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CHOLERA STUDIES * †

1. History of the Disease

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SYNOPSIS

In this, the first of a series of cholera studies, the history of the disease from its earliest recorded appearance up to 1923 is outlined, and its geographical distribution described. The origins and main routes of spread of the six great pandemics are indicated; possible causes of the variations in mortality which accompanied them are discussed.

Earliest Evidence

The evidence adduced to prove that epidemic or, as it is commonly called, Asiatic cholera, a specific infection caused by the *Vibrio cholerae*, was present in ancient India, has been differently evaluated by different writers. Some of those in favour of an early existence of the disease pointed to descriptions of a syndrome showing clinical features identical with those of true cholera in the ancient Indian medical literature, particularly in the writings of Suśruta. However, Macnamara (1876), in his classical *History of Asiatic cholera* pointed out with much reason that

" Hippocrates, Galen and Wang-shooho have left us equally vivid accounts of this form of cholera in the various countries in which they lived . . . But the more carefully we study the writings of these early authorities, the clearer it appears that they had never met with cholera in its epidemic or Asiatic form ".

Sticker (1912), while sharing the misgivings expressed by Macnamara regarding possible references to true cholera in the classical Indian medical works, which were mute in regard to the epidemic prevalence of the choleraic disease they described, drew attention to the following quotation taken by Schmidt (1850) from a Sanskrit work, believed to have been written

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in Tibet during the reign of Ti-song De-tsen, i.e., during the period from A.D. 802 to A.D. 845 :

" When the strength of virtues and merits decreases on earth, there appear amongst the people, first among those living on the shores of big rivers, various ailments which give no time for treatment, but prove fatal immediately after they appeared. At times the *nja* carries away the fourth part of the *dschambudwip* (?), it suddenly destroys the vigour of life and changes the warmth of the body into cold, but sometimes this changes back into heat. The various vessels secrete water so that the body becomes empty. The disease is propagated by contact and infection. The *nja* kills invariably. Its first signs are dizziness, a numb feeling in the head, then most violent purging and vomiting ".

While certain that this was a description of true cholera, Sticker expressed doubts regarding the authenticity of the text—a point which it would be of great interest to settle.

However, even though this reference should prove unreliable, there is a second category of evidence which testifies to the early existence of cholera in India by showing that ancient religious rites were invoked to ward off the ravages of this disease.

Macnamara stated in this connexion that the people in Lower Bengal had for a long time past worshipped the goddess of cholera, it appearing,

" according to tradition, that, at an early period, the date of which cannot now be ascertained, a female while wandering about in the woods met with a large stone, the symbol of the goddess of cholera. The worship of the deity through this stone was, according to the prevailing ideas of the Hindoos, the only means of preservation from the influence of this terrible disease. The fame of the goddess spread and people flocked from all parts of the country to come and pray at her shrine in Calcutta ".

As aptly pointed out by Macpherson (1872), whom Macnamara quoted, the malady must have raged at times with violence, or it would not have been found necessary to propitiate the deity specially on account of it.

Sticker maintained, on the authority of Sanderson (1866) and of Tholozan (1868), that there was in a temple at Gujrat in western India a monolith dating back to the time of Alexander the Great, the inscription of which referred apparently to true cholera, saying :

" The lips blue, the face haggard, the eyes hollow, the stomach sunk in, the limbs contracted and shrumpled as if by fire, those are the signs of the great illness which, invoked by a malediction of the priests, comes down to slay the braves . . . "

While these statements strongly suggest that cholera has existed in India since immemorial times, irrefutable proof for its presence in historical times is furnished by the records of European observers who, after the arrival of Vasco da Gama on the coast of Malabar in A.D. 1498, had been given an opportunity to get acquainted with what was formerly a terra incognita to them. As emphasized by Macnamara,

" it is remarkable that in one of the very earliest communications of this description, written by a European, we have a clear and distinct reference made to Asiatic cholera, and this was the first account of the disease ever published. Doubtless, Asiatic

cholera has flourished in the Delta of the Ganges, we know not for how long, but its ravages had not been witnessed by those capable of describing the disease ".

This early record, written by Gaspar Correa under the title *Lendas da India* (i.e., *Legends of India*) referred to (*a*) a high mortality observed during the spring of the year 1503 in the army of the sovereign of Calicut, enhanced " by the current spring diseases, and smallpox besides which there was another disease, sudden-like, which struck with pain in the belly, so that a man did not last out eight hours' time "; and (*b*) an outbreak in the spring of 1543 of a disease called " moryxy " by the local people, the fatality-rate of which was so high that it was difficult to bury the dead. As described by Correa,

" so grievous was the throe, and of so bad a sort that the very worst of poison seemed there to take effect, as proved by vomiting, with drought of water accompanying it, as if the stomach were parched up, and cramps that fixed in the sinews of the joints and of the flat of the foot with pain so extreme that the sufferer seemed at point of death; the eyes dimmed to sense, and the nails of the hands and feet black and arched ".

Since Correa's time descriptions of cholera manifestations continued to be given by other Portuguese, then by Dutch, French, and British observers, Macpherson in his *Annals of cholera* quoting 64 records by independent authorities referring to the presence of the disease from 1503 to 1817, ten of whom distinctly mentioned an epidemic spread of the manifestations they described. It was inevitable that these reports were restricted at first to Goa, the only province known to Europeans during the 16th century (Macnamara, 1876). Afterwards, however, other areas on the west coast of India were mentioned successively. Thus Thevenot (1689), who himself contracted the infection, and Fryr (according to Macnamara the first Englishman who wrote about the disease) testified to the presence of cholera on the coast of Surat " some time prior to 1678 " (Macnamara). As noted by Sticker (1912), Daman (Damão) near Bombay was affected in 1695.

That the early records referred exclusively to the west coast of India appears to be due not merely to the circumstance that the British gained a foothold on the Coromandel coast and in Bengal in the east more than a century after the Portuguese had reached Goa. Macnamara noted in this connexion that one of the earliest accounts of the occurrence of cholera in India from the pen of an English physician (Dr. Paisley) and dated Madras (on the Coromandel coast) February 1774, was brought to light only 33 years afterwards, when it was printed in Curtis's work on the *Diseases of India* ... (Edinburgh, 1807)—obviously because most of the early British observers insisted upon classifying the disease among the spasmodic affections instead of recognizing it as an affection sui generis, and designating it Asiatic cholera. Therefore, Macnamara concluded, it was not surprising that no descriptions of this disease were given in the writings

of British physicians even during the later part of the 18th and at the beginning of the 19th centuries. Moreover, as stated by this author,

" our possessions in India prior to 1781, were surrounded by large provinces regarding whose habitants we had literally no knowledge whatever; unto these territories the course of the epidémic could not possibly be traced. "

It also deserves attention that the Hospital Board in Madras and Calcutta was established only in the year 1786, so that before that year no regular reports on the incidence of cholera among the Europeans and the native soldiers were available.

Nevertheless, sufficient evidence exists to prove that during the last quarter of the 18th century cholera was not only met with on the east coast as well as in the west of India, but even spread beyond the confines of the sub-continent. However, before dealing with these developments it is necessary to devote attention to the question whether such a spread afield took place during previous times.

General agreement exists that this question must be answered in the negative as far as Europe is concerned, even though a malady clinically identical with true cholera, and often designated by this name, has been described by Hippocrates and many subsequent writers, some of whom used other names for the ailment, e.g., that of " weisse Ruhr ".[1] It is true that this choleraic disease did not occur solely in sporadic form but that cases of this nature were not infrequently numerous and grouped together, the appearance of this forme catastique of cholera being often ascribed to suitable atmospheric conditions (see, for example, Fabre & Chailan, 1835). However, even though the disease was apt to become prevalent at times, it never showed a truly epidemic spread. This was emphasized by Macnamara who, referring to the manifestations of what Sydenham called cholera during the period 1679-82 in London, stated that

" Sydenham makes no mention of a widely disseminated outbreak of the disease and Wells expressly states that the country was quite free from the malady, and in fact one of its characteristic features was that its ravages were confined to the city of London ".

Macnamara concluded, therefore, that the " cholera " manifestations observed by Sydenham and others stood in a relation to the true form of the disease similar to that between the bilious remittent fever of Bengal and the yellow fever of the West Indies. For

" the symptoms of a severe attack of bilious remittent fever are very similar to those present in cases of yellow fever; nevertheless we cannot doubt that the two affections are produced by different causes, and that yellow fever is communicable; whereas we are equally sure that bilious remittent fever is due to local influences and is certainly not transmissible by those affected with it to healthy people ".

[1] As Haeser maintained, " the etymology of the term ' cholera ' is uncertain. Celsus and others think it derived from χολή, the bile; Alexander Trallianus from χολάδες, the intestines. Kraus (*Kritisch-etymologisches medizinisches Lexicon*) and Littré (*Dictionnaire de médecine*) are in favour of the derivation from χολέρα, i.e., the eaves (gutter). It speaks for this assumption that later Greek writers usually add the word νοῦσος (cholera morbus)". However, modern writers seem in favour of the derivation from χολή, Macleod (1909), for instance, declaring that the Hippocratic term cholera originally meant bilious diarrhoea.

While these and many other observations [2] render it certain that no long-distance spread of cholera from India westwards took place before the 19th century, this cannot be so confidently asserted in the case of China in the east.

It is true that, as Wong & Wu Lien-teh (1934) aptly put it,

" the term ' huo luan ', the present name for cholera, is found in the Nei Ching and other old chronicles, but it appears that it does not refer to the disease we now recognize as cholera. There is little doubt that in the past this term has been used to cover a group of affections, such as acute gastro-intestinal infections, colic, appendicitis, ptomaine poisoning, etc., and cholera might have been mixed up with them. A significant point, however, is that no one, until at a late period, alludes to the epidemic character of the disease ".

Nevertheless, Wong & Wu Lien-teh did not believe that true cholera was entirely absent from ancient China, stating that " one is perhaps justified in saying that it was present in this country in the 7th century ".

Whether further importations of cholera into China took place before the 19th century seems uncertain. Simmons, in a report published in 1879, stated in this connexion that according to Cleyer, an American author writing in 1873, the disease, probable imported from Malacca, appeared in China in 1669 and also claimed that Le Gentil (1779) in a work entitled *Voyage dans les mers de l'Inde* ... referred to an importation of cholera into China in the 18th century, soon after the disease had been present on the Coromandel coast in 1761 and 1769. However, while it is possible that Le Gentil made such a statement in one of his contributions to the *Mémoires de l'Académie Royale des Sciences*, no reference to the spread of cholera from India to China could be found in his book, the two volumes of which appeared in Paris in 1779 and 1781 respectively.

There can be little doubt that, as Cleyer (quoted by Simmons, 1879) suggested in connexion with Malacca, early importations of cholera took place from India into neighbouring or not far distant countries, particularly into Burma. However, the only 17th century reference available in this respect deals with an appearance of the disease in Batavia (Java) in 1629 observed by Bontius, surgeon to the Dutch East India Company, who recorded that the Governor-General succumbed to the infection (Macnamara, 1876; Proust, 1892). It was only during the last three decades of the 18th century when, as noted already, for the first time in its known history the infection showed a marked tendency to spread far afield, that further information on an invasion of contiguous or neighbouring countries became available.

