The sterilization and disinfection machines: sanitation and public health in the late Ottoman Empire

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To cite this article: Ufuk Adak (2022): The sterilization and disinfection machines: sanitation and public health in the late Ottoman Empire, Middle Eastern Studies, DOI: 10.1080/00263206.2022.2027765

To link to this article: https://doi.org/10.1080/00263206.2022.2027765

Published online: 28 Jan 2022.
The sterilization and disinfection machines: sanitation and public health in the late Ottoman Empire

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The increasing speed of the flow of people from place to place with the help of steamships and trains widened the scope of contagious diseases, such as cholera and plague in the Ottoman Empire in the nineteenth century. After the construction of the first quarantine stations in the Ottoman Empire during the first half of the nineteenth century, the Ottomans continued to follow contemporary developments in sanitation and started to use cutting-edge technology such as sterilization and disinfection machines to secure public health. There were two methods of sanitation in the Ottoman Empire; sanitation with heat (tebîr-i tabîî) through the sterilization machines (etûv) and vapor, and sanitation with chemical compounds including acid fenic (phenolic acid) and calcium chloride. The sterilization machines used one hundred-and-ten degree vapor pressure (tazyik-i buhar ile tebhir-i ameliyat) to disinfect clothes and other personal belongings in a process that took about seventeen minutes. The technical information about how these machines were built at the Imperial Arsenal is scarce, but thanks to brochures sent by Geneste Herscher Company to the imperial centre, we do have some basic knowledge about how these machines worked. The sterilization machines were mounted in a place where infected and clean items were separated. The machines were connected to a steam-generating water boiler. Their lids were tightly closed during the sterilization process, and when the steam temperature reaches 110°C Celsius, the system was turned off by sterilization officers. They waited for twenty minutes to take the disinfected items out of the machine and let them dry. The non-portable sterilization machine was designed for ‘hospitals, quarantines, shelters, health stations, and asylum for aliens’. In addition to the sterilization machines, portable disinfection machines (pulverizatör) spraying chemical disinfectants were also commonly used at the disinfection stations (tebhirhâne) and for sterilizing public spaces. Geneste Herscher in Paris, the leading company in sanitation technology and sanitary engineering in Europe in the nineteenth century, manufactured the sterilization machines which killed microorganisms quickly and did not fade the colors of infected clothes during the sterilization process (Figure 1).

In 1890, Ahmed Ragıb Bey, a member of the Health Commission in the Ottoman Empire, penned a report about the lack of sterilization machines at Ottoman quarantine stations. Ragıb Bey noted that unlike other foreign countries the Ottomans still used the old methods of sanitation (eski usûl ile tathirat ve tebhirat). Thus, in 1891, Abdulhamid II placed an order for two small models of sterilization machines from Geneste Herscher Company, one for Kavak Quarantine in Istanbul and the other one for Klaçomen (Urla) Quarantine in İzmir to take measures against contagious diseases in the Ottoman Empire. The sterilization and disinfection machines were manufactured by European companies, and for Ottoman officials, financing the import of these machines and overseeing their distribution throughout the Empire were troublesome prospects. Since importing these machines from Europe was very costly for the Ottomans, Abdulhamid II...
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gave an order and permission to the Imperial Arsenal (Tersane-i Amire) in 1892 to manufacture similar machines in Istanbul.\textsuperscript{10} On the other hand, the Ottomans’ attempt to manufacture these machines at the Imperial Arsenal in defiance of the Law of Patent Right (İhtira Beratı Kanunu) resulted in a legal case between the inventor/distributor of these machines and the imperial center.

Although there is a burgeoning literature on the history of health, specifically contagious diseases in the Ottoman Empire and public health, the examination of the implementation of sanitation technology, particularly the sterilization and disinfection machines, remains limited.\textsuperscript{11} This article attempts to fill this lacuna by relying on the Ottoman archival sources, including reports penned by Ottoman health inspectors and specialists, the correspondences between the imperial center and sanitary technology representatives in Europe, and articles on sanitation published in Ottoman and British periodicals. This article focuses on the application of sanitation technology, specifically the sterilization (etüb) and disinfection machines (pulverizatör), through the prisms of public health, hygiene, and governance in the late Ottoman Empire. I argue that the reports penned by health inspectors in the Empire about the urgent need for sterilization machines in Istanbul and the provinces in the late Ottoman Empire, and also the scientific discussions regarding sanitation methods held at the international health and hygiene congresses had considerable impact on Ottoman sanitation policies, including the establishment of sterilization and disinfection machines at the quarantine stations.

This article examines these machines to understand their critical role in Ottoman sanitary reform efforts to secure public health. Firstly, this article discusses the implementation of the sterilization and disinfection machines in the late Ottoman Empire within the framework of the invention, ‘reproduction’, and patent rights of these machines. Secondly, the article focuses on the extent to which the reports of Ottoman health specialists and inspectors and the international sanitary and hygiene conferences affected the dissemination of sanitary technologies throughout the Empire. Thirdly, the article elaborates on the usage of sterilization machines that became intertwined with Ottoman public health policies including the professionalization of the sterilization officer cadres from the late nineteenth to the first decades of the twentieth century.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.jpg}
\caption{The Brochure of Geneste Herscher Company sent to Istanbul illustrating the models of sterilization and disinfection machines. BOA. Y.PRK.SH. 3/49.}
\end{figure}
Invention or ‘imitation’

On 13 June 1892, the Minister of the Navy proudly noted that under the command of Dr Angelo, the leading figure of the manufacturing process and installation efforts of the sterilization machines in the Empire, who later published a book on the methods of disinfection, and Mehmed Ali Efendi (Çarkçı Kol Ağası), made a prototype of the sterilization machine called etüv makinesi that eliminated microbes that caused contagious diseases with pressurized vapor (Figure 2). The machine was operated for the first time right after the Friday prayers and then transferred to the Imperial Palace.

