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The Cholera Epidemics in Hamburg and What to Learn for COVID-19 (SARS-CoV-2)

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When I was walking through the City of Hamburg last week, I passed the courtyard of the town hall with a fountain from the late 19th century. It was built in memory of the last outbreak of cholera in Hamburg, which was also the last cholera epidemic in Europe. The fountain is dedicated to Hygeia (Fig. 1), daughter of Asclepios and goddess of health. I took this picture for you to illustrate that epidemics are part of human civilization. Particularly interesting is that the cholera outbreak was foreseeable and partially man made. In the 19th century, the Government of Hamburg espoused the Miasma Theory, which claimed that the source of diseases was bad air and that diseases were transmitted by inhaling and not from person to person (1). A strong promoter of the Miasma Theory, also known as the anticontagion theory, was the famous chemist and inventor of practical and scientific hygiene von Pettenkofer (1818–1901) (2). Hamburg decided not to follow the germ theory of Robert Koch (1843–1910, 1905 Nobel Piece in Medicine) which claimed that microorganisms are the source of epidemics and disease (3) for good reasons. The consequences of accepting the germ theory would have meant substantial investments in the city's infrastructure, including water cleaning, sewage treatment, quarantine, and other measures. The memorial is well placed between the town hall and the stock market as a reminder of the responsibility that politics and finances had in that epidemic. During the epidemics in 1892, around 17,000 were infected, of whom more than 8,600 died (1). The numbers are not completely certain as, in the beginning, microbiological tests were not performed, and numbers were kept under lock and key not to jeopardize the economy and trade. The situation was resolved when, after the infections moved from the poor and unhygienic neighborhoods to those of the wealthy, Robert Koch was sent to Hamburg. He took all necessary precautions of modern disease control, and the epidemics finally stopped within a few months.

At that time, Hamburg was (and still is) a boomtown of commerce, trade, and shipping. The consequences of the cholera outbreak were substantial: hysterics if not outright panic gripped the city, schools were closed, gatherings canceled, traffic from and to Hamburg stopped, and industrial production was brought to a halt. It took some time to get back to normal. It is worth remembering that cholera was never fully eradicated and, since 1961, remains classified as a pandemic, albeit "only" persisting in the resource-poor settings of Africa and Haiti (4), regions with limited access to clean water.

I do not mean to compare directly the disasters of a cholera epidemic with the actual COVID-19 epidemic (or pandemic if the WHO scales COVID-19 up after I have finished this editorial). Luckily, the mortality of this coronavirus is not as disastrous as that of cholera. But when reading the events of the 19th century, I found some interesting parallels on both the local and global scales. Signs of hysteria are obvious now, clearly triggered by the immediate access to information (real and fake). Most evident for everyone is panic buying, in China but also in Europe. Yesterday (March 2), I went to the store in my small hometown and found that rice, noodles, cereals, and—noteworthy—toilet

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Figure 1. The Hygeia fountain (1895/96) in the inner courtyard between town hall and the stock market of the City of Hamburg built as a reminder to the last cholera outbreak in 1982 in Germany (photo taken by A. Tarnok).

paper were more or less sold out. It does not make much sense: given that, so far, there are only 17 confirmed cases in the northern part of Germany, we should not expect to run short of nutrients but that is group behavior.[1]

[1] I wrote this editorial in the first days of March 2020. Thus, some of the data might be when published outdated. Today, about 10 days later when checking the page proofs the number is 402.

More concerning is that essential disease control products are increasingly unavailable. This includes face masks and disinfectants selling out—even for medical care needs—in spite of information that hand washing is better than Sterillium and that most face masks do not prevent infection. This scarcity reveals flaws in our present health system, and one can only hope that we will learn from this lesson. One weakness is the lack of stock-keeping in health institutions of essential goods, such as face masks, for sudden unexpected

situations like the current one. Warehousing has been nearly completely abandoned and replaced by Just-in-Time or Lean Manufacturing (5), leading to reduced costs but becoming vulnerable to supply shortfall, as observed in this real-time experiment.

Even more severely, cost minimization and profit maximization for the manufacturing companies and the pressure from customers ever yearning for lower prices lead to the search for manufacturers that offer their products for lower and lower costs. As a result of this rush to the bottom, many companies outsourced production to other parts of the world with lower wages and lower, if not lax, environmental standards. Consequently, if one pharmaceutical company cannot provide a drug due to production problems of a key compound in a chemical plant, then all the others cannot either. They all use just this one company for the specific compound because it is the cheapest provider. Furthermore, pharmaceutical companies also outsourced essential expert knowledge. Johnson & Johnson was the last major drug company to stop R&D on antibiotics last fall; others had stopped years ago.[2]

This development is neither surprising nor unexpected. It was termed Monopoly Capitalism by the German philosopher and economist Karl Marx (1818–1883), who stated, in his theory, that profit maximization leads to concentration of production in the (final stage) of capitalism. It is concerning to imagine that drugs of high global importance, such as antibiotics, anticancer drugs, antihypertensives, and many more are at least partially produced in maybe just one factory. If this factory fails to produce for whatever reason, then the entire production chain grinds to a halt. As many experts predict, it is of great concern that the consequences will become obvious in the upcoming weeks and months when key medications start to fall short (*We ain't seen nothing yet?*).

A central part of the research in our community is developing and improving technologies that are of high relevance in diagnosis, follow up, and therapy development. I have no information on how many of our reagents and instruments or their components are manufactured or produced at maybe just one location, but you can bet that there are many.

COVID-2019 could have at least one positive effect, namely, to make us aware of how vulnerable the present production chain is. It is of clear importance that all—regulatory institutions, producers, and scientists—work together on reducing the structural weaknesses of the system. COVID-2019 is not yet done, and we can be confident that the next pandemic or other unforeseeable incident will come.

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4. https://www.who.int/cholera/the-forgotten-pandemic/en/
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[2] I spared you from a citation at the end of this paragraph: "H.d.y." (G. Thunberg, September 2019 at the UN). Decisions like this have understandable (economic) reasons but can have concerning global consequences.