The first dips in European mortality

Beginning in the mid-18th century, enough will change to bring health to a higher level than it ever had been before, at least in Europe – followed by the United States. Stagnation had become the norm over 8,000 generations of *Homo sapiens*, but health finally began to improve. With it, mortality went down and life expectancy increased. We can define an initial period ranging from the mid-18th century – say 1750 – until the beginning or middle of the 19th century depending on the country. This initial turning point period may be characterized by a fragile improvement of health. Progress was unstable and regressions occurred, but slow, slight progress was nonetheless made. Georges Rosen (1910-1977), doctor and author of a major work on the history of public health[1], sees this period as having structured the subsequent history of world health. For him, the 1750-1830 span is a "pivot moment" the "legacy [of which] continues to affect us."

Demographers have studied data from several European countries, turning them into historical information.[2] Fragmented and heterogeneous, these data nevertheless provide an idea of how mortality evolved in the countries examined over the given time period. The demographic approach was either direct or indirect: the direct approach used civil registries, but not all of the countries under study issued civil registries at the same time. Scandinavian countries were the first to use such a system of registries, and as such, data for these countries begin before the others. Finland began in 1722, followed by Denmark, Iceland, and Norway (1735), and finally Sweden in 1736. The indirect approach is called reconstitution – or reconstruction – and is in fact a correction in that it is based indeed on data, but not the data sought after.

[1] Georges Rosen. *A History of Public Health*, 1958.
[2] Jacques Vallin. *Annales de Démographie Historique*, 1989.

Instead of direct civil registry data, the approach uses parish data, given that parishes recorded baptisms, weddings, and deaths. Extrapolating on these data, demographers attempted to trace mortality and draw overall conclusions. This was the approach taken for France and England. Equivalent data are unavailable for other European countries such as Germany, Italy, and Spain, but subsequent accessible data suggest that these countries lowered mortality at a later date. This discrepancy leads demographers to believe that the countries having created registries first are also those to have improved the health of their people before the others. *To measure is to know.*

The direct approach has two advantages over reconstruction: data, theoretically exhaustive for a given country, are of better quality and cover more ground. The results are therefore both more robust and more general. Conversely, parish sources are incomplete and prone to error. Their data remain local and fragile, and results are thus likely more uncertain. From these two sources of data - civil registers and parish registers - demographers have produced mortality charts for all the countries mentioned. A cautious comparison has therefore been made between these European countries' mortality rates during the period delimited by Rosen (1750-1830). The decline in mortality seems to have been effective as early as 1750, but comparative observation reveals two main features characteristic of European human mortality at the time: irregularity in time within a country and heterogeneity between countries at a given date. The irregularity is represented by intense curve fluctuations. These fluctuations reflect crises of mortality caused by famines and epidemics. Europe still played host to health crises. However, recurring crises tended to become less frequent and thus less common. Humans began improving their health by mitigating crises. These crises - reflected in mortality peaks on the curves - seemed to differ from one country to another. They were less severe in the most populous countries, as population density likely diluted their importance. England seemed more vulnerable than France. Finland was particularly vulnerable to crises, probably also because of its climate. Some years, Finland lost 8% of its population. Such a loss would correspond to more than 5 million deaths per year in France in 2020. Nevertheless, crises were beginning to spread out, creating a mathematical effect on mortality. The same countries took longer to improve their normal mortality regime, that is, mortality not in times of crisis but in periods of remission.

The other main feature of the European picture was heterogeneity, with notable differences between countries. These differences concerned both starting levels and trajectories. English reconstructions indicate that British mortality in the mid-18th century would have been lower than that of France. These estimates suggest that the British began with a head start. But this presumed advantage was contested by Louis Henry (1911-1991), the demographer behind the French analysis. He pointed to methodological problems as an explanation for the differences in mortality rates [Henry/Blanchet, Populations 1983]. According to Henry, the English estimates had made two errors: they failed to account for migration and had neglected child deaths. Henry thought that the English research had ignored the third indicator of interest to demographers after births and deaths: migration. People who had left no longer died locally, and were therefore not counted. Since the English data were local, migrations may have biased the analyses and skewed their results. Second, according to Henry, these same studies did not correct a major bias, the under-recording of burials for very young children. By excluding a share of infant mortality, English historians may have overestimated the state of health of their country, presenting it as superior to others'. We cannot be completely sure that in the 18th century England's mortality rate was so far removed from that of France.

But it was not only the starting lines that separated the countries. The race itself also contributed. The dip in mortality looked different from one country to another: it appeared steady in Sweden but discontinuous in France and England. This simplified summary illustrates the history of global health since it first began improving. But positions are never definitive. Some countries began earlier but finished late. They initially promised better health, but ended up punishing their people. Delays can be made up for, and leads may be lost.