Due to budgetary issues and increasing demands received from the provinces to obtain sterilization machines, the Ottomans attempted to manufacture the sterilization machine at the Imperial Arsenal, but these efforts turned into a legal case between the inventor/distributor and Ottoman officials. On 5 December 1894, the French Consulate in Istanbul sent a note to the Ministry of Foreign Affairs of the Ottoman Empire to draw attention to the rights of its subjects. Monsieur Geneste Herscher, an engineer, who had designed the sterilization machine (étuve), had received the patent right (ihtira berati) from the imperial center to distribute the machine in the Empire, but according to M. Herscher, the Ottoman Ministry of the Navy started to manufacture an imitation of the machine (âlâtın tamamiyle taklidi olmak üzere) at the workshops of the Imperial Arsenal. The French Consulate boldly stated that if this manufacturing of imitation sterilization machines continued, the Consulate would defend the rights of its subjects to the end.

The Ministry of the Navy denied Herscher’s claims by stating that the machine manufactured at the Imperial Arsenal was very different from Herscher’s design, and if any committee of
specialists were to inspect and compare these two machines, they would definitely accept that they were different from each other. Furthermore, according to the Ministry’s self-confident or hypocritical response, there was no legal clarification about the manufacture of any goods by the State even in cases where the patent rights had already been given to an inventor. The Ministry of the Navy stated that the Imperial Arsenal manufactured the machine before the machines were imported from the Geneste Herscher Company. However, as the archival evidence confirms, the Ottoman state had ordered two machines from the Company in 1891 and the Ottomans’ manufacturing attempts started in 1892. The Ministry of the Navy again stressed that the machines produced by the Arsenal and the Company had many differences, therefore it could not be called an ‘imitation,’ but an ‘invention.’ The Ministry of Trade and Public Works also stated that Geneste Herscher Company received the patent right for fifteen years but paid only the first year’s fees and did not pay the rest, therefore, according to the thirty-eighth article of İhtira Beratı Kanunu, the Company could not use their patent right since they did not fulfill its requirements. 15 Alongside the correspondence between the representatives of the Company and the imperial center about the patent right, the Ottomans continued importing Geneste Herscher’s sterilization machines from France and also distributed the machines manufactured by the Imperial Arsenal throughout the Empire from the late nineteenth century to the first decades of the twentieth century. 16 The major port cities of the Ottoman Empire such as Izmir and Beirut mostly benefited from the latter. 17

In 1892, the Ministry of the Interior sent a note to the Grand Vizierate (Sadaret) emphasizing that although sterilization machines (âlât-ı tebhîriye) for sterilizing the goods of those who passed away from contagious diseases were used in the various capitals of Europe, the goods belonging to infected people in the Empire were mostly distributed to the poor or sold in the bazaars in Istanbul. Thus, the imperial center and the provinces needed non-portable sterilization machine and several portable disinfection machines to sterilize infected goods. 18 The imperial center also sent a note to several provinces including Beirut, Aleppo, Aydın, and Sivas stating that ten-day quarantines should be applied for passengers who came from places affected by contagious diseases (bulaşık mahaller) and the quarantine stations needed to have a sterilization machine (etüv denilen alet-i mahsusa). 19 In 1893, the Ministry of Health proudly stated that the Imperial Arsenal manufactured a one-hundred-and-twenty centimeter long sterilization machine and all of the quarantine stations in the Ottoman Empire followed the contemporary scientific developments in sanitation, and almost all of them had sterilization machines. 20 The length of the sterilization machines was important particularly for sterilizing bulky objects in one go.

In the late nineteenth and the first decades of the twentieth century, Servet-i Fünun (Wealth of the Sciences) journal published articles about contemporary scientific innovations heralding the emergence of new models of disinfection machines. According to the journal, based on the statistics compiled in Europe, some of the sanitation methods, particularly the sterilization machines worked well to prevent contagious diseases, but the production of these machines was troublesome for the Ottomans. 21 Moreover, in 1899, the Ottoman Translation Office translated newspaper clippings from French into Ottoman Turkish about the invention of Georges Gautier, a mechanical engineer in Marseille, who invented the machine to prevent plague. 22 The Directorate of Bacteriology (Bakteriyolojihane-i Şahane Müdiriyeti) noted that it would be difficult to understand the benefits of this machine without testing it in Istanbul. 23 Gautier also penned a letter to the Ministry of the Interior later in 1899 stating that the tests of his invention carried out in front of foreign consuls were successful and his machine could sterilize various items including trousers, shoes, horse gear, and tack, and every kind of leather without causing any harm to the items. 24 This illustrates that the implementation of sanitation technology in the late Ottoman Empire was tangled with Ottoman officials’ genuine attempts to implement cutting-edge tools and methods in sanitation technology, as well as European entrepreneurs’ and inventors’ marketing strategies.
Dissemination of the sterilization machines

In 1893, the Municipality of Istanbul (Şehremaneti) corresponded with the Sadaret stating that they had imported only three sterilization machines and four disinfection machines from Europe to distribute them to quarantine stations, and still required more machines manufactured by the Imperial Arsenal. The Municipality repeated their request later, particularly when signs of contagious diseases were seen in the imperial center. According to Şehremaneti, the numbers of disinfection machines were inadequate to curb the spread of diseases in the Empire, and importing these machines from Europe took time, therefore the Ministry of the Navy should continue to manufacture these machines.