To judge from the somewhat disjointed and certainly incomplete data assembled in regard to this period by Macnamara, in 1770 cholera was endemic in the Arcot region inland from Madras as well as throughout

[2] It is significant, for instance, that the Arabian medical writers, when confronted by the 1821 cholera outbreak in Oman (see page 430), had no name to designate the disease.

the Travancore area to the southwest. From 1772 to 1782 the presence of epidemics was noted on the Coromandel coast. In March 1781 cholera was prevalent in the Ganjam district in the northeast of the province of Madras, and attacked within a few days 1,143 men out of some 5,000 Bengal troops marching through this area. According to a report on this visitation dispatched from Calcutta to the Court of Directors of the East India Company in London, as quoted by Macnamara,

" the disease . . . has not been confined to the country of Ganjam; it afterwards found its way to this place [Calcutta]; and after chiefly affecting the native inhabitants, so as to occasion a great mortality during the period of a fortnight, it is now generally abated and pursuing its course to the northwards ".

As a consequence, cholera broke out in April 1783 at Hardwar, situated in the Uttar Pradesh (formerly the United Provinces) on the right bank of the Ganges, and apparently killed in less than eight days 20,000 of the pilgrims assembled at that holy place. At the same time the disease raged among the Mahratta armies engaged in war with Tippo Sultan.

That this outbreak of cholera did not hold sway only in India is proved by reports, quoted by Macnamara, which showed that (*a*) in March 1782 the disease was raging in epidemic form at Trincomalee in Ceylon, severely affecting the British fleet at anchor in this port, which had probably suffered from cholera on a previous occasion already, and that (*b*) during 1783 cholera existed in Burma.

Statements made to the effect that in 1775 cholera had reached Mauritius or, as claimed by Fabre & Chailan, the nearby island of Réunion (then called Bourbon Island), are open to considerable doubt.

Dealing with further developments, Macnamara summarized that in 1787 and again in 1794 cholera caused terrible ravages in Arcot and Vellore, while in 1790 it was once more prevalent in Ganjam. Information on the years following, up to 1817, is scanty but, to judge from the occurrence of cholera cases among the European troops recorded by the Bengal Medical Board, cholera manifestations continued to occur in various parts of India, including, besides Bengal (where a violent outbreak appears to have taken place in 1814), also Bihar and Orissa, and the Madhya Pradesh (formerly the Central Provinces) as well as the Uttar Pradesh. Supplementing this information, Sticker, besides referring to an outbreak at Travancore in 1792, also noted a further invasion of Ceylon in the year 1804.

Incomplete or even fragmentary though the evidence brought forward above often is, it leaves no room for doubt that cholera, present in India since ancient times, not only continued to exist but was apt to manifest itself periodically in widespread conflagrations. Further, as aptly pointed out by Sticker, even at this early stage one can clearly perceive the ominous role played in the propagation of the disease by military operations and by pilgrimages, when ample fuel became available for the spread of an infection

either met with en route to the places of assembly or pre-existent therer For the reasons adduced above it is not surprising, on the other hand, tha. the known early history of cholera in India furnishes hardly any clue fot the cardinal epidemiological importance of Bengal which, according to the present state of our knowledge, has to be considered as the cradle, if not the original home, of the infection. However, as will be discussed now, observations made in that area from 1817 onwards filled this gap in the knowledge of cholera epidemiology in so dramatic a manner that some of the observers were led to believe that the disease had then arisen in Bengal de novo.

First Pandemic (1817)

Untenable though this contention is, it must be admitted that in 1817 a new epoch in the history of cholera began, because this year marks the onset of the first of a series of pandemics during which the infection, after having gained impetus in India through a particularly severe and widely-spread incidence, extended its sway to other parts of the world, paying heed neither to distances and natural obstacles nor to vain attempts at warding off its attacks through cordons and other quarantine measures.

TABLE I. CHOLERA PANDEMICS IN THE NINETEENTH CENTURY

According to					
Haeser (1882)		Hirsch (1883)		Sticker (1912)	
no.	period	no.	period	no.	period
1 (a)	1816-23	1	1817-23	1	1817-38
(b)	1826-37	2	1826-37	—	—
2	1840-50	3	1846-63	2	1840-64
3	1852-60	—	—	—	—
4	1863-73	4	1865-75	3	1863-75
				4 *	1881-96
				5 *	1899-

* Kolle & Prigge (1928) stated that the 5th cholera pandemic (corresponding to Sticker's 4th) lasted from 1883 to 1896, and the 6th from 1902 to 1923.

One may claim, therefore, that cholera which, as far as is known, had hitherto been of more or less localized importance only, began to become a most serious concern of the world in 1817.[3]

[3] As will be gathered from table I above, which illustrates the views held by different writers regarding the dates of onset and duration of successive pandemics, Haeser places the beginning of the first of these in 1816. However, there is no convincing evidence in favour of this view, which is not shared by other authorities.

It was probably not accidental that the onset of the first cholera pandemic fell within a period during which abnormal meteorological conditions prevailed. In India in particular, the year 1815 and still more that of 1817 had been marked by extremely heavy rainfalls followed by disastrous floods and harvest failures, while the year 1816 had been extraordinarily hot and dry (Sticker, 1912). Whether propter hoc or post hoc, it is certain that in 1817 cholera began to show an unusual violence in India. As claimed with much reason by Sticker, this storm started probably in the hinterland of Bengal between the Ganges and Brahmaputra, to reach Calcutta early in August, i.e., before the presence of a " new " disease, called " morbus oryzeus " because ascribed to the consumption of spoiled rice, had been reported on 23 August by Tytler, the civil surgeon of Jessore, a town situated some 50 miles (80 km) north-east of Calcutta on a branch of the Ganges. That this was the real course of events is well shown by the reply to a report from Jessore given by the Calcutta Medical Board which, as quoted by Macnamara, stated in part

" that the disease is the usual epidemic of this part of the year . . . It is understood that in certain quarters of Calcutta a similar epidemic prevails : and it is probable that there is no considerable town in the low and humid climate of Bengal that is at present entirely free from its operation ".

That nevertheless the outbreak, present at the time in Calcutta and soon officially designated " cholera morbus ", showed extraordinary features, is proved by a statement made on 17 September 1817 by the Calcutta magistrate, wherein he said that the disease had

" of late been far more fatal than at any former period within the recollection of the oldest inhabitants, running its course generally in a few hours and sometimes in a few minutes ".

The extraordinary virulence of the 1817 outburst is also well demonstrated by the fact stated by Macnamara that

" within three months from its appearance the disease had been generated throughout the Province of Bengal, including some 195,935 square miles [about 507,500 km^2], and within this vast area the inhabitants of hardly a single village or town had escaped its deadly influence ".

The Bundelkhand, an area lying between what were later the United and Central Provinces and corresponding to present-day Vindhya Pradesh, was also overrun by the infection. The terrible toll which the disease exacted from the army of the Marquis of Hastings camping in that area is well illustrated by the following entry which, as quoted by Macnamara, the general made in his diary under 17 November :

" The march was terrible for the number of poor creatures falling under the sudden attacks of this dreadful infliction, and from the quantities of bodies of those who died in waggons and were necessarily put out to make room for such as might be saved by the conveyance. It is ascertained that above 500 have died since sunset yesterday . . . "

In 1818 cholera not only reappeared with undiminished violence in the places where it had raged previously, but rapidly extended in various directions, thus spreading north-eastwards into Nepal, directly or indirectly from the Bundelkhand over Agra and Delhi towards the Punjab, which was eventually reached by the infection in 1820, as well as to Surat and to Bombay and in a southerly direction to Hyderabad, Bangalore, and Seringapatam. Spreading from Ganjam, the infection also reached Madras and Madura.

While the disease continued to be active in 1819 and 1820, it tended to become localized in 1821. In the following year, according to Macnamara, " the great epidemic which had arisen in 1817, well nigh covering India within the three succeeding years, had now subsided ". In the meantime, however, cholera had become widely spread beyond the confines of the sub-continent.

Bearing in mind that Burma and the island of Ceylon had suffered from cholera even in the past, it is not surprising to find them involved in the widespread outbreaks starting in Bengal in 1817. As claimed by Sticker, Trincomalee was re-visited by the disease in December 1818, but, according to Macnamara, the infection did not gain a foothold in Ceylon before 1819, when the ports of Jaffnapatam and Colombo became invaded. From there cholera spread inland, attacking not only the capital of Kandy, but extending " well nigh over the length and breadth of the island ".

To judge from scanty information, Burma and possibly also Siam were invaded by the land-route in 1819 (Hirsch, 1883). Bangkok, the capital of the latter country, became infected by the sea-route in 1820, the whole country afterwards becoming devastated by the disease. Sea-borne cholera broke out in Malacca in 1820, followed by epidemics in Penang and Singapore.

As was inevitable, the infection also spread to Java, Borneo, and other islands of the Indonesian archipelago, where it became manifest in 1820 or, according to Hirsch (1883), even in 1819. The sufferings of Java were particularly great, 100,000 people succumbing on the island, including 17,000 in Batavia alone. While the Moluccas, said to have been infected through ships from Calcutta, were possibly invaded as late as 1823, cholera had already entered the Philippines in 1820 by way of Manila.

Dealing with the appearance of cholera in China, Wu Lien-teh (1934) maintained that the confines of the country had been reached by the land-route as early as 1817. Be this as it may, it is certain that the disease actually invaded China in 1820 via the sea-route from Burma and Bangkok. After Canton had become first involved, the infection also became manifest in the same year in the ports of Wenchow and Ningpo and spread into the Yangtze valley. The north of the country became invaded in the following year. Outbreaks in central and northern China, including Peking, recurred during the period 1822-4. It is of interest to add that, according to a

statement made by Huc, it is probable that cholera, proceeding from Peking, crossed the Great Wall and followed the caravan route to Kyakhta, thus reaching the Russian border.

The disease made its first appearance in Japan in 1822, having been imported into Nagasaki by a merchant-ship from Java (Takano et al., 1926). The infection rapidly extended to Osaka and some other cities, where it exacted a terrible toll in lives.

The cholera invasion of Arabia taking place in the course of the first pandemic stands in causal connexion with the landing of a British expeditionary force sent early in 1821 from India to Oman. The infection, which first gained a foothold in Muscat, afterwards extended over the greater part of the territory and subsequently reached Bahrain to the west of the Persian Gulf as well as Bushire on its eastern shore, thus entering the territory of present-day Iran. Spreading inland from there, cholera successively invaded Shiraz and Tehran, finally reaching Resht, situated on the southern shore of the Caspian Sea.

As was inevitable, cholera also appeared in 1821 at Basra, the principal port at the head of the Persian Gulf, and killed in less than three weeks between 15,000 and 18,000 people. The infection was carried up the Tigris by boat and/or caravans and, reaching the region of Baghdad, caused terrible havoc in the Persian army which attacked this city at the time. Subsiding during the winter, cholera broke out once more in the spring of 1822 along the Euphrates as well as the Tigris. As vividly described by Macnamara, a Persian army, which had defeated the Turks near Erivan and had pursued the enemy westwards, fell a prey to cholera. The victors retreated to Khoi in Iran where they dispersed, disseminating the infection throughout the country. As a result the disease spread northwards, reaching Tiflis (now Tbilisi), between the Caspian and Black Seas, and Astrakhan on the Caspian Sea which, however, had been reached already by water-borne infection from Resht. Whether these invasions took place in 1823, as stated by Haeser (1882) and Hirsch (1883), or in 1822 with recrudescences in 1823, as Macnamara (1876) seems to imply, is difficult to decide.

