it became the first widely used antiseptic in surgery. Lister also found that carbolic acid solution swabbed on wounds remarkably reduced the incidence of gangrene and subsequently published a series of articles on the "*Antiseptic Principle of the Practice of Surgery*" describing this procedure in Volume 90, Issue 2299 of The British Medical Journal published on 21 September 1867.

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