In August 1893, due to the spread of cholera in Izmir, the Ministry of Health took precautions and requested three small types of sterilization machines from the Ministry of the Navy. This time the machines were requested not for quarantine stations but rather to be mounted on trains. The trains going back and forth between Izmir and Kasaba needed to have three small disinfection machines produced by the Imperial Arsenal. Ottoman officials also closely followed the stages of the spread of contagious diseases in Europe to take precautions and implement or suspend quarantine measures at the ports of the Empire. For instance, in 1893, the news about the end of a cholera outbreak in Marseille resulted in halting five-day quarantine in the Ottoman Empire, and also forty-eight hours of quarantine for those who came from Europe. Still, the goods and clothes of the passengers who came via train to Cisr-i Mustafa Paşa, today in Bulgaria, were to be disinfected with a sterilization machine.

Health specialists and inspectors penned reports about the sanitary conditions of provinces stating whether any preventive measures were taken to curb contagious diseases or not and highlighted the lack of sterilization machines to disinfect contagious items in the provinces. For instance, in 1893, the Health Commission in Izmir found the capacity of the sterilization machine inadequate to disinfect the goods of those infected by cholera. In 1894, the report written by Bonkowski Pasha, a chemist and pharmacist, and the head inspector of public health, was about the lack of a sterilization machine to disinfect the uniforms of soldiers in Izmid. Bonkowski’s report triggered the Ministry of Health to request the supply of a sterilization machine from Geneste Herscher. Bonkowski Pasha later reported from Edirne in 1894. In this report, Bonkowski stated that the spread of contagious disease was under control in Edirne and the infected goods belonging to three to four thousand people were burned or sterilized, thus, the disease could not be a threat for Istanbul anymore. Bonkowski Pasha noted that many people suffered in Edirne during the sterilization process and could not go back to their homes. Women had to sleep at coffeehouses due to the sanitary cordon. Bonkowski stated that these people could go back to their homes right after their items were sterilized.

In addition to the reports of the Ottoman health specialists and inspectors about sanitation and public health, the international sanitary and hygiene conferences in which the Ottomans participated shaped the Ottomans’ sanitation and public health policies. There were several international sanitary conferences held in various European cities during the nineteenth century. The one held in Istanbul in 1866 confirmed that ‘Hygiene has become a science’. These conferences were the stages for health scientists to discuss contemporary scholarship on sanitation and public health, including preventive measures, tools, and techniques against contagious diseases and epidemics. The reports penned by health specialists based on the contemporary improvement in sanitation shaped public health policies throughout Europe, including the establishment of quarantine stations in European countries. Based on these reports, the Ottomans attempted to apply the contemporary sterilization and disinfection methods to prevent contagious diseases in the Empire. The anonymous special correspondent of The Lancet journal also emphasized the Ottomans’ attempts to secure public health by stating that ‘For the last ten years [Abdulhamid II’s reign] or more the scientific advisers of the Sultan, themselves natives of Turkey, have urged the necessity of organizing staff of disinfectors, of providing disinfection
stoves, and of creating a bacteriological institute. According to The Lancet, Dr Stekoulis, member of the Superior Council of Hygiene of the Ottoman Empire, reported at the International Congress of Hygiene held in Budapest in 1894 that ‘the good sanitation of towns, the isolation of the sick, and rigorous disinfection’ were ‘the true measure of prophylaxis against cholera.’

The mobilization of pilgrims was one of the key topics of the international sanitary conferences. Pilgrims traveling from distant localities to Mecca and Medina were mostly seen as the main reason behind the spread of contagious diseases in Europe. The travel of pilgrims itself became very dangerous as seen in the tragic incident in 1894 when a ship took 1370 pilgrims from Jeddah and 334 of them passed away because of overcrowding and lack of a sterilization machine until they arrived in Istanbul. In 1895, Dr Koçoni, the general inspector of health in the Ottoman Empire, who was sent to Europe to inspect their sanitation methods and quarantines, reported that sterilization machines should be established on ships by making references to the debates at the Ninth International Sanitary Conference held in Paris about sterilization of pilgrims’ goods. Following the reports of the health inspectors, the sterilization machines were used on ships, particularly the ones transferring pilgrims, and also at quarantine stations to disinfect the goods and clothes of passengers who commuted by train, such as in Tuzla Quarantine Station. The inspectors of the quarantine checked ships to determine whether they had a proper sterilization machine or not.

The imperial center also sent sterilization machines to Mecca and Medina to disinfect the goods of the pilgrims to prevent contagious diseases. However, the introduction of quarantine procedures and sterilization machines created tensions among pilgrims due to rumors spread among them that ‘Christians particularly invented these machines to kill poor Muslims.’ As a result, in June 1895, when thousands of pilgrims left for Arafat almost four thousand people attacked the building that held the sterilization machine in Mecca and destroyed it.