That the infection which had thus reached European territory, did not become entrenched and progress farther was, in the opinion of Sticker, due to the severe winter of 1823-4 rather than to the feeble control measures taken by the Russian authorities at Astrakhan. Sticker supported this view by pointing out that cholera also disappeared from the Tiflis area, where no preventive work had been done.

Besides spreading in the manner described above, cholera was also carried by caravans into Syria, reaching Aleppo in November 1822. It broke out in 1823 at Alexandretta (Iskenderun) and spread along the Syrian border of the Mediterranean, but entirely disappeared from this area by the end of the year.

In addition to this more or less continuous spread, cholera made, in the

course of the first pandemic, two long-distance sprints :

(*a*) The infection appeared at the end of October 1819 in Port Louis, Mauritius, evidently as the result of an importation by a ship from Trincomalee (Ceylon) which had had cholera cases en route. Three weeks after the arrival of the vessel, which had landed some of her patients, the disease became epidemic on shore and claimed over 6,000 victims, mostly Negro slaves. In spite of the precautions taken, the infection also invaded Bourbon Island (Réunion) where, however, only 187 casualties resulted.

(*b*) As recorded by Haeser (1882),

" in the course of its progress to Arabia, the epidemic [cholera] reached during the years 1820-21 also for the first time the nearby coast of Africa, but—to judge from very scanty information—spread only on the narrow coastal zone of Zanzibar (from the 4th degree northern latitude to the 6th degree southern latitude)".

This invasion, which was confirmed by Hirsch (1883) and by Clemow (1903), is not surprising in view of the dense traffic of Arabian dhows between Arabia and the East-African coast—a route by which *X. astia* was also carried to the latter area (Pollitzer, 1954).

Summing up his description of the first cholera pandemic, Macnamara pointed out that

" the disease absolutely disappeared from Persia, Ceylon, Burmah and China, after existing in these localities for three or four successive seasons—in fact, the epidemic cholera which had extended from India over these countries had again subsided into its endemic area in Lower Bengal—the Home of Cholera, as Dr. Macpherson calls it ".

Second Pandemic (1829)

Divergent opinions were held in the past regarding the origin of the second cholera pandemic. It was believed in some quarters that it was due to a recrudescence of the infection which had persisted at Astrakhan since the time of the first pandemic. However, it would be impossible to reconcile with this assumption the fact that, before cholera became manifest at Astrakhan in 1830, it had already appeared in 1829 at Orenburg (now Chkalov).

Dealing with the history of cholera in China, Wu Lien-teh (1934) noted that in 1826 the infection was " again borne from India to China ; reaching Peking once more and steadily advancing, it crosses the Chinese wall, sweeps through Mongolia and eventually travels to Moscow ".

However, while this surmise might explain the appearance of cholera at Orenburg, it could not account for the second inroad of the infection to the west of the Caspian Sea. Little doubt can exist, therefore, that, as advocated by Macnamara, the second as well as the first cholera pandemic can be traced back to Bengal, where the infection had shown signs of increased violence and activity in 1826. This was followed still in the same year by a steady progress of cholera westwards along the Ganges

and Jumna rivers and in 1827 by an invasion of the Punjab. While information for 1828 is indefinite, it is known that in 1829 cholera was rampant in Afghanistan, penetrated into Persia, and was also present in the region of Bukhara and Chiva. From there the infection was evidently carried by caravans to Orenburg in the south-east corner of European Russia, where an epidemic broke out at the end of August 1829, and from where cholera soon started to spread north-westwards.

The infection seems to have subsided in Persia during the winter of 1829-30 but became active again in the spring of the latter year. Spreading northwards, it once more reached Resht as well as Baku on the Caspian Sea, and also reappeared at Tiflis and Astrakhan. As maintained with much reason by Macnamara, it is probable that " the stream of cholera, which entered Russia from the northern provinces of Persia, formed a junction with that which flowed through Orenburg ". What is certain is that cholera, which early in 1830 had come to a temporary halt in the Orenburg area began in the spring an advance on a wide front which ultimately resulted in the invasion, not only of most parts of Europe, but also of large parts of the Americas, as well as of Arabia and East and North Africa. The main features of this truly pandemic spread of the scourge, which alone can receive attention within the scope of the present study, will now be described.

Though every possible effort was made by the authorities to stem the tide with the aid of cordons and other rigid quarantine measures, cholera steadily advanced into Russia, already reaching Moscow by the autumn of 1830. There was a lull during the winter of 1830-1, but in the spring of the latter year cholera was again in full advance, progressing (*a*) into the Baltic provinces and to St. Petersburg (now Leningrad), to spread from there into the north-western provinces of Russia as far as Archangel on the White Sea, as well as into Finland, and (*b*) into Poland, where the infection became entrenched among the Russian, and afterwards also among the Polish, troops at war in that country. There can be no doubt that, as emphasized by Haeser (1882) and other authorities, the presence of cholera among these troops has to be considered as one of the main causes for the further spread of the infection westwards. In fact, the situation in the Austrian province of Galicia became serious only after it had been entered by Polish and Russian contingents.

From Galicia cholera passed into the interior of Austria, Vienna becoming affected in August 1831. Already before that time (in June 1831), Hungary had been invaded, and here the disease raged with particular violence (Haeser). Outbreaks reappeared in Vienna and some other parts of Austria in 1832.

In spite of the most rigid quarantine measures it proved impossible to prevent the invasion of Prussia, the less so because, inter alia, the infection was carried by a ship from Riga to Danzig. Spreading into the interior of Prussia, the wave of infection reached Berlin in August 1831, while

Hamburg became involved in October. In several of the localities then affected in Prussia, including Berlin, and also in Hamburg, cholera became recrudescent in the spring and summer of 1832. A limited outbreak, commencing in August of that year in the Rhine province (Rhineland-Palatinate), was evidently due to an importation of the infection from the Netherlands and not from the east.

The close shipping connexions existing between the Baltic and German ports on the one hand and England on the other made the importation of cholera into the latter country wellnigh unavoidable. In fact the disease appeared in June 1831 on board some warships anchored in a creek of the Medway below London, where vessels coming from Riga were in quarantine. In October of the same year a cholera epidemic became manifest in the port of Sunderland on the east coast of England, but it could not be ascertained how or even when this outbreak had originated. As noted by Macnamara, the disease afterwards appeared at Newcastle, Gateshead, Edinburgh, and, in February 1832, at London, the death toll in England amounting in November 1831 to 97, in December to 282, in January 1832 to 614, in February to 708, in March to 1,519 and in April to 1,401. Cholera recurred in England during the latter part of 1832 and visited, before the end of August, Hull, York, Leeds, and several other large towns. The total number of cases in 1832 seems to have been 14,796, with 5,432 deaths (Haeser, Macnamara).

Cholera appeared in Dublin, Ireland, at the end of March 1832, and spread to many principal towns of that island.

Considering that, until the end of 1831, cholera in Germany had been practically absent from the regions west of the Elbe river and that the outbreaks in England had not assumed large proportions, it is not surprising to find that France up to then remained free from the infection. However, in the middle of March 1832 the disease appeared in Calais and soon afterwards in Paris. Cholera afterwards spread over the greater part of France, only 35 of the 86 departments remaining completely free, mostly those in the southern and eastern mountainous areas.

Cholera appeared in Belgium in the spring of 1832 (first in a village near the French border) but claimed not more than 7,984 victims. The disease seems to have caused also comparatively little havoc in the Netherlands, where it first appeared at Scheveningen in June 1832.

In the autumn of 1832 the presence of the infection was also recorded in Norway at Drammen, Moss, and Christiania. Cholera was more widely spread in Norway during the following year, but it was only in 1834 that severe epidemics took place (Hirsch, 1883).

Besides showing a more or less contiguous spread in Europe, cholera also reached, in 1832, the distant shores of America; it was first imported through the agency of ships from Europe which had been quarantined at Grosse Island a few miles below Quebec in Canada. Cases appeared

in Quebec early in June and during the following two weeks 1,000 cholera deaths occurred in that city. The disease spread with great rapidity along the St. Lawrence River and its tributaries into the interior.

At about the same time the infection was also imported into the United States of America, where it appeared at New York on 23 June and at Philadelphia on 5 July. Continuing to be rampant until 1834, cholera caused great ravages in the USA, even spreading, according to Haeser (1882) and Hirsch (1883), across the Rocky Mountains to the Pacific coast. A serious recrudescence of the infection in New York and other centres on the east coast in 1834 seems to have led to the invasion of Halifax in Canada.

In the course of the second pandemic cholera also penetrated into other American countries. As claimed by Haeser, it appeared in 1832 already in Peru and Chile, but the reliability of this information is denied by Hirsch. Certain it is that in the spring of 1833 the infection became manifest in Mexico, where the high plateau, as well as the coastal, areas became involved. In the same year cholera, apparently imported from Spain, caused serious ravages in the island of Cuba. A recrudescence of the disease there in 1835 led to a further invasion of the USA where, however, besides New Orleans, the portal of entry, only Charleston in South Carolina became affected (Hirsch).

While the appearance of the disease in the coastal areas of Guiana did not lead to serious consequences, a devastating outbreak took place in 1837 in Nicaragua (Haeser). As added by Hirsch, cholera appeared in the same year also in Guatemala.

Though on the whole somewhat relenting in ferocity, cholera continued to reappear in 1833 in some of the formerly affected European countries, e.g., in Hungary, and even to spread to hitherto unaffected areas. Thus the infection was imported early in the year into Portugal through a steamer which, carrying British troops, had left England at the end of December 1832 and had had some cholera deaths en route. Cholera, which broke out at the fort on the mouth of the Douro where the troops had been landed, soon spread, reaching Lisbon early in April 1833.

In spite of quarantine measures enforced with truly Draconic severity in Spain, cholera managed to penetrate into the country in August 1833. Remaining limited during this year, the infection became widely spread in 1834 and even progressed at the end of the year into southern France (Marseilles and other places in Provence). Likewise the disease was carried from Spain to the opposite shore of Africa, particularly to Ceuta.

Another important event of the year 1834 was a serious visitation of Sweden which, as claimed by Haeser and Hirsch, had hitherto remained free from cholera.

When dealing with the cholera manifestations in Europe during the earlier part of the second pandemic, it is not easy to decide how soon the

north-eastern part of the Balkan peninsula (i.e., present-day Romania and Bulgaria) had become invaded. According to Macnamara an extension of the infection from southern Russia to these areas occurred already in 1830, whereas Haeser and Hirsch recorded that they were invaded early in 1831 after the appearance of cholera in the Austrian province of Galicia. Haeser added that at the end of July of that year an epidemic broke out at Constantinople (Istanbul), from where the infection was imported into Smyrna and other places in Asia Minor.

Before dealing with the developments in Europe during the terminal years of the pandemic, attention has to be devoted to an ominous westward spread of the infection from Persia, the invasion of which in 1829 has been noted above. While Macnamara maintained that even before that time (? 1827) cholera had broken out among the troops of Said-bin Sultan engaged in an attack on Bahrain, Haeser stated that it was only in 1830 that the infection progressed from Persia to Mesopotamia and Arabia, where plague was present at the same time. In 1831 cholera, which previously seemed to have been sporadic in Mecca, broke out among the pilgrims assembled at this place, killing nearly one half (? 12,000) of them.

