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The History of Chronic Diseases and Industrial Revolution

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Abstract

The current research investigates the historical association between the industrial revolution and an increase in the prevalence of chronic diseases. Less time spent being physically active and more calories consumed have been linked to an increased risk of developing chronic diseases such as diabetes. This resulted in obesity, which then contributed to the development of cardiovascular disease and other illnesses. According to the findings of this research, the main characteristics of chronic diseases are linked to the transition to modernity. These shifts in the composition of the community have been observed in more recent times in history. When viewed as a whole, changes in lifestyle are a contributing factor in the problem of rising disease rates and have the potential to be both part of the problem and part of the solution.

Keywords: History; Chronic Diseases; Diabetes; Lifestyle; Physical Activity

Abbreviations: TTM: Term Transition to Modernity, GBD: Global Burden of Disease, WHO: World Health Organization

Introduction

The current research investigated the changes in history that have been linked to an increase in the prevalence of chronic diseases such as cardiovascular diseases, diabetes, and others. The Industrial Revolution was responsible for a number of societal shifts, one of which was an increase in sedentary behavior, which in turn contributed to the development of chronic diseases. The authors continue their discussion of various aspects of societal shifts, the industrial revolution, and chronic diseases in the following sections.

Industrial Revolution

The Industrial Revolution, along with the accompanying nutritional, epidemiological, and demographic shifts, has had a profound impact on human ecology and biology, leading to

major shifts in life history traits such as age and size at maturity, age-specific fertility, and lifespan **[1]**. This is because the shifts in nutrition, epidemiology, and demographics that occurred simultaneously with the Industrial Revolution **[2]**.

These shifts are directly responsible for bringing about these changes that have taken place. Gene variants that in the past were thought to be associated with higher fitness may now, as a result of antagonistic pleiotropic effects, predispose post-transition populations to non-communicable diseases such as Alzheimer's disease, cancer, and coronary artery disease **[3,4]**. This is because previous adaptations are not suitable for the environment that exists today. There is mounting evidence to suggest that the transition to modernity has also altered the course and intensity of natural selection acting on a wide variety of traits, which has significant repercussions for public and global health. These repercussions have been brought about by the fact that natural selection acts on generations of organisms rather than just one **[5]**.

The term transition to modernity (TTM) refers to a period that encompasses not only the Industrial Revolution but also the ecological, epidemiological, and demographic changes that occurred at the same time. The effects of these shifts have been felt to a significant degree by human populations. The advent of modernization has led to fundamental changes in the environment, including long-term improvements to nutrition and food security **[6]**, a precipitous fall in the number of people who are exposed to infectious agents **[7]**. and a general rise in the number of people who are exposed to air and water pollutants [8]. These are just some of the changes that have been brought about as a result of the advent of modernization. Examples of biological changes include shifts in our physiology, development, immunobiology, microbiota, and life history traits, as well as alterations in the age structures of our populations **[5]**.

As a direct consequence of this process, mismatches have developed between the capabilities we have developed over time and the rapidly shifting environment we live in. These mismatches have a wide range of implications for both health and disease. It is possible that previously evolved genetic effects that are mediated by antagonistic pleiotropy are now responsible for a significant proportion of the growing burden of non-communicable diseases, which are currently responsible for more than 63% of the deaths that occur all over the world **[8]**. This statistic is based on the fact that non-communicable diseases currently account for over 63% of all deaths. Eighty percent of these fatalities occur in nations with a low or middle income, and fifty percent of the victims are men and women who are of working age in those nations. Non-communicable diseases continue to pose a significant threat not only to people's health but also to the expansion of economies around the world, despite the significant progress that has been made in the fight against the ever-increasing death toll caused by non-communicable diseases3 over the course of the past decade in the fight against these diseases **[5]**.

The progression into the present day and age

The demographic transition, which can be described as an unprecedented shift from a system that was characterized by high fertility and high mortality to one that was characterized by low fertility and low mortality, got its start in the northwestern region of Europe around the year 1800 and has since spread to every other region of the world. The demographic transition can be described as an unprecedented shift from a system that was characterized by high fertility and high mortality to one that was characterized by low fertility and low mortality. During the time of transition, first the mortality rates and then the fertility rates fell, which resulted in an initial acceleration of population growth rates, followed by a slowdown as rates returned to their previous levels. In the long run, this resulted in lower fertility rates, longer life expectancies, and an increasingly elderly population. It is anticipated that the demographic shift will be complete by the year 2100, and it is currently in the process of fundamentally reshaping economic conditions and restructuring populations **[9]**.