In the late nineteenth century, the Ottomans continued participating in the international sanitary conferences and following the contemporary developments in sanitation technology. In 1898, Mahmud Pasha, director of the School of Medicine in Istanbul, represented the Ottoman government at the Ninth International Congress of Hygiene and Demography held in Madrid and at the Conference he stated that ‘science had no country, especially sanitary science, and that international sanitary congresses might well become the first link that would ultimately establish the solidarity of humanity.’ In the same year, as evidence of international cooperation for sanitization efforts, goods sent as humanitarian aid from India to the Muslims in Crete were sent to Izmir to be disinfected with the sterilization machine first.

Although the sterilization machines were one of the key tools to secure public health in the Ottoman Empire, the import of these machines to the Empire was not an easy task for the European companies. The archival sources reveal that the Ottoman tax officials were ambivalent about whether these items should be exempted from customs taxes or not. The Office of Taxation requested from all the tax offices throughout the Empire not to take customs taxes from the sterilization machines imported from Europe. In 1894, the Sadaret underlined that the sterilization machine and disinfection machine imported from Europe to secure public health should be exempted from customs taxes. In 1901, Şehremanevi again stated that disinfection machines imported from Paris to use at the disinfection stations should be exempted from customs taxes.

In the first years of the twentieth century, Besim Ömer sent an urgent note to the Ministry of the Interior stating that each province should list their sterilization equipment including sterilization and disinfection machines and their need for chemical compounds to prevent the spread of cholera. After this call, the imperial center received many telegraphs from several provinces from Beirut to Sivas requesting the supply of sterilization machines to lessen the effects of contagious diseases in their localities. In 1903, cholera heavily affected Aleppo and the province of Syria requested small sterilization machines from the Sadaret. As a
response to this request, the Sadaret noted that sterilization machines were not local products, they were imported from Europe and the Sadaret had no small and portable models of sterilization machines, but only disinfection machines. The Ministry of Health also requested from the Sadaret to obtain sterilization machines that would be paid for from the municipalities’ budgets particularly for the major cities of the Empire such as Izmir, Aleppo, Beirut, and Salonica to disinfect the goods and clothes of cholera patients.

The transportation of the sterilization and disinfection machines from one location to another in the Empire was also challenging. For instance, in 1910, the Province of Erzurum requested to obtain disinfection machines to take precautions against cholera, but they were not able to receive the machines for three months after the cholera outbreak ended in the region. In 1911, the governor of the Province of Adana sent a telegraph to the Ministry of Interior requesting to obtain a sterilization machine, and Besim Ömer, the head of the Council of Medicine and Public Health, responded to this request by stating that transporting sterilization machines to every province depended on the quality of the roads of the Empire, and suggested to them that the chemical compounds used through portable disinfection machines could do the same work as the sterilization machines. Meanwhile, in 1911, the Supreme Council (Meclis-i Vâlâ) ordered two sterilization machines and fifty disinfection machines from the Geneste Herscher Company in France and some sterilization compounds including acid fenic (phenolic acid) from Vienna to distribute them both in the imperial center and the provinces to take precautions against the spread of cholera. In the summer of 1912, in the correspondence between Bitlis Province and the Ministry of the Interior, the governor of Bitlis Province stated that since there was no disinfection station or any type of sterilization machine in Bitlis, the Province needed one sterilization machine or if that was not possible, a couple of disinfection machines to secure public health in the region.

The sterilization officers and securing the public health

Archival documents do not provide us detailed information about the operators of the sterilization and disinfection machines and their training. The sterilization officers (etüv/tebhir memuru) appeared mostly in statistics and in between the lines of the archival documents. The yearbooks (salnâme) and the documents illustrate that the sterilization officers were in the cadres of the hospitals, municipalities, and quarantine stations. In 1893, during the year of the cholera outbreak in Istanbul, the Sadaret sent a note to Şehremaneti stating that although there were many disinfection machines at the imperial center, the sterilization procedures could not be fulfilled as planned because of a lack of trained personnel. Therefore, the imperial center invited a specialist (dezenfektör) from Paris to give a one-month training to the Ottoman personnel. Military forces were also appointed to disinfect the imperial center during the spread of contagious diseases.

Since the sterilization machine was a new sanitary technology for the Ottomans, and due to a lack of expertise and inattention, several cases illustrating the misuse of the machine occurred in the late Ottoman Empire. For instance, in 1893, some of pilgrims’ belongings were burned in the sterilization machine at the quarantine station in Tripoli, which caused panic among the pilgrims, and some of them even attempted to escape from the quarantine because of this incident. Ahmed Rasim, the governor of Tripoli, attempted to calm the panicked crowd by announcing that all the damaged goods would be compensated for by the Governorate. Another case of the inexperience of the use of sterilization machines occurred in 1894 during the spread of cholera in Istanbul. This time, some of the diplomatic letters waiting to be sent from the Ottoman Empire to foreign countries including the United States of America, Germany, Russia, and Romania were put into the sterilization machine (etüvdenden geçirmek), and most of these documents and their envelopes got stuck together due to the high volume of pressurized vapor, and these official letters needed to be re-written.
In 1910, Servet-i Fünun also allocated its columns to the issues related to health administration and disinfection stations (tebhirhane) in the Ottoman Empire. One of the anonymous articles published in the journal criticized the disinfection stations built in 1891 left in ruins after the spread of cholera in Istanbul during the Hamidian era. The municipalities transferred these disinfection stations to the General Directorate of Health (Müessesat-i Hayriye-i Sıhhiye Müdürüyeti) after the promulgation of the Second Constitution of 1908, and the General Directorate achieved the restoration of these stations in three months. According to the article, during a short period of time, the General Directorate imported many disinfection machines and various equipment from Europe and hired almost one hundred temporary staff (tebhir memuru) who now wore proper uniforms for the sterilization process (Figure 3). These personnel disinfected khans, hotels, houses, schools, bathhouses, and apartments, and sea and land vehicles (merakib-i berriye ve bahriye) and sterilized ‘90.998’ items with a sterilization machine. The General Directorate also disinfected Balat, Hasköy, and Kasımpaşa Fındıklı mahalles that were heavily affected by contagious diseases. According to the article, the sterilization officers who worked day and night were exposed to the contagious items, but they were not affected by diseases at all since they took proper precautions.