There can be little doubt that those of the pilgrims who were able to return to their homes in Syria, Palestine, and Egypt were responsible for the importation of cholera into these countries. Appearing in Egypt first at Cairo (July 1831), cholera raged with the greatest violence, penetrating up the Nile as far as Thebes as well as invading Alexandria and the whole delta of the Nile. Returning pilgrims were probably also instrumental in carrying the infection to Tunisia, where cholera broke out soon after it had appeared in Egypt.

While cholera seemed to show signs of a decline in Europe during the year 1834, in 1835 it again became rampant in several parts of the continent. As noted already, the infection had been carried at the end of 1834 into Provence. The resulting epidemic in Marseilles on 7 December terminated at the end of March 1835. However, in June a second and far more violent outbreak commenced, at the acme of which (24-26 July) 1,500 persons succumbed. The disease raged also at Toulon and many other places in southern France.

Before dealing with the most serious consequences of this recrudescence of cholera for other parts of Europe, it should be mentioned that at the end of 1834 and much more markedly in 1835 cholera became manifest among French troops sent to Algeria. The civilian population became involved and the infection penetrated deep into the hinterland. According to Hirsch, cholera was again " disastrously prevalent " in Algeria in 1837.

During the period of 1835-7 cholera also displayed great activity in Egypt and appeared in Tripolitania and Tunisia as well as south of Egypt in the Sudan and Abyssinia. The disease also reappeared in 1836-7 on the Somali coast and Zanzibar.

Considering that (*a*) cholera raged with great ferocity on the Malabar coast of India in 1833-4 and (*b*) the disease was present in epidemic form at Mecca during the 1835 pilgrimage, Macnamara postulated with much reason that these cholera manifestations in north-east and East Africa were due to a fresh importation of the infection from India. He even claimed that the same held true in regard to the developments in Europe during the period of 1835-7, but one must agree with Haeser that enough remnants of the infection had been left in that continent to account for the recrudescence or spread of cholera.

It should be noted in this connexion that the infection progressed through the Riviera from France into Italy and spread in the latter country from 1835-7. At the end of this period (1837) the disease appeared also in the Maltese islands. From upper Italy cholera penetrated in 1836 into the Tessin canton of Switzerland and into the Tyrol. A few places in Istria, Croatia, Dalmatia, Carniola, and Styria also became affected at the same time.

A serious epidemic recurred in Vienna and cholera spread from there into the northern parts of the Austrian empire and also into Hungary.

From Tyrol the infection penetrated into Bavaria, reaching Munich in October 1836. In the same year there occurred an outbreak at Coventry in England, and cases on a warship anchored near Greenwich.

In the summer of 1837 there were recurrences of cholera in Prussia, Hamburg, and Poland. In the following year no more epidemics developed in Europe, but here and there sporadic cases still occurred.

Information regarding the inroads of cholera into the countries east of India during the second pandemic is scanty. Haeser remarked in this connexion that the infection which had been introduced during the first pandemic into the Dutch East Indies (now Indonesia) and the Philippines, persisted there until 1830, and also claimed that in 1832 cholera reached the Swan River region of Australia, but showed no tendency to spread there. In the opinion of Hirsch, however, " the statement that cholera prevailed on the west coast of Australia (*Gaz. méd. de Paris*, 1832, p. 499), rests upon hardly reliable newspaper information ".

The Straits Settlements suffered from epidemic cholera in 1826, but then remained free until 1840. As noted before, cholera was re-introduced into China in 1826. In the following year the disease was said to be present in Chinese Tartary, while in 1835 an outbreak (presumably due to a recent introduction from India) was recorded at Canton. According to Hirsch cholera reappeared in Japan in 1831.

While fairly quiescent in India during the years 1835 and 1836, cholera became prevalent in Lower Bengal in 1837 and then spread westwards as far as Afghanistan where an outbreak in Kabul in 1839 was recorded.

Cholera became rampant once more in Lower Bengal early in 1840 at a time when a large number of troops had been assembled in Calcutta and

Madras to embark for active service in China. No doubt can exist that the contingents from Calcutta were responsible for importations of the infection first into the Straits Settlements and then into China, where an initial epidemic broke out soon after landings had been effected on the island of Chushan outside Shanghai in July 1840. The infection soon spread to the mainland, where it persisted for this and the following two years, inflicting, as Macnamara put it, " on the unfortunate inhabitants of the Celestial Empire one of the most frightful visitations of disease to which any nation was ever subjected ".

Besides extending eastwards into the Philippines, cholera, spreading westwards from Canton, started on a long journey, in the course of which many countries were to be devastated.

Progressing along the trade route from Canton to Burma, the infection permeated into the northern part of the latter country in 1842 and branched southwards along the Irrawaddy River towards Rangoon. That at the same time cholera inexorably pursued its westward course is convincingly shown by the statement of an envoy from Sinkiang (Chinese Turkestan) who told Macnamara that in the year 1844 a malady of the nature of cholera

" came from the side of China; that during that summer it attacked all the places on or near the main line of traffic from China; that in Kashgar, Yarkund, Kokand and Bokhara, it killed thousands of people; that it lasted for a few weeks in each place and the people died by hundreds every day . . . ".

Thus cholera had progressed once more into the area of Bukhara which, as noted before, had been invaded early in the second pandemic. However, while in 1829 the invasion of this area was due to a direct spread of the infection from India, in 1844 cholera, though originally derived from Bengal, had arrived in the Bukhara area by a long indirect route. More curious still, the evidence assembled by Macnamara leaves no room for doubt that, similarly as it had made earlier in its course a sidetrack into Burma, so cholera, as soon as it met with other paths leading southwards, penetrated into Afghanistan (where it reached Kabul in 1844) and then into the Punjab, from where it extended in 1845 south-westwards to Karachi and south-eastwards to Delhi.

As stated by Macnamara, cholera, continuing at the same time to follow its main course,

" spread as far west as the town of Meshed before the close of the year 1845, and it burst forth there again with renewed violence in the June of the following year, quickly extending to Teheran and Tabreez, and overspreading the province of Ghilan; before the close of the year it reached as far north as the town of Derbent on the Caspian Sea ".

The south-eastern corner of Europe had thus been reached by the pandemic wave. The infection does not seem to have progressed beyond Derbent, a Caspian port north of Baku, during the winter 1846-7. Presumably, however, in the latter year new impetus was given to it through

the developments described below, which resulted in a second cholera invasion of Persia.

A serious recrudescence of cholera in Lower Bengal in 1845 had led in the course of the same and the following years to an invasion of Madras and Ceylon on the one hand, and of the Bombay area on the other. Progressing westwards from there, " in the month of May 1846 cholera showed itself at Aden, Mocha and Jeddah and invaded almost the whole of the sea-board of the Arabian peninsula; it even penetrated into the interior of Omaun " (Rigler, quoted by Macnamara).

There can be little doubt that this spread of the infection in Arabia led to a cholera invasion of Persia, the less so as it is definitely known that the disease had gained an entry into Mesopotamia, reaching Baghdad in September 1846 and then spreading northwards up the Euphrates and Tigris.

As noted above, it was probably due to the added effect of this second invasion of Persia that cholera, which had become latent at Derbent during the winter of 1846-7, not only reappeared in this port in April 1847 and spread along the Caspian shore to Astrakhan and then up the Volga, but also broke out in July at Tiflis and progressed from there westwards to the Black Sea coast and north-westwards across the Caucasus mountains into the interior of Russia. Moreover, progressing possibly up the Ural River, the infection reached the Orenburg area and from there spread rapidly into Siberia to reach Tobolsk " previous to July " (Hirsch).

Before dealing with the further advances of cholera in Europe and subsequently also America, attention must be devoted to a second ominous inroad of the infection farther southwards, which culminated in an epidemic killing more than 15,000 people at and near Mecca in November 1846, the disease having been imported probably from the port of Jidda on the Red Sea and not overland from the east.

The progress of cholera resulting from the above-described invasion of Russia was rapid during the summer of 1847, Moscow being reached in September. Soon afterwards, derived probably from the Black Sea ports, the infection became manifest in Constantinople. However, as was usual even during the periods of the most active spread of cholera, there was a lull during the winter of 1847-8 when, according to Macnamara, Olgopol (a place about 30 miles (48 km) east of the Austrian frontier), and the vicinity of Riga had been reached.

Resuming its march early in 1848, cholera progressed not only in Europe, reaching Norway in the north, the Balkan countries in the south, England, Scotland, and Ireland in the northwest, and Spain in the southwest, but was carried on the one hand to Egypt by way of pilgrims returning from Mecca, and on the other to the USA, reaching Staten Island outside New York, and New Orleans, and continuing to spread—still in the same year—from the latter port far up the Mississippi and also to Texas. Thus,

as stated by Macnamara, " between May and December 1848, cholera had extended its influence from Moscow (37°E longitude) to the southern part of the United States of America (90°W longitude) ". Moreover, a reappearance of cholera at Constantinople led to the invasion of Asia Minor, Syria, Palestine, and possibly even Persia (Haeser).

Following a comparatively quiet spell during the winter, cholera reappeared in the spring of 1849 over the greater part of Europe. The whole of France became involved, the infection spreading from there into Italy as well as to North Africa (Algeria and Tunisia). The ravages of the disease in England were pathetically described by Farr (1852) thus :

" If a foreign army had landed on the coast of England, seized all the seaports, sent detachments over the surrounding districts, ravaged the population through the summer, after having destroyed more than a thousand lives a day, for several days in succession, and in the year it held possession of the country, slain 53,293 men, women and children, the task of registering the dead would be inexpressibly painful; and the pain is not greatly diminished by the circumstance, that in the calamity to be described, the minister of destruction was a pestilence that spread over the face of the island, and found in so many cities quick poisonous matters ready at hand to destroy the inhabitants ".

Justifying the designation of " America's greatest scourge " given to it by Chambers (1938), cholera also caused widespread ravages in 1849 in the USA, where—owing to the appearance of an epidemic in May of that year—New York City had become a most potent centre for the distribution of the infection. Spreading from there, and also continuing its progress from New Orleans, cholera overran practically the whole of the States lying east of the Rocky Mountains and made inroads into Canada which, however, was also invaded by the sea-route directly from Europe. Moreover the infection spread by various routes into Mexico, and was also carried at the end of 1849 by ship from New Orleans to the river Chagres in Panama.

During the year 1850 cholera reappeared in a virulent form in Egypt, and spread from there along the whole coastal area of North Africa. In Europe it was reproduced in most areas which had been visited in 1849 and appeared de novo in Denmark and Sweden in the north, and in the Maltese and Ionian islands in the south. The mainland of Greece was spared on this occasion was well as in 1832 and 1837.

Extensions of the infected areas also took place during 1850 in the Americas. California was reached by ship from Panama to San Francisco and by the overland route to Sacramento. In South America cholera penetrated into Colombia as far up as the plateau of Bogotá and—to judge from somewhat unreliable accounts—also into Ecuador, to become prevalent at Quito (Hirsch).