Decisive factors of change

In order to make progress for the first time in history, circumstances had to allow for change. Two words suffice to summarize those circumstances: the Enlightenment and the Revolution. Theory came before practice. The change had to be possible from a cognitive point of view. The Enlightenment would provide the intellectual means to initiate the change in proposing new ideas and knowledge. The leaders of the movement were in France: Diderot, Voltaire, D'Alembert, and Rousseau were its champions. The Enlightenment emphasized the social value of intelligence, the relevance of methodical doubt and reason [...]. In one of the chapters of his *Encyclopédie*, Diderot emphasized that the decline or growth of a population is strongly influenced by infant mortality. For him, a sovereign who cared about one should necessarily care about the other. Diderot also defended the need for an insurance system for health and against illness. The other galvanizing event for health was the French Revolution, the influence of which was not only national. Writing in 20th-century America, Rosen observes that despite the complexity of Europe at the end of the 18th century, all of its countries "accepted change as inevitable." The

Enlightenment had made progress conceivable, but the Revolution would make it desirable.

How did the decline in European mortality occur after 1750? The answer is inevitably uncertain, but historical information provides significant clues. The course of events may be summarized in three parts: a segment of the population, a group of diseases, and an approach. Children were the population segment. The first humans to see their health progress were the youngest. Their mortality had always been a dramatic burden. Demographers estimated that in 1750s France, the risk of death before age 10 was almost 50%. By reducing infant mortality, humans unknowingly and almost unwittingly targeted the problem that was pulling down hardest on the longevity curve. Infant mortality had a disproportionately large effect on average life expectancy and for purely algebraic reasons. Averages are sensitive to extremes. Saving more children was mathematically the most efficient action. Second, the diseases that declined in frequency were microbial diseases. Such diseases were the overwhelmingly main causes of illness and death, particularly in children. These first two points - infant mortality and microbial diseases - are sufficiently certain. They tell us what happened but do not answer the question of how. This leads to the third point, namely, actions that have reduced infectious mortality. Though certainty is impossible, hypotheses are strong. It is always difficult to understand retrospectively the factors that determine health, but it appears clear that public health measures were decisive. Historical and demographic work indicates that a small number of changes pushed health toward improvement after 1750: sanitation (waste treatment), provision of drinking water, better nutrition, and the struggle against smallpox. These four points will all be discussed in detail. All of these changes were collective. Their approach was population-based even if they ultimately benefited individuals. To simplify matters marginally, it is immediately apparent that health improvements during this period were only slightly dependent on medicine, which was hardly progressing. But for these public measures to be implemented, someone had to decide. Humans needed health policy.

Human health's downward turn

Environmental and behavioral risks brought with them handicaps, diseases, and death. They damaged the lives of individuals, often also shortening them. But general longevity soon returned, spreading further and further. How to explain this counter-intuitive turn? The response is necessarily mathematical. First, lives shortened by man-made risks did not counterbalance other lives which were getting longer. These longer lives could either be higher in number or could be longer than those that were shortened. Second, certainly not all humans are happy in life, but most do not wish to die. Since the beginning of time – but even more so since we have had the means – humans have struggled to maintain sick people alive. To the increase in the population frequency of chronic diseases, industrial humans have more often responded by attempting to treat than to prevent. In treating diseases, they have very rarely cured them. Rather, they have succeeded in mitigating or controlling them. Drugs used to treat inflammatory diseases do not eradicate the diseases but partially or totally eliminate them for a given period of time before observing a relapse, which will itself often be kept in check by other drugs. Anti-diabetic drugs keep blood sugar levels within acceptable limits, thereby delaying or reducing the risk of complications. Even cancer often tends to become a true chronic disease characterized by cycles of alternating remissions and relapses. The flow of therapeutic innovations, not always stable but never interrupted, has provided technical tools to counter the effects of diseases or delay the onset of their complications. As we have also seen, increasing resources have been allocated to continue caring for patients, regularly breaking with established standards. Intensive-care physicians have raised the age of admission to intensive care units. In the 1980s or even 1990s, an 80-year-old patient requiring intensive care could be refused solely on the basis of their age and independently of their case. Today, age is almost no longer a criterion. Intensive-care physicians assess what is called a patient’s physiological age. This age speaks more directly about the patient's life expectancy and the relevance of admitting them to intensive care. Industrial humans have almost never stopped trying to treat diseases. As long as a patient functions minimally, it is very rare that a decision is made to stop care, even at advanced ages. There is self-prolongation in this logic. As life expectancy increases, so does life expectancy among older people. In 2020 in France, life expectancy at age 80 was around 10 further years - a little more for women, a little less for men - which justifies taking standard care of just about any treatable disease. Ten years of life provides strong ethical justification. Treating people in their early 80s in this way allows them to live longer; it also maintains or even increases their statistical longevity.