In 1911, the Council of Medicine and Public Health (Meclis-i Tibbiye-i Mülkiye ve Sıhhiye-i Umumiye) emphasized the importance of prevention of contagious diseases that ensured the welfare of the Empire, particularly by securing the life and health of people living in the Empire. The Council underlined that due to the lack of sterilization machines in many provinces, the Council’s attempts to take precautions (tedâbir-i sîhhiye) failed. Therefore, according to the Council,
every municipality should allocate a budget for taking health measures specifically to own sterilization machines.\textsuperscript{69} However, according to the Council’s report, none of the municipalities had attempted to have these sterilization machines apart from one or two cities. The report concluded with a note that the imperial center could not provide all of these machines to provinces.

Based on the Regulation of Health in Provinces (\textit{Vilayet-i İdare-i Sıhhiye Nizamnamesi}) issued in 1913, every province was to have a sterilization station that had a sterilization machine, and towns should have disinfection machines and antiseptic medicines to guard against epidemics.\textsuperscript{70} Although requests to obtain sterilization machines were sent from many parts of the Empire, there was a lag between the regulations and the allocated budgets, which now became a responsibility of the municipalities, and the implementation of sanitation technology throughout the Empire. Members of the Ottoman Parliament also discussed the use of sterilization machines in the first decades of the twentieth century.\textsuperscript{71} In 1918, on behalf of the Minister of Health, Adnan Bey emphasized the importance of precautions taken against cholera and plague in the Empire through the implementation of sterilization machines and the construction of quarantine stations (\textit{tebhirhaneler, etüvhaneler}).\textsuperscript{72} Adnan Bey also noted that in some places in Anatolia that did not have a sterilization machine they used ovens made of clay and the items were put into these ovens for the sterilization.\textsuperscript{73}

Conclusion

Driven by the urgency to take preventive measures against epidemics, and as a reflection of the scientific discussions held at the international sanitary conferences, the Ottoman state managed to implement sanitary reforms, including the construction of quarantine stations and the dissemination of new sanitation technologies, particularly sterilization and disinfection machines that were imported from Europe and also manufactured at the Imperial Arsenal. Alongside the discussions between the Ottoman officials and the legal representatives of Geneste Herscher Company about the patent rights and ‘the re-invention’ of the sterilization machine, Ottoman officials distributed both the Company’s and the Arsenal’s products throughout the Empire to take contemporary sanitary precautions against contagious diseases in the Empire. The imperial center also encouraged, and in some cases, forced the municipalities and local officers to allocate budgets to obtain these machines to curb the spread of contagious diseases in the provinces. The logistics, particularly importing and transporting of these machines, and also the lack of trained personnel to set up and operate these machines were the main hindrances to extend the use of these machines in the Ottoman Empire. The sterilization procedures (\textit{tebhirat-ı nizamiye}) with the use of sterilization machines continued at the disinfection stations in the first decades of the twentieth century to secure public health.\textsuperscript{74}

Disclosure statement

No potential conflict of interest was reported by the author.

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Notes

2. The Ottomans called the sterilization machine variously as étuv drawn from étuve in French and also tebhir makinesi. Devlet-i Aliyeye-i Osmaniye Tatihfuzhanelerinde Düstür-ül-amel tutulmak üzere Meclis-i Umur-i Şihhiye'nin 15 Haziran sene 1315 tarihli icmianda usul-i tebhir hakkında kararlaşılan talimat-i umumiyenin tercümesidir [Translation of the general instructions about the sterilization methods used at the quarantine stations in the Ottoman Empire decided at the meeting of the Public Health Commission on 25 June 1899], (Dersaadet: Matbae-i Osmaniye, [1315] 1897), pp.2–3.


5. BOA. Y.PRK.SH. 3/49, 19.3.1309 [23 October 1891].


9. As a company specialized in sanitary technologies, Geneste and Herscher Company attended the International Health Exhibition in 1884 to illustrate their machines that used heating and ventilating and later introduced automatic flushing of the sewers. The Lancet, ‘The International Health Exhibition: The French Section,’ 2 August 1884, p.209; The Lancet, ‘Sanitary Progress At Nice,’ 24 March 1888, pp.599–600. The officers of the Klapomen (Urla) Quarantine reported to the imperial center that the machine worked well and disinfected the contagious goods. P. Böke, İzmir Karantina Teşkilatının Kuruluşu ve Faaliyetleri (1840-1900) [The Foundation and Activities of Izmir Quarantine Organization], CTTAD Vol.VIII/18-19 (2009), p.152; BOA. Ayn. 996, 82/2, 27 M 1290 [27 March 1873].