Besides being prevalent on the American continent, cholera raged in 1850 and again in 1851 with rarely paralleled violence in Cuba and in Jamaica, which then seems to have been visited for the first time. From

Cuba the infection was carried in May 1851 to Grand Canary island, where it caused no less than 9,000 deaths, most of them within the space of a few days.

In North Africa in 1851 cholera was a serious menace only in Morocco. Outbreaks in Europe during that year were restricted to Poland, Silesia, and Pomerania, while elsewhere the pandemic seemed to have subsided. Noting, however, that in 1852 the disease not only reappeared in Poland, but spread from there into some of the adjacent provinces of Russia as well as into Prussia, some writers such as Tholozan (1868) and Hirsch incriminated a persistence of the infection in Poland as the cause of the new pandemic spread of cholera commencing in 1852. Still, while it would be wrong to disregard the merits of this contention, there can be no doubt that much impetus was added to this renewed activity of cholera through a fresh wave of infection starting in India in 1849. The result was that, according to Macnamara,

" at the end of 1852, the inhabitants of the northern and western provinces of Russia were under the influence of the cholera of 1848-49, and the inhabitants of her Caucasian provinces were again subjected to a fresh importation of the disease from western India through Persia".

Third Pandemic (1852)

There can be no doubt that during its course as well as at its commencement the third cholera pandemic was the combined result of local recrudescences due to a temporary entrenchment of the infection and of repeated importations of the disease so that, as noted by Macnamara, it was no more possible to trace its course step by step than could be done in the previous outbreaks.

The main features of the third cholera pandemic from 1853 onwards may be described as follows :

Besides raging in Persia and Mesopotamia, as a consequence of an 1852 outburst in India, cholera was rampant in 1853 in the northern part of Europe and also reached the USA, Mexico, and the West Indies.

In 1854 the infection continued to exact a serious toll in some countries of northern Europe, for example, England, but was particularly rampant on the continent in the south. The transport of troops from southern France, effected on account of the Crimean war, was no doubt responsible for the appearance of cholera in Greece and Turkey. In the west the disease not only raged in most parts of the USA and Mexico, and in some of the West-Indian islands, but also appeared in Canada and in Colombia on the northern shore of South America. The only consoling feature amidst the calamities caused by the infection in 1854, one of the worst cholera years

on record, was that observations made in England clearly showed, to those who were not obsessed by fanciful theories, that contaminated water played a major role in the spread of cholera and that consequently a supply of safe drinking water was of cardinal importance in the prevention of the disease.

Besides reappearing in 1855 in many of the areas affected during the previous year, cholera, which had probably gained impetus through a most serious recrudescence in India, appeared in countries hitherto not, or not seriously, affected during the pandemic. In the near east the infection spread via Arabia into Syria and Asia Minor. In Africa the disease appeared in Egypt, spread into the Sudan and along the north coast as far as Morocco, and also visited, for the first time, the Cape Verde islands. In Europe the infection penetrated into previously unaffected parts of Italy and adjacent parts of Austria and made an inroad into Switzerland. North America was apparently free, but cholera broke out in Venezuela and Brazil.

Except in Spain and Portugal (including Madeira), cholera did not cause much havoc in Europe during the period 1856-8. However, the disease was rampant during these years in India, where the spread of the infection was fomented by the disturbances of the mutiny and the subsequent military operations.

Cholera which, commencing an eastward spread early in the pandemic, had reached Indonesia in 1852 and China and Japan two years later, became most serious in these two empires during the period 1857-9. The Philippines were revisited in 1858, while Korea suffered from the disease in the following year.

Other noteworthy events of the period now under review were (1) four outbreaks of cholera from 1854 to 1862 in Mauritius, and one (1859) in Réunion; and (2) serious inroads of the infection into East Africa where, Zanzibar serving as the main distributing centre, the infection spread along the coast to Mozambique in the south and from there to Madagascar and the Comoro Islands, as well as inland into Uganda. As added by Haeser and Hirsch, cholera, which had already invaded Abyssinia (Ethiopia) in 1853, reappeared there in 1855 and, more markedly, in 1858.

In the Americas cholera manifestations were recorded in 1856 in various parts of Central America, and during that and the following year also in Guiana.

In 1859 cholera showed signs of a much increased activity, ushered in by a serious recrudescence of the infection in Bengal. From India the disease spread, following its old routes, westwards into Persia, Mesopotamia, and Arabia, and in a north-western direction into Russia. It is uncertain, however, to what extent the outbreaks subsequently taking place in that country, as well as in other parts of Europe (Sweden, Denmark, Mecklenburg-Schwerin, western Prussia, the Netherlands, and Spain) were due to this fresh importation or to the local reactivation of latent infections.

Probably being imported from Spain, the infection appeared in 1859 also in some ports of Morocco and Algeria.

Apart from a serious recrudescence in Spain in 1860, in the course of which Gibraltar became involved, and slight cholera manifestations in St. Petersburg, where the infection seems to have lingered on until 1864, Europe seems to have become free from cholera at the end of 1859.

Fourth Pandemic (1863)

The fourth pandemic, beginning in 1863 and lasting, according to Haeser until 1873 or, as maintained perhaps more appropriately by Hirsch and Sticker, until 1875, stood in marked contrast to the previous pandemics because, as summarized by Haeser,

" cholera did not penetrate into the heart of Europe as previously over its ancient paths through Persia, the Caspian sea ports, etc., but by new traffic routes which had been created in the meanwhile : over Arabia into Egypt, Constantinople, southern France and Italy". [4]

Opinions as to how and when Mecca was reached by cholera from India during the initial stage of the pandemic were at variance. It was claimed that the disease had been brought to Arabia by pilgrims reaching Jidda by ship from India or even Malacca, but Macnamara, while not denying that this might have been the case, declared that

" to attach undue importance to such incidents to the neglect of those broader features presented by the disease in its course from Bengal into Arabia and the Hadjiz, is to complicate the subject, and tends to withdraw our attention from the major to minor details in the history of this remarkable epidemic".

Whether cholera was already present in Mecca at the time or was imported in 1865 only, it is certain that conditions for a rapid spread of the infection were particularly favourable in that Jubilee year, when extraordinarily large numbers of pilgrims were assembled. The outbreak taking place in May 1865 was, therefore, of extreme violence, Macnamara stating that probably, including those who succumbed at Jidda, not less than one third of the 90,000 pilgrims assembled at and near Mecca fell victims to the disease.

The infection was carried from Mecca by returning pilgrims to other parts of Arabia, Mesopotamia, Syria, and Palestine as well as—most fatefully—by the sea-route to Suez which was by then connected with Alexandria by a railway. As a consequence cholera broke out in the latter city

[4] " Von der grössten Wichtigkeit wurde in dieser Pandemie der Umstand, dass die Cholera von Indien her, nicht wie seither, vorzugsweise auf ihren alten Pfaden, über Persien, die Häfen des kaspischen Meeres u.s.w., nach dem Herzen von Europa gelangte, sondern auf den inzwischen ins Leben getretenen neuen Verkehrswegen : über Arabien nach Aegypten, Konstantinopel, das südliche Frankreich und Italien."

at the end of May or early in June. Though the epidemic ensuing there was not particularly severe, Alexandria became a distributing centre from where the infection was carried by refugees into other parts of Egypt and by steamer to several Mediterranean ports, among which Istanbul, Smyrna, Ancona, and Marseilles became the most important subsidiary distributing centres.

From Istanbul, which had already been reached in July 1865, the infection spread over Turkey as well as southwards to Asia Minor, Cyprus, Rhodes, and some of the Ionian islands, and north-westwards into Bulgaria, Romania, and apparently also into the (then) Austrian province of Bukovina.

Russia was invaded by different routes from the south but nevertheless suffered little in 1865 and early in 1866, the infection remaining restricted to six governments.

However, having entered through Ancona, cholera became serious in southern Italy, including Sicily. The infection also became fairly widespread in France, where Paris became affected in September 1865, but there were only about 10,000 victims in the whole of the country. Persisting through the winter, cholera reappeared in 1866 in many parts of France. In 1867 only a few of the formerly affected districts suffered to a slight extent.

Spain, infected in July 1865 by a traveller arriving in Valencia from Alexandria via Marseilles, suffered appreciably, but the disease became sporadic in 1866 and then disappeared. An extension of the infection from Spain into Portugal led to outbreaks only in a few places. Cholera also did not assume serious proportions in 1865 in England. An invasion of Luxembourg in the same year was of importance in so far as an exacerbation of the situation there in 1866 led to an appearance of cholera outbreaks in the Rhineland-Palatinate and Westphalia in 1866 and 1867.

Curiously the infection also appeared in the autumn of 1865 in Saxony, having been imported by a woman who arrived in Altenburg with her cholera-affected child from Odessa and soon fell a victim to the disease. 468 cases resulted.

While cholera showed but little activity during the winter of 1865-6, the infection flared up once more in the spring of the latter year, thus ushering in a season which Haeser considered as one of the most distressing episodes in the history of epidemics. How far the ravages then caused by cholera in Europe were due to renewed importations of the infection from the east and not to local recrudescences, is difficult to decide, the more so as the data supplied regarding this question by Haeser and by Macnamara respectively show a marked discrepancy. No doubt can exist that the war waged by Prussia against Austria and her allies, as well as the hostilities between Austria and Italy, exerted a most unfavourable influence on the cholera situation in central Europe.

In Russia cholera extended its sway from the Caucasus as far as St. Petersburg and from Orenburg to the western border of Poland, claiming in 1866 a toll of more than 90,000 lives. The disease reappeared in the spring of 1867, but caused much less havoc.

With the exception of Sweden, which recorded 4,503 cholera deaths, the Scandinavian countries suffered little in 1866. In Germany, on the contrary, epidemics breaking out in several regions caused a great loss in lives, the cholera deaths in Prussia alone amounting to almost 115,000. The situation was also most serious in war-torn Austro-Hungary, resulting in a cholera mortality of about 80,000 in Bohemia and Moravia, while other parts of Austria also suffered, and 30,000 succumbed to the disease in Hungary. In Italy there was a serious cholera recrudescence in 1866, for which the military operations were largely responsible. During that year cholera also led to almost 20,000 deaths in the Netherlands and over 30,000 in Belgium. In Great Britain cholera became manifest in many places but usually did not spread, so that the death toll from the disease totalled not more than 14,378, 5,596 succumbing in London, 2,501 in Ireland, and 1,170 in Scotland.

Generally speaking, cholera was far less severe in Europe in 1867 than during the previous year. An exception was formed in Italy, where widespread epidemics, involving even Sardinia, led to 130,000 deaths. Importations of the infection from Italy led to cases or limited outbreaks in Switzerland. In 1868 cholera reappeared in only a few European localities, particularly in Essen (North-Rhine, Germany), and in Reggio di Calabria and Messina (Italy).

Besides raging in Europe and, as will be discussed below, in the Americas, during the period now under review cholera showed an amazingly extensive spread in Africa.

An importation of the infection, apparently from Bombay via Aden, taking place in 1864, led to an invasion of Somaliland, where cholera caused great ravages in 1865.

In February 1865 the infection was carried across the Red Sea from Jidda to Suakin and Massawa and penetrated from there into Abyssinia (Ethiopia). Continuing a southward course, cholera eventually (1869) reached the region of the Kilimanjaro and spread from there in various directions, particularly (*a*) south-westwards to and across Lake Tanganyika to invade finally in 1870 the upper reaches of the Congo River, and (*b*) south-eastwards to Zanzibar island where, in 1869, 70,000 persons succumbed to the disease.