The American case

This resistance to dying has nevertheless met its limits. While population-based health was deteriorating in some countries, this was reflected in the final indicator that many observers had taken as a reassurance: life expectancy. At least two countries where health systems were known to be dysfunctional or underfunded - the United States and the United Kingdom respectively - saw overall mortality and average life expectancy deteriorate. The United States broke new ground in being the first industrialized country to reduce its population's life expectancy. Researchers Anne Case and Angus Deaton have done extensive work documenting and analyzing the decadence of American health. Princeton University-affiliated economists and a couple in their non-academic lives, Case and Deaton have studied Americans' vital and health data in depth. Their work spans several research papers followed by a book. In 2015, they published an initial paper. Highly descriptive but only slightly analytical, the paper emphasized two main messages. First, the authors reported "a set of facts," namely a deterioration in the health of some Americans. Second, they identified the main immediate causes of this deterioration. An increase in mortality, no matter the cause, was observed among middle-aged, non-Hispanic whites. The study period was from 1999 to 2013. The phenomenon was exclusive - no other country observed a similar trend - and was limited to this segment of the American population. Middle-aged black or Hispanic people and people over 65 regardless of ethnicity or skin color continued to see a decline in average mortality over the same period. Next, Case and Deaton looked for the immediate reasons for this selective degradation. The increase in mortality among middle-aged non-Hispanic whites was largely due to a small number of causes that had one factor in common: they were of direct human origin. Three were common to all of the calculations: alcohol, opioids, and suicide.

The Impact of Climate Change

That climate has influenced not only life but also human health seems plausible and intuitive, but it has long remained a theoretical hypothesis. We know and have seen that a small number of causes explained sickness and death in prehistory and most of history. Nutritional problems, microbial infections, and violence led to most human death from prehistoric times until the 18th century, keeping average life expectancy at a rate most likely three times lower than today's levels. A great deal of historical information suggests and even demonstrates that climate has often been at the root of these three causes of illness and death. Information provided in the first chapter on the health of prehistoric or pre-industrial humans has been compared with climate data from corresponding periods. Anthony McMichael, an Australian epidemiologist, described and analyzed it in several articles and in a book he was unable to finish before his untimely death in 2014. McMichael's numerous historical examples respond to several time scales: long term, medium term, short term, and even acute. McMichael explains that climate may have affected human health through three mechanisms, namely direct effects (first mechanism) and two types of indirect effects. Temperature and extreme events are the direct effects. Heat waves, floods due to intense rainfall, and other extreme events such as hurricanes are examples. These direct effects come most easily to contemporary minds because they are the most visible. Though people are most aware of climate-related effects, they are not necessarily the most important in terms of impact. Furthermore, we know little about the role they played on the health of prehistoric humans; old enough data on this direct mechanism is not readily available.

Most of the historical information relates to the other two mechanisms of indirect effects of climate on health. Either the effect goes through a natural change - ecological or biophysical - or it occurs through social disruption. In other words, climate alters human health by disrupting the balance of human environment or collective human life. The destabilization of natural systems generates several types of risks. It can reduce crop yields and expose people to malnutrition, or alter water quality. It can also increase the risk of climate-sensitive microbial diseases. Climate can directly influence microbes, or affect their vectors (often insects) or intermediate host animals. Finally, climate and its adversity may exert a negative social effect on humans, leading to a disorganization of human life. Hostile conditions can directly cause population displacement, unrest, and violence. But it can also severely degrade social order through the other problems already mentioned for the second mechanism, namely food shortages and microbial diseases. This social disruption of varying degrees, which is also a threat to mental health, may in itself generate other health-related stress already discussed in the previous chapters.

This somewhat cumbersome description brings out a few recurrent features in the history of the links between climate and health. Firstly, climate produces a mostly indirect effect on population health by causing or magnifying three types of problems that interact with each other: nutritional deficiency, infections, and social disorders. These three problems are the dominant causes of mortality in prehistory and pre-industrial history. They can be seen simultaneously as a result of the same climate change, or they can be observed one by one. The first may cause the others, and so on. For example, poor harvests weaken the nutritional level of a population, making it vulnerable to microbial infections, whether they are habitual (endemic) or cyclical (epidemic). This population stress can itself be the cause of social unrest. Conversely, a drop in temperature, especially if it is sudden, can contribute to the emergence of an epidemic, which also affects population health by deteriorating nutritional status and disrupting social order. Climate adversity has always had this capacity to generate negative health dynamics with problems that complicate one another.