10. We do not have detailed information about the price of each machine in different types. In the late nineteenth century, importing four sterilization machines and two disinfection machines for the Ottomans cost approximately 1.800 francs including their transportation and installation. Due to the high costs of importing these machines, the imperial center urged municipal authorities to allocate part of their budgets for them with hopes that they would be installed in localities throughout the Empire in the first decade of the twentieth century. BOA., DH.MKT., 1963/106; 1969/48; BOA., DH. İD., 7/26, 10 October 1911; Sarıyıldız, p.91; Yıldırım, ‘Tersane-i Amire Fabrikaları’nda, p.423. For the professionalization of engineering in the Ottoman Empire, see D. Martykánová, Reconstructing Ottoman Engineers: Archeology of a Profession (1789-1914) (Pisa: Plus-Pisa University Press, 2010).

11. For the recent literature on health and diseases in the Ottoman Empire, see Maraz-i Sârî, Emrâz-i Müstevlî: Tarihte Salgın Hastalıklar [Contagious Diseases: Contagious Diseases in History], Toplumsal Tarih Vol.296 (Aug. 2018); B. Kurt and I. Yaşayanlar (eds), Osmanlı’dan Cumhuriyet’e Selâgın Hastalıklar ve Kamu Sağlığı [Contagious Diseases and Public Health from the Ottoman Empire to the Republican Era] (İstanbul: Tarih Vakfı Yurt Yayınları, 2017); N. Yıldırım, 14. Büyük-ül Cumhuriyet’e Hastalıklar Kurumları: Sağlık Yazarları – I [Diseases, Hospitals, and Institutions from the 14th Century to the Republican Era] (İstanbul: Tarih Vakfı Yurt Yayınları, 2004).

12. Dr Angelo was a doctor at the Central Hospital at the Navy (Bahriye Merkez Hastahanesi) and a member of the Ottoman Medical Society (Cemiyet-i Tıbbiye-i Osmaniye). In the introduction of his work, Dr Angelo noted that his work was about the methods of the production of sterilization machines, some of which were imported from France and later reproduced by the Imperial Arsenal, and their use at quarantine stations, hospitals, municipalities. He stated that he benefited from some of the European literature on methods of sterilization. Some of the chapters of his work were also published in Vekâyi-i Tıbbiye journal in series in 1894. Âlât-i Tebhirîye ve Usûl-i Tathir [The Sterilization Machines and Disinfection Methods] (İstanbul: Bahriye Matbaası, 1311 [1893]); Yıldırım, ‘Tersane-i Amire Fabrikaları’nda, pp.423–24. Nuran Yıldırım’s works examining the history of sterilization machines and quarantine procedures in the Ottoman Empire are very important to contextualize the usage of these contemporary sanitation technologies. Yıldırım, ‘Disinfecting Stations’, pp.267–77.


14. BOA. BEO. 630/47187, 1.12.1312 [26 May 1895].

16. In 1895, M. Karspi (?), the legal representative of Geneste Herscher Company, sent a petition to the Ministry of Foreign Affairs. In his petition, he claimed that the Ministry of the Navy imitated his client’s innovation by referring to the articles of the Law of Patent Right (İhtira Beratı Kanunu). BOA. BEO. 682/51134, 25.03.1313 [15 September 1895]. Nuram Yıldırım noted that the Imperial Arsenal’s production of sterilization machines probably continued until 1905 despite the patent right of Geneste Herscher. Yıldırım, ‘Tersane-i Amire Fabrikaları’n’dâ’, p.426.

17. BOA. A.MKT.MHM. 570/6, 10 Rebi‘ülâahir 1311 [21 September 1893].


22. BOA. DH.MKT. 2255/25, 26 Eylül 1315 [8 October 1899].

23. BOA. DH.MKT. 2255/25, 14 Teşrîn-i sânî 1309 [23 November 1893].


25. BOA. BEO. 185/13815, 3 Nisan 1309 [15 April 1893].


27. BOA. BEO. 246-18441, 14.01.1311 [28 July 1893]. In 1893, there were nine sterilization machines in the Ottoman Empire, in Kavak, Klazomen, Beirut, Sinop, Cisr-i Mustafa Paşa, Trablusgarb, and two machines in Kamaran, and the one used on ships. BOA. BEO. 247/18486, 16.01.1311 [30 July 1893]. For a detailed analysis of Kamaran Quarantine Station, see G. Sarıyıldız and M. Oya, ‘Cholera Pilgrimage and International Politics of Sanitation: the Quarantine Station on the island of Kamaran’ in N. Varlık (ed.), Plague and Contagion in the Islamic Mediterranean [Croydon: Arc Humanities Press, 2017], pp.243–73.

28. BOA. DH.MKT. 2055/103, 12 Şuvat 1308 [24 February 1893]. In 1892, the representative of Geneste Herscher Company assembled the sterilization machine in Cisr-i Mustafa Paşa. BOA. BEO. 66/4950, 15 Safer 1310 [29 August 1892].