Progressing also from the south end of Lake Tanganyika along trade routes on the western shore of Lake Nyasa, cholera reached, in May 1870, the city of Mozambique. This port, like Zanzibar, became a distributing centre of the infection, which was thus carried to the Comoro Islands, Madagascar, and the Seychelles.

The countries on the Mediterranean shore of Africa, which also were ravaged by cholera during the period under review, seem to have been invaded by various routes. Thus it was claimed that in 1867 cholera was imported into Tunisia by smugglers from Sicily, while the infection of Algeria in 1865 was probably derived from France. The Algerian invasion culminated in an outbreak taking place in 1867 and alleged to have caused 80,000 deaths.

Similarly Morocco, though already infected through pilgrims returning from Mecca in 1865, had its most violent outbreak in 1868, when the disease, imported from Algeria, seems to have progressed from the hinterland towards the coast.

In 1868 cholera, carried probably by caravans from Morocco, appeared at Podor on the Senegal River in French West Africa and then progressed to St. Louis. From there the infection spread, via MacCarthy Island, to Bathurst in Gambia and Bissau in Portuguese Guinea (1869). According to Macnamara, at Bathurst cholera carried off 1,700 victims out of a population of about 5,000.

During the period 1865-70 cholera became epidemic in several West-Indian islands—first, imported from Marseilles, in Guadeloupe, where it claimed in 1865-6 almost 12,000 victims among a population of about 150,000, then in Santo Domingo (1866), St. Thomas (1868), and Cuba (1867-70).

Whether cholera reached the USA in 1865 or in 1866 is uncertain. Chambers considered it as possible that the infection, imported by several ships from Le Havre, appeared at New York in the autumn of the former year, but was soon suppressed by the cold weather. The onset of a serious outbreak in May 1866 might, therefore, have been the result of a recrudescence of the infection and not of its recent importation by cholera-affected ships, particularly the German steamer " England ", as assumed by Haeser. It is certain that cholera was rampant in New York during the summer and autumn of 1866, the official figure of about 2,000 deaths being probably far below the mark.

The further spread of the infection in the USA was facilitated by a considerable extension of the railways into the interior of the country, which had taken place since 1849. An even more ominous role in the spread of cholera there during 1866 was played by troop movements due to the reorganization of the army after the war between the States. Military encampments like that at Newport, Kentucky, thus became subsidiary distributing centres of the infection, in addition to several of the major cities such as New Orleans, where the disease, probably imported by troopships from New York, appeared in July and, lasting until October, claimed a toll of about 1,200 lives.

In contrast to previous outbreaks, the role of New Orleans as a distributing centre was limited because, as aptly stated by Chambers,

" trains from the Eastern ports outstripped the steamboats to Cincinnati, Louisville, Chicago and St. Louis in carrying the seeds of the scourge, just as they were winning the race for the commerce, travel and romance of the upper interior valley ".

However, transport of the infection by ships, particularly by vessels carrying troops, was responsible for the appearance of cholera in several localities of Louisiana as well as of other southern States, including Texas.

This spread of the disease by the railway traffic was responsible for the appearance of cholera in the middle west as far as Kansas. A solitary case observed at Albuquerque, New Mexico, indicated, according to Chambers, the western limit of the 1866 invasion.

Though, as estimated by this writer, the number of cholera deaths occurring in the USA during 1866 possibly amounted to 50,000, it deserves attention that, according to him,

" even so the mortality in '66 did not compare to that of previous epidemics. While estimates for the whole country were not even attempted for either of the previous epidemics, in '33 a mortality of 5 percent, 10 percent or even 15 percent of the population of a locality was not unusual; the mortality in '49 seldom reached 10 percent; while in '66 we know of no considerable community where the mortality reached 5 percent ".

As was to be expected, in 1867 a recrudescence of the infection was observed in many of the principal cities which had suffered from cholera during the previous year. With few exceptions, however, these manifestations were restricted to a few or a limited number of cases. A major outbreak took place at New Orleans which suffered at the same time from yellow fever. While the latter disease claimed over 3,000 lives, the number of cholera cases was restricted to 575. Some spread of cholera from New Orleans to adjacent territories took place, apparently brought about mainly by troop movements.

While Canada remained almost free from the infection during the period under review, an importation of the disease from New Orleans led to cholera manifestations in Central America (Nicaragua and British Honduras) from 1866-8. At the same time the disease, becoming first entrenched among Paraguayan troops engaged in war against combined forces of Argentina and Brazil in April 1866, reached, in the autumn of that year, the Argentinian city of Corrientes. A recrudescence of the infection there early in 1867 led to a spread of cholera down the Paraná River, in the course of which Buenos Aires was reached in December. In 1868 Uruguay also became affected. Involvement of the interior provinces of Argentina in 1869 led to an overland invasion of Bolivia and Peru, where the disease spread from the hinterland to the coast. As maintained by Hirsch, in contrast to Haeser, this was the first appearance of cholera on the west coast of South America.

In addition to the above-mentioned countries, Brazil became invaded by cholera in April 1867. Entering from Paraguay, the infection spread

in the States of Rio de Janeiro and Rio Grande do Sul and again became prevalent in 1868.

While, as noted above, in 1868 cholera became manifest in only a few places in central Europe and the west of the continent remained free, the infection continued to persist during that and the following year in Russia, but did not, as a rule, cause much havoc. A moderately severe epidemic taking place at Kiev in August 1869 was, in the opinion of Macnamara, possibly the result of a re-importation of the infection from Persia where cholera raged perennially from 1865-71. It is noteworthy, however, that a minor outbreak had already taken place in Kiev in 1868.

Cholera was more active in Russia during 1870 when 37 governments suffered. In the following year the disease raged in practically all parts of European Russia as well as in the Tobol'sk and Tomsk governments of Siberia, claiming a total death toll of 130,000. Almost the same mortality was recorded in 1872, when the southern and western governments in particular were involved. In 1873 there were but few outbreaks in Russia proper, but cholera remained active in Poland during that and the following year.

During 1871 cholera spread from Russia in various directions. Southwards the infection was carried to Black Sea ports in Romania and Bulgaria and also to Istanbul and Trabzon in Asia Minor. Manifestations of the disease in other localities of Asia Minor and in Egypt in 1871 and 1872 stood probably in causal connexion with these invasions. Cholera also became prevalent in Romania in 1872 and, more markedly, in 1873, when the infection spread into Bulgaria and from there to a slight extent also to Salonica.

Westwards, cholera spread in 1871 from Russia to (*a*) Finland and Sweden, where no major spread took place; (*b*) Prussia; and (*c*) the Austrian province of Galicia.

The infection spread in Prussia during the summer of 1871 as far as Berlin and also reached Hamburg, but except in East Prussia no major outbreaks resulted. While during the year 1872 cholera remained sporadic in the easternmost part of Prussia, major outbreaks, causing a total death toll of 33,156, took place in 1873 in many parts of Germany, including, besides Prussia and Hamburg, Bavaria, Württemberg-Baden, and Hesse. During the winter of 1873-4 cholera remained manifest in Bavaria (particularly in Munich) and in a district of Prussian Silesia, where a major outbreak resulted in the spring of 1874.

Austria had serious outbreaks in 1872 and, to a much lesser extent, in 1873. Hungary suffered severely during these two years, when cholera claimed a total of 190,000 victims.

Though repeated importations of the infection into Great Britain took place during the period under review, it was invariably possible to prevent a spread of the infection. Similarly, the appearance of sporadic cases in the Netherlands and Belgium did not lead to serious consequences.

Slight outbreaks were noted in 1873 in Sweden and at Bergen in Norway. In France cholera appeared at Paris as well as in several districts, a major epidemic developing at Caen.

In the USA, New Orleans and the Mississippi basin became once more seriously involved during the year 1873.

Besides India, where cholera raged with particular violence in 1875 (364,755 deaths), other eastern territories suffered severely during the concluding years of the pandemic.

An exacerbation of the cholera situation in Persia where, as noted above, the infection had become entrenched since 1865, led to most violent outbreaks in 1870 and to a spread of the infection into Turkish Kurdistan, Mesopotamia, and Arabia.

During 1871-2 the infection, derived possibly from Persia, besides progressing westwards to Egypt, spread in an eastern direction into Bukhara and Russian Turkestan.

A reappearance of cholera at Mecca in 1872 resulted in an invasion of cholera via Suakin into the Sudan.

It also deserves mention that in 1875 Syria was devastated by a cholera outbreak of unknown origin.

To judge from scanty information, the regions in Asia to the south-east and east of India repeatedly suffered from cholera throughout the pandemic now under review. As stated by Wu Lien-teh et al., in 1862 the disease was widespread in China, reaching Peking and Manchuria. Thousands of people were stated to have fallen victims to the infection in Shanghai.

According to Hirsch, disastrous epidemics, connected probably with the serious exacerbation of the cholera situation in India in 1863, occurred in the "East Indies" (Indonesian archipelago) in 1863 and 1864, and in China and Japan in 1864-5.

Prevalence of the infection in Thailand and Malaya led in 1873 to most serious inroads of cholera into Sumatra, Java, and Madura. From Singapore, which seems to have acted as the main distributing centre, the infection was also carried to Borneo and—directly or indirectly—to Manado on Celebes.

As far as the records collected by Wu Lien-teh et al. go, the incidence of cholera in China was not particularly heavy during the last years of the pandemic. Whether the disease was present at that time in Japan could not be established.

However, most serious outbreaks took place there in 1877-9, in which latter year 158,204 cases with 89,207 deaths were recorded.

Fifth Pandemic (1881)

Although, notwithstanding the wide areas over which it held sway, the fifth cholera pandemic, customarily stated to have lasted from 1881 to 1896, caused considerably less havoc than its predecessors, it marks a most important epoch in the history of this disease. For in 1883-4 Koch, studying the outbreaks then rampant in Egypt and Calcutta, was able to prove that, as had been suspected before by some advanced thinkers, cholera was the result of a specific gastro-intestinal infection.

The main features of the pandemic may thus be outlined :

As the result of a serious exacerbation of the cholera situation in India, which led in 1881 to violent outbreaks in the Punjab, especially in Lahore, the infection was carried to Mecca, where epidemics occurred in that as well as in the following year. In 1883 cholera, possibly already imported during the previous year by pilgrims returning from Mecca (Hussein) became epidemic in Egypt, first at Damietta, situated at one of the mouths of the Nile not far from Port Said, where at the time a fair was in progress. Spread initially by infected persons fleeing from Damietta, the disease broke out in Cairo, Alexandria, and other places, claiming—according to Hussein—58,511 victims in the country.

In Europe cholera remained during the early years of the pandemic practically confined to France, Italy, and Spain. In the first-mentioned country it assumed epidemic proportions in April 1884 at Toulon, and this outbreak was soon followed by small epidemics in other places, including Marseilles and Paris, the total number of cases recorded during the year in France amounting to about 10,000 with a mortality of 50% (Sticker). Cholera reappeared in France in 1885, mainly in localities afflicted during the previous year. In 1887 a small outbreak (7 cases with 4 deaths), due to the arrival of an infected sailing vessel, took place on the island of Yeu in the Bay of Biscay (In der Beeck, 1948).