29. BOA. DH.MKT. 110/29, 19.02.1311 [1 September 1893]. For the preventive measures taken against contagious diseases in Izmir, see M. Ayar, Osmanlı Devleti’nde Kolera: İstanbul Örneği (1892-1895) [Cholera in the Ottoman Empire, in Kavak, Klazomen, Beirut, Sinop, Cisr-i Mustafa Paşa, Trablusgarb, and two machines in Kamaran, and the one used on ships. BOA. BEO. 247/18486, 16.01.1311 [30 July 1893]. For a detailed analysis of Kamaran Quarantine Station, see G. Sarıyıldız and M. Oya, ‘Cholera Pilgrimage and International Politics of Sanitation: the Quarantine Station on the island of Kamaran’ in N. Varlık (ed.), Plague and Contagion in the Islamic Mediterranean [Croydon: Arc Humanities Press, 2017], pp.243–73.

30. BOA. A.MKT.MHM. 554/49, 23 Teşrîn-i evvel 1318 [4 November 1894].

31. In 1901, the goods of the people infected by the plague were mostly burned and some of them were sterilized through the sterilization machines in Izmir. BOA. Y.MTV., 211/104, 27 Şevval 1318 [17 February 1901].

32. BOA. İ.HUS. 27/45, 20 Temmuz 1310 [1 August 1894].

33. The international sanitary conferences were held in Paris (1851, 1859, 1897, 1903), Istanbul (1866), Vienna (1874, 1892), Washington (1881), Rome (1885), Dresden (1893), Venice (1897). Henri Monod, Conférence


35. These policies also aimed to secure the commercial relations between the states in the nineteenth century. For more details see Rapport de la Commission Chargée Par Le Conseil de Santé d’Élaborer Un Projet de Tarif des Droits Sanitaires dans L’Empire Ottoman [Report of the Commission Charged by The Board of Health to Prepare a Draft Tariff of Health Fees in the Ottoman Empire] (Constantinople: Imprimerie Centrale, 1866), p.5.


41. BOA. İ.RSM. 3/25, 13 Eylül 1310 [25 September 1894]. According to the article published in Servet-i Fünun, sulphur fumes had been used for the disinfection of ships in the past. However, in France this old fumigation method was abolished since it was not successful in sterilizing every part of a ship and could not fulfill goals of the quarantine procedures. Therefore, as the British government started, carbon monoxide was to be used on ships to exterminate the rats that caused the plague. ‘Sefainde Tebihirat’ [Sterilization on Ships], Servet-i Fünun Vol. 30/765 8 Kânûn-ı evvel 1321 [21 December 1905], pp.161–63; F. Apéry, Pierre Apéry (1852-1918): Un Pharmacien Face À La Peste Dans L’Empire Ottoman’ [Pierre Apéry (1852-1918): A Pharmacist Facing The Plague In The Ottoman Empire], Osmanlı Bilimi Araştırılanlar Vol.VI/1 (2004), pp.15–35; L. Engelmann and Christos Lynteris, Sulphuric Utopias: A History of Maritime Fumigation (Cambridge: The MIT Press, 2020).

42. BOA. BEO. 677/50740, 23 Ağustos 1311 [4 September 1895]; BOA. BEO. 3212/240843, 5 Kânûn-ı evvel 1323 [18 December 1907]. In 1907, during the regular inspection of ships, the inspectorship realized that Tiger, one of the ships owned by a Russian company, to transfer pilgrims, attempted to cheat the inspectorship by using a simple water tank as a sterilization machine. The Ministry of Health warned that the inspection of these ships was under the governors’ responsibilities. The introduction of the maritime quarantine system in the nineteenth century included the bills of health, the periods of detention of ships and passengers infected by a disease, and the construction of facilities for isolation called lazaretto. L. Kuhnke, Lives At Risk: Public Health in Nineteenth Century-Egypt (Berkeley: University of California Press, 1990), p.93. For the inspection of the ship’s bill of health (patente de santé, sihiye tezkiresi), see İ. Yaşayanlar, ‘Osmanlı Döneminde Uygulanan Deniz Karantinasi İlişkin Bazı Bilgiler’ [Some Information about the Application of the Maritime Quarantine in the Ottoman Era] in O. Kolbaş and Ö. Üçer (eds), Â-İ Hayât’ı Arama: Gönül Tekin’e Armağan [Seeking for Water of Life: A Tribute to Gönül Tekin], (Istanbul: Yeditepe, 2018), pp.745–50. Sea captains also gave misleading information about the numbers of infected people or even deaths on their ships. Sarıyıldız, Hicaz Karantina Teşkilâtı, p.45. For the quarantine procedures for ships, see Kolera Karantinasi Hakkında Nizamname [The Regulation regarding Quarantine for Cholera] (Dersaadet: Matbaa-i-


44. BOA. BEO. 637/47718, 8.12.1312 [2 June 1895]. For details about the incidents and other reactions against the sterilization machines in Jeddah and Yenbu, see Sarıyıldız, *Hicaz Karantina Teşkilâtı*, pp.119–22.


47. BOA. Y.MTV. 175/177, 11.11.1315 [8 April 1898].

48. BOA. DH.İD. 7/23, 10 Muharrem 1319 [29 April 1901].

49. Dr Besim Ömer published extensively about the health and sanitation in the late Ottoman Empire. In his book entitled *Hıfz-i sıhha* gave detailed information about various types and models of sterilization and disinfection machines by providing illustrations and images to explain how these machines worked. B. Ömer, *Hıfz-i Sıhha* [Hygiene] (İstanbul: Karabet Matbaası, 1318 [1900]).

50. BOA. DH.İD. 7/35, 19 Eylül 1318 [2 October 1902]; DH.İD. 142/8, 10 Şaban 1328 [17 August 1910].

51. BOA. İ.RSM. 12/20, 1 Ağustos 1316 [14 August 1900].

52. During the First World War, in 1915, Hüdavendigar Province placed an order to have a sterilization machine produced in Germany. The ship carrying these machines had to anchor by the Piraeus Port, and transport - ing them to Dedeağaç and then Istanbul and Bursa became a more complicated issue due to the War. BOA. HR.H. 37/10, 11 Receb 1333 [25 May 1915].


54. The disinfection machines were also used in agriculture to prevent plant diseases. In 1900, Şura-yi Devlet noted that 250 kilograms of blue vitriol (göztaşı) and 100 disinfection machines were imported to curb downy mildew (mildiyö), which was common both in the imperial center and some of the provinces. BOA. İ.RSM. 12/20, 1 Ağustos 1316 [14 August 1900].

55. 1915, Hüdavendigar Province placed an order to have a sterilization machine produced in Germany. The ship carrying these machines had to anchor by the Piraeus Port, and transporting them to Dedeağaç and then Istanbul and Bursa became a more complicated issue due to the War. BOA. HR.H. 37/10, 11 Receb 1333 [25 May 1915].

64. BOA. BEO. 266/19897, 14 Safer 1893 [17 Ağustos 1893].

65. BOA. Y.PRK.BŞK. 37/25, 21.01.1312 [25 July 1894].

66. Ayar, p.323. For more details about quarantine spaces (tebhirhaneler, tahaffuzhaneler) in the Ottoman Empire in the first decades of the twentieth century, see Besim Ömer and Akil Muhtar, *Koleraya Karşı İttihaaz Lazim Gelen Tedabir* [Precautions against Cholera], p.85; p.112; p.237.

67. ‘Müessesat-ı Hayriye-i Şihhiye İdaresi ve Tebhirhaneler’ [The General Directorate of Public Assistance and the Disinfection Stations], *Servet-i Fünun* Vol.40/1020 9 Kânûn-ı evvel 1326 [22 December 1910], p.141. Besim Ömer and Akil Muhtar also gave details about the safety requirements for sterilization officers who had direct contact with infected items and people at the quarantine stations and infected spaces. Besim Ömer and Akil Muhtar, pp.145–53. Besim Ömer and Akil Muhtar made references to quarantine spaces established in Berlin and Paris by providing their architectural plans and giving details about their organization, staff, and technology. They also gave information about Sinop Tebhirhanesi [Sinop Disinfection Station] which for them was one of the best quarantine spaces in the Ottoman Empire. Ibid., pp.85–100.

68. BOA. DH.İD. 7/26, 9.11.1329 [1 November 1911].

69. The second part of the seventh chapter of the Regulation for Provinces of 1871 underlined the municipality’s responsibilities particularly for taking precautions such as keeping drinking water and public spaces clean. M. Seyitdanlıoğlu, *Tanzimat Döneminde Modern Belediyeciliğin Doğuşu: Yerel Yönetim Metinleri* [The Birth of Modern Municipalism in the Tanzimat Period: Local Government Texts] (İstanbul: Türkiye İş Bankası Kültür Yayınları, 2010), pp.97–99. The Regulation also defined the responsibilities of the Regional Health Commissions (Mahalli Şhhiye Meclisi). These commissions comprised of the governor, municipal officers, health inspectors, doctors, bacteriologists, and pharmacists were responsible for inspecting the distribution of water, testing the cleanliness of the water, taking precautions against epidemics, and founding a quarantine station (tecridhane) that had a sterilizer machine (etüv makinesi). M. Karayaman, *İzmir’de Sağlık: 1920-1938* [Health in Izmir] (İzmir: İzmir Büyükşehir Belediyesi Kültür Yayınları, 2008), p.7.


71. The disinfection machines were also used in prisons and detention centers that were notoriously overcrowded and filthy places. In 1919, prison officials at Kütahya Prison used a sterilization machine to disinfect clothes and belongings of prisoners who had scabies. BOA. DH.MKT. 2420/31, 12 Teşrîn-i evvel 1316 [25 October 1900]; DH.MKT. 2374/95, 3 Temmuz 1316 [16 July 1900]; N. Bozkurt, ‘XIX. Yüzyıl Başlarında Kütahya Hapishanesinin Genel Durumu’ [The General Situation of Kütahya Prison in the Early Nineteenth Century], *Uluslararası Sosyal Araştırmalar Dergisi* Vol.21 (2012), p.216. In 1921, the Directorate of Prisons and Building Construction requested to have the goods of prisoners disinfected but due to the scarcity of coal, the sterilization machines did not work every day. BOA. DH.MB.HPS., 99/19, 9 Kânûn-ı sâni 1337 [9 January 1921]. In 1926, Dr Esad Nureddin published an article about the disinfection houses in Istanbul Municipality’s journal and made references to the German disinfection methods based on the use of chemical compounds. Doktor E. Nureddin, ‘Aletsiz ve Kolay Usul ile Mesken Tathiri = Dezenfeksiyon’ [Disinfection = Device-free and Easy Disinfection of Houses], *Şehremaneti Mecmuası* Vol.27 1926, pp.150–51.