Though an attempt was made to protect Italy through quarantine measures, cholera became widely spread there in 1884, but caused great havoc only at Naples where, in August and September, over 10,000 cases and more than 5,000 deaths were recorded. The infection persisted in Italy and again became widespread in 1886 and 1887, but no further major epidemics developed.

Spain did not suffer severely from cholera in 1884 (592 deaths), but in the summer of 1885, when the provinces of Valencia and Murcia in particular became afflicted, the case incidence rose to 160,000 with almost 60,000 deaths. The country was once more visited by cholera in 1890.

Though cases were repeatedly imported into Great Britain, the infection invariably failed to entrench itself, both because adequate measures were taken and because wholesome water supplies (" eine für alle Zwecke der

Reinlichkeit genügende Wasserversorgung" (M. Pettenkofer, quoted by Pertl, 1940)) were available.

An importation of cholera into New York by way of an infected steamer arriving in October 1887 from Marseilles and Naples was averted by the rapid establishment of a correct diagnosis through laboratory methods. As maintained by Chambers, this had been the first occasion "to put bacteriology to practical use in combating an invasion by the scourge".

However, although the disease failed to gain entry into North America, serious outbreaks during the period under review took place in South America (Argentina, 1886 and 1888; Chile, 1887 and 1888).

Violent cholera outbreaks in 1892 in Afghanistan and Persia, where the infection had found a temporary home, led to an invasion of Russia via Baku. The infection once more reached Moscow and St. Petersburg and extended to the western confines of the country. Continuing to exist in 1893 and 1894 (when serious outbreaks took place in the Volyniya-Podolsk area), cholera is estimated to have claimed 800,000 victims in Russia during this period.

In 1892 cholera became widespread not only in Russia but also in Germany and France; it assumed serious proportions only at Hamburg, however, where an explosive outbreak, due no doubt to the distribution of unfiltered Elbe water by the waterworks, took place. The incidence of the disease in Hamburg and its suburbs, where this water was utilized, was therefore incomparably higher than that in two adjacent communities obtaining their water supplies from other sources, as is shown by the following data, quoted by Sticker :

Locality	*Number of inhabitants*	*Number of cases*	*Cases per mille*	*Number of deaths*	*Deaths per mille*
Hamburg and suburbs	579,904	19,891	34.3	7,582	13.0
Altona	143,249	572	3.9	328	2.3
Wandsbeck	20,571	64	3.1	43	2.0

Cholera appeared in more than 250 other German communities besides Hamburg, but since the cases remained mostly sporadic, the total number in these places was restricted to 1,048, with 607 deaths (Sticker). The reappearance of the disease in Germany during the following years also caused little havoc, the case incidence in 1893 being 915 (with 396 deaths) and that in 1894, when the eastern parts of the empire alone were involved, amounting to 1,004 (with 490 deaths).

As stated by In der Beeck, cholera appeared in 1892 in the northern departments of France (including Paris and its vicinity) but did not assume epidemic character. In the following year it was mainly the southern parts of the country that were affected, but in most of the 33 departments involved there were only sporadic cases or at most small outbreaks. In 1894 sporadic cases alone were noted in Toulon, Marseilles, and Paris.

Though, as described by Chambers, eight badly infected ships arrived in New York harbour during 1892, adequate measures, facilitated by the opening of a city health laboratory, rendered it possible to keep the infection at bay, with the result that none of the 10 cases occurring in the city led to the establishment of a focus.

However, as earlier in the pandemic, cholera appeared in South America, involving Brazil in 1893-5, Argentina in 1894 and 1895, and Uruguay in 1895. Still, as stated by Sticker, the infection invariably failed to entrench itself in these countries (" es blieb bei kraftlosen Anfängen, die rasch von selber erloschen ").

In Africa, according to a table furnished by Kolle & Schürmann (1912), the following countries recorded cholera manifestations during the period under review :

Year	*Countries*
1893	Tripolitania, Tunisia, Algeria, Morocco, French West Africa
1894	Sudan, Tripolitania, French West Africa
1895	Egypt, Morocco
1896	Egypt

However, with the exception of the 1896 outbreak in Egypt which caused over 16,000 deaths (Hussein, 1949), no considerable epidemics resulted.[5]

Throughout the pandemic, cholera not only continued to be prevalent in India, but appeared frequently or even perennially in the countries to the south-east or east of India. Besides outbreaks in Annam taking place, according to Wu Lien-teh et al., in 1882, cholera manifestations in South-east Asia were recorded by Kolle & Schürmann thus :

Year	*Countries affected*
1888, 1889	Indonesia (" Sunda Islands ")
1890	Indonesia
1891	Ceylon, Thailand, Straits Settlements, " Sunda Islands "
1896	Java

Cholera was also reported to be present in Thailand and Indonesia during 1897.

In China the infection appears to have been particularly widespread from 1881-3 as well as in 1888 and—to a lesser degree—in 1890 and 1895, while the presence of the disease in Korea in 1881, 1888, 1890, 1891, and 1895 was noted by Wu Lien-teh et al.

Cholera epidemics in Japan during the period under review took place, according to Takano et al., in 1881 (9,000 cases), 1882 (more than 50,000 cases), 1885 (13,772 cases), 1886 (155,000 cases), 1890 (46,000 cases), 1891 (11,000 cases), and 1895 (over 55,000 cases).

[5] As stated by Simmons et al. (1944), in 1891 cholera occurred in the Setit River region of Eritrea. According to the same authors the last cholera outbreak in Ethiopia occurred in 1892-3.

An outbreak at Manila in 1882 was mentioned by Hirsch. The presence of the disease in the Philippines was also recorded in 1888 and 1889 (Kolle & Schürmann).

Sixth Pandemic (1899)

The appearance of the sixth cholera pandemic, which may be said to have lasted until 1923, stood, no doubt, in causal connexion with a most marked exacerbation of the cholera situation in India. It is true that, as pointed out by Sticker, after the fifth pandemic the disease had not totally disappeared from western Asia and even Egypt, but a local recrudescence from foci of the infection which possibly continued to persist in western Asia could, at most, have been of auxiliary importance.

This exacerbation of the cholera situation in India, commencing in 1899, led in 1900 to violent outbreaks in Calcutta and Bombay, followed, until 1904, by a prevalence of the disease in the south of the sub-continent, particularly in the Presidency (now State) of Madras, as well as in the north. That the infection possessed from the first a great tendency to spread beyond the confines of India is shown by a westward extension of cholera into Afghanistan and the Persian Gulf areas, taking place in 1900, and by the invasion of Burma and Singapore in 1901 which, as is described on page 455, led to a further spectacular progress of the disease eastwards in the following year.

Simultaneously with this spread to the east, cholera was carried in 1902 by the maritime route, presumably by pilgrims who left Madras, to the port of Jidda and from there to Mecca, where an outbreak beginning in the last week of February killed 4,000 of the assembled multitude. Though every possible precaution was taken, it provided impossible to prevent an invasion of Egypt, where the disease, imported in some manner never elucidated, became first manifest in Asyut and then spread, claiming within three months almost 34,000 victims (Hussein).

In what way the infection penetrated early in this pandemic into Russia, is difficult to decide. In the opinion of Sticker, an invasion of Syria, taking place via the Sinai Peninsula in 1903, was responsible for the appearance of cholera in the same year not only in Palestine, Asia Minor, and on the Black Sea coast, but also in Mesopotamia and Persia, from which latter country the disease was imported in the spring of 1904 by caravans via Samarkhand into Baku on the Caspian Sea. It is certain that cholera, becoming epidemic in this port in September 1904, spread in the same year still westwards into Transcaucasia, northwards via Astrakhan up the Volga as far as Samara (now Kuibishev), and, according to Sticker, also into western Siberia. In 1905 cholera remained restricted to the valleys

of the Ural, Volga, and Don rivers, while the infection seems to have become quiescent in 1906. In the following year, however, the disease became once more epidemic in the Volga basin and spread in 1908 (*a*) as far as St. Petersburg and some of the Baltic ports; (*b*) to several Black Sea ports; and (*c*) eastwards into Transcaspia, Turkestan, and Siberia. The cholera incidence slightly abated in 1909 but, as shown by table II, rose in 1910 to over 230,000 cases with almost 110,000 deaths, particularly severe epidemics being noted in Jekaterinoslav (18,894 cases), St. Petersburg (4,591 cases), Kiev (4,077 cases), and Orenburg (3,355 cases). Cholera caused no great havoc in Russia in 1911 and appears to have become sporadic during the following two years. However, as shown by the adjoined table, the disease again became widespread during the first World War, particularly in 1915, and, being also frequent in 1918 and 1920, showed a terrifyingly high incidence in 1921. 1922 was still a bad cholera year, but there was a marked decline in 1923, while only sporadic cases were noted in 1924 and 1925. Since then Europe has remained free from cholera.

TABLE II. CHOLERA INCIDENCE IN EUROPEAN RUSSIA FROM 1902 TO 1925*

Year	Cases	Deaths	Year	Cases
1902	2,167	1,393	1914	9,716
1903 †			1915	66,455
1904	9,226	6,860	1916	1,800
1905	598	286	1917	130
1906 †			1918	41,586
1907	12,703	6,244	1919	5,119
1908	30,705	15,542	1920	29,615
1909	22,858	10,677	1921	207,389
1910	230,232	109,560	1922	44,049
1911	3,416	1,646	1923	1,114
1912	9	3	1924	Sporadic cases only
1913	324	149	1925	

* After Olzscha (1939)
† No records available

The orbit within which the prevalence of cholera during the period under review led directly or indirectly to the invasion of western countries was far more limited than had been the case in previous pandemics. The infection failing to penetrate into the Americas, the westernmost point reached by the disease was Madeira, which was affected in October 1910 through the arrival of a steamer with unreported cases among immigrants

en route from Russia to South America. Lasting until February, this epidemic claimed—according to the official records—600 victims among 1,769 patients (Goldschmidt, 1910).

The visitations of western Europe by cholera during the sixth pandemic were restricted to the appearance of sporadic cases or, in the rare cases where a spread of the infection did take place, to abortive outbreaks. Thus, importation of the disease into Rotterdam in 1909 led to only 26 cases with 6 deaths among the population of the port, and to isolated occurrences in 18 other communities of the Netherlands (Sticker).

Though also causing considerably less havoc than on previous occasions, cholera at times during the sixth pandemic assumed quite serious proportions in central and south-eastern Europe. In Italy, where insignificant manifestations had been observed in 1909 in Apulia and at Naples, there were considerable outbreaks during the two years following. In the summer of 1910 the infection, stated to have been recently imported via Brindisi through gipsies coming from Russia, claimed within a few weeks 1,400 victims, but, as in 1909, remained restricted to the south of the country. In the summer of 1911 cholera became manifest in all parts of Italy, including Sicily, but assumed serious proportions in only a few of the numerous affected localities.[6]

In Hungary, where, as in several other European countries, cholera had been sporadic in 1909, a few epidemics took place in the following year and again in 1913. There, as in Austria, importations of the infection through Russian (and later also through Serbian) war prisoners led to a quite serious cholera situation during the first World War (1914-6). In November 1914 Austrian troops, who had come from the Volyniya-Podolsk area, were instrumental in bringing the infection into Prussian Silesia, but no serious outbreak resulted. However, as in the case of Austro-Hungary, transports carrying Russian prisoners of war were responsible for the importation of cholera into the interior of Germany, where the disease became manifest in and near prison camps situated in various parts of the country. Still, as stated by Krehnke, the number of cholera victims among the civilian population of Prussia from 1914-8 totalled less than 60. Except among troops stationed in Turkey, the incidence of the disease in the German army, which had been systematically vaccinated against cholera, remained low.

As shown by table III, cholera outbreaks during the period under review were quite frequent and often serious in the Balkan peninsula, where the spread of the infection was facilitated by the local wars taking place in 1912 and 1913 and also to some extent by the first World War.

In south-west Asia during the period under review cholera manifestations continued to be frequent in Arabia and Persia. A particularly violent

[6] The prevalence of cholera in Italy was presumably responsible for the appearance of an epidemic in Tunisia in 1911, in the course of which 733 cases occurred.

outbreak, due, apparently, to the arrival of pilgrims by ship via Odessa, arose in Mecca at the end of 1907 and claimed in 1908 more than 25,000 victims in the Hejaz (Sticker). Further appearances of the disease in Arabia were recorded in 1909 (Hejaz), 1910 (Mecca), 1911 (major outbreak involving Mecca), and 1912. According to Duguet, Mecca and the Hejaz as a whole have remained free from epidemic cholera since then.

TABLE III. CHOLERA OUTBREAKS IN THE BALKAN PENINSULA, 1910-22 *

Year	Countries affected
1910	Greece, Turkey
1911	Bulgaria, Greece, Montenegro, Romania, Serbia, Turkey †
1912	Bulgaria, Turkey †
1913	Bulgaria, Greece, Romania,† Serbia,† Turkey
1914	Bulgaria, Serbia †
1915	Serbia
1916	Albania, Bosnia and Herzegovina,† Corfu, Turkey
1917	Turkey (Istanbul)
1918	Macedonia
1919-20	Turkey (Istanbul)
1922	Greece (Athens), Romania

*** Largely based on data from Kolle & Schürmann (1912) and Kolle & Prigge (1928) ; Greece is included for 1913 on the authority of Savas (1914)**

† Major outbreak

In Persia cholera appears to have been rampant in 1906 but seems to have caused no great havoc when re-imported from the north in 1908 (Sticker). Further manifestations of the disease in Persia were recorded in 1911, 1912, perennially from 1914-9, and also in 1922-3.

No doubt fomented by the first World War, cholera was rampant in Turkey-in-Asia in 1916. After the war outbreaks were recorded in Mesopotamia in 1918 and 1919 as well as in 1923 (Heggs, 1938), and in Palestine in 1918.

As noted already, the great activity displayed by the infection before the beginning of the sixth pandemic in India led to a rapid spread of the infection south-eastwards and eastwards. The invasion of Burma and Malaya in 1901 was thus followed in 1902 by a spread of cholera over most parts of the Far East as far as China and Manchuria, Korea, Japan, and the Philippines. It is possible, however, that in some of the countries then invaded the new wave of infection merely reactivated already existing cholera

TABLE IV. YEARS OF HIGH CHOLERA INCIDENCE IN SOUTH-EAST ASIA†

Year	Burma	Indo-China	Thailand	Federation of Malaya	Java	China	Korea	Japan	Philippine Islands
1902								* 8,164	
1903	* 8,233								
1904									
1905	* 5,347								
1906	* 7,872								* 6,067
1907	* 7,678							* 1,702	
1908	* 11,911								* 17,770
1909	* 11,389					*	*		* 8,566
1910								* 1,957	* 7,202
1911		* 3,833	*		*				
1912	* 7,186	* 12,028	*		* 5,511			* 1,683	
1913					* 2,040				
1914				*					
1915	* 17,597	* 6,326							
1916		* 6,987						* 6,260	* 7,986
1917									* 8,723
1918					* 9,864				* 6,340
1919	* 13,260	* 4,798	* 10,277		* 8,861	*			* 17,537
1920			* 2,748					* 3,426	
1921		* 2,838							
1922	* 5,047								

† Where mortality records are available, figures are given.

foci. Be this as it may, it is certain that in most of the countries involved outbreaks continued to be frequent or even perennial, though varying in extent and severity. As far as can be gathered from the compilations of Kolle & Prigge (1928), Swaroop & Pollitzer (1952), and Wu Lien-teh (1934), particularly serious outbreaks took place as shown in table IV.

As will be noted, in some of the countries concerned the cholera situation was particularly serious in 1908 and/or 1909. It is interesting to note that these bad cholera years were preceded by a period lasting from 1905 to 1908, during which cholera was particularly rampant in India, as shown by the following figures.

Year	*Cholera deaths in India*	*Year*	*Cholera deaths in India*
1904	189,855	1907	400,024
1905	439,439	1908	579,814
1906	682,649	1909	227,842

The cholera mortality in India once more exceeded half a million annually in 1918 (556,533 deaths) and in 1919 (565,166 deaths). As shown by table IV, the cholera mortality in Java became quite unusually high during these two years, while 1919 was a bad cholera year for Thailand and China. It is, however, difficult to decide whether these parallel developments indicate more than coincidences.

Conclusion

When trying to deal in a summary manner with the geographical distribution of cholera throughout the world, it is far easier to refer to the few areas unaffected by this scourge than to enumerate the many countries where the presence of the disease has been recorded. Generally speaking, it may be maintained that the infection has not penetrated into the northernmost and southernmost parts of the globe. Accordingly, it may be noted that in Asia, northern Siberia and Kamchatka have been spared and the same holds true of the most northern parts of western Europe (Iceland, the Faeroe, Shetland, and Orkney islands, the Hebrides, Norway north of Bergen, and Lapland) as well as the North American regions beyond the 50th parallel, including Newfoundland (a major part of which, however, lies south of that degree of latitude) and Greenland. Similarly, cholera, though occasionally imported into South African ports, for example, in 1890 into Durban (Clemow), invariably failed to entrench itself, while the countries on the west coast of Africa south of Portuguese Guinea appear to have remained altogether free from the infection. In South America also cholera has remained absent from the southernmost parts of Chile and Argentina, and from the Falkland islands. However, the appearance of the disease in the Archangel government situated on the White Sea in European Russia forms an interesting exception to this rule.

Besides the areas mentioned above, some islands such as St. Helena and Ascension, and the Bermudas, situated well away from continents, have remained exempt from cholera invasions. Further, as will be discussed in a later study, certain circumscribed localities situated within cholera-affected or even cholera-endemic areas, have for various reasons remained free from inroads of the infection.

It is no doubt true that cholera was far more frequent in areas situated north of the equator than in the southern hemisphere but, as shown by the frequency of violent manifestations of the infection in Indonesia and the repeated appearance of the disease south of the line in Africa and America, this unequal distribution cannot be due to factors of a strictly epidemiological nature.

An interesting question arising in this connexion is whether cholera ever gained an entry into the Pacific areas. As noted above, the claim of an inroad of the infection into western Australia deserves little, if any, credence. Lack of other pertinent information makes it also difficult to accept the statement of Simmons et al. (1944) that the disease was present during the 19th century in the Japanese Mandated Islands (Marianas or Ladrone Islands, the Caroline Islands, and the Marshall Islands), while the true nature of a few cases reported there in 1929-30 seems rather questionable. However, it deserves attention that, as asserted by Sticker, cholera was imported in 1893 into (German) New Guinea and continued to occur there without causing major havoc and that in 1896 the infection also gained a foothold in the Bismarck Archipelago and the island of New Britain, areas situated comparatively near the frequently cholera-affected Indonesian archipelago.

Although fairly reliable figures are occasionally available, it is—as justly maintained by Haeser—altogether impossible to determine with even approximate accuracy the global mortality caused by cholera during the above-described pandemics. Nor is it possible to arrive indirectly at a reliable estimate by establishing in a generally valid manner the relation existing between the incidence of the disease, or the fatalities caused by it, and the number of the inhabitants of the affected localities. This is impracticable not only because the percentage rate of cases and deaths was apt to show marked differences in different outbreaks, but also because quite often a panic flight of the people from cholera-stricken places led to a great reduction of the individuals actually at risk, while in other instances the presence of pilgrims or other non-residents resulted in a marked increase of the fuel available for the infection.

However, even though exact information is often lacking, there can be no doubt that, as asserted by Haeser, the loss in lives caused by cholera during the rather short course of its known history must be counted in millions. Great as this death toll must have been, it cannot compare in any way with the mortality caused in the past by plague, which is supposed

to have killed 100 million people during the pandemic taking place in the 6th century and to have caused the death of 25 million in Europe alone at the time of the Black Death. It is, however, of great importance to note that, as indicated by the figures for India given in table V, there is reason to assume that the number of fatalities caused by cholera is now greatly in excess of the death toll exacted by plague.

TABLE V. DECENNIAL MORTALITY FROM CHOLERA AND PLAGUE IN INDIA, 1909-48 *

Decade	Cholera deaths	Plague deaths
1909-18	347,068	422,153
1919-28	250,246	170,272
1929-38	188,190	42,288
1939-48	202,195	21,797

* After Swaroop & Pollitzer (1952) and Pollitzer (1954)

It must be admitted that the great reduction in the incidence of plague —evident not only in India but also in most other still-affected parts of the world—which set in long before it was possible to implement the improved methods for treatment and control now available, is due largely to intrinsic causes. There can be no doubt, however, that increasing use of these procedures is now bound to speed up the reduction of the disease. In the case of cholera, which, in India at least, has so far shown no signs of a really satisfactory decrease, methods of treatment and control combining easy application with full efficiency must still be sought. Hence, while in most respects the plague problem may be considered as a res gesta, the many still-unsolved problems of cholera continue to call for urgent attention.

RÉSUMÉ

Cet article constitue la première d'une série d'études sur le choléra, qui paraîtront plus tard sous forme de monographie.

L'auteur y retrace l'historique de la maladie, connue dans l'Inde de temps immémorial semble-t-il. Le choléra prit l'ampleur d'un fléau mondial au début du XIX^{e} siècle. Dès 1817, la première pandémie, venant du Bengale où le choléra avait gagné en virulence et en force expansive, ignorant les distances, déborda les obstacles naturels et les mesures de protection et déferla sur l'Inde, l'Extrême-Orient, l'Arabie, la Syrie, l'Ile Maurice et Zanzibar. D'autres pandémies se succédèrent, en 1829, 1852, 1863, 1881 et 1899, frappant l'Europe, l'Amérique et l'Afrique, causant des millions de décès dans le monde entier. Seules furent épargnées les zones les plus septentrionales de l'hémisphère boréal et les zones les plus méridionales de l'hémisphère austral.

La mortalité due au choléra n'est certes pas comparable à celle que provoqua la peste au cours des âges. Pourtant, à juger d'après les chiffres connus pour l'Inde, le choléra

cause actuellement dans ce pays beaucoup plus de décès que la peste. La tendance naturelle à la régression qu'a présentée la peste dans les temps modernes, accentuée encore par l'application de mesures de lutte et de protection, a fait reculer cette maladie. Le choléra, au contraire, ne présente pas de signes d'affaiblissement notables et des méthodes de lutte et de prévention qui soient à la fois aisément applicables et efficaces sont encore à trouver. C'est pourquoi, tandis que le problème de la peste peut être considéré comme pratiquement résolu, celui que pose le choléra reste aigu.

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