Mortality

In the more impoverished regions of Europe, the Ottoman Empire, Egypt, India, China, and Japan prior to the 16th century **[10]**, there was not much of a difference in the standard of living of unskilled workers and farmers. In pre-industrial populations, the death rate ranged from a minimum of 30 deaths per 1,000 people each year to a rate that was many times higher during times of famine or epidemic **[11]**.

In modern populations, the death rate has been steadily declining since the industrial revolution. This volatile pattern of mortality began to recede in Western Europe in the 16th and 17th centuries **[12]**, although total mortality remained high due to a marked increase in childhood mortality, especially from smallpox **[13]**. This unstable pattern of mortality began to recede in Western Europe in the 16th and 17th centuries **[12]**.

Beginning in Europe in the 18th century, improvements in agriculture, transport, and food distribution uncoupled cycles of mortality and fertility from fluctuations in the price of grain **[6,12]**. Associated improvements in nutrition led to the earliest and most significant increases in child and maternal survival, in part by increasing resistance to infectious diseases **[14]**.

Beginning around the year 1800 in England and then gradually spreading throughout Europe, urbanization imposed a mortality penalty that was only partially compensated for by the invention and subsequent adoption of civic hygiene, the creation of a public health infrastructure, the emergence of safe milk and clean water supplies, and the development of sewage disposal **[15]**.Urbanization imposed a mortality penalty that was only partially compensated for by the invention and subsequent adoption of civic hygiene. Urbanization imposed a mortality penalty that was only partially compensated for by the invention and subsequent This mortality penalty was first imposed on England as a result of urbanization, and then it gradually spread throughout Europe. Because of the response, the mortality rate that was caused by enteric and water-borne diseases like cholera and typhoid dropped significantly. The first vaccination against smallpox was given in the year 1796, which led to a significant decrease in the number of smallpox epidemics as well as a reduction in the severity of these outbreaks. As a result of improvements in the built environment and other aspects of living conditions, mortality rates from other airborne diseases, such as tuberculosis, diphtheria, and whooping cough, also steadily decreased in the latter half of the 19th century. An increase in the availability of soap and clothing made of washable cotton **[16]**, as well as an improvement in housing that was less crowded, led to a reduction in the exposure to pathogens **[17]**.This was made possible by an improvement in hygiene and cleanliness, which was made possible by an increase in the availability of washable clothing18. The decline in mortality rates caused by infectious diseases was also contributed to by technological advancements such as refrigeration and antisepsis, as well as improvements in health education, health promotion, and public health and environmental regulation **[18,15]**. The beginning of this long-term trend of falling mortality rates can be traced back to the 1930s, when new childhood vaccines and antibiotics were first made available. The year 1940 marked the beginning of human use of antibiotics. Comparatively, communicable diseases are responsible for between 20 and 80 percent of the years of life lost in countries that are not as developed as those in the developed world in the 21st century, where they account for less than 10 percent of the years of life lost. Comparatively, communicable diseases are responsible for less than 10 percent of the years of life lost **[5]**.

Lifespan

There was a sizeable improvement in the life expectancy of newborns in the countries that currently hold the title of having the highest life expectancy on a global scale between the years 1840 and 2000 **[19]**. Between 37 and 40 years was the typical amount of time a person could expect to live in Sweden and England before the industrial revolution. This is comparable to the life expectancy at birth of contemporary hunter–gatherer populations as well as forager and horticulturalist societies **[19,20]**, in which the life expectancy at birth ranges from 27–37 years and 40-42 years, respectively. Between the years 1860 and 1969, the maximum age at death in Sweden increased by 0.4 years every decade. However, between 1969 and 1999, the maximum age at death increased by 1.1 years every decade **[21]**. Similar patterns in maximum lifespan were found in six additional North European countries with complete and validated data on centenarians **[22]**.These nations all had about the same number of centenarians per population. Prior to the year 1950, the majority of improvements in lifespan were brought about by reductions in mortality at younger ages. This trend continued until the year 1950. Since that time, the vast majority of progress that has been made can be attributed to an increase in the number of people who are surviving past

the age of 45 **[19]**. In the modern era, the average life expectancy in countries with high levels of per capita income was 80 years in the year 2015 (). (The World Bank Group, 2018). It is likely that the continuation of the increase in lifespan will be dependent on the development of additional significant medical advances **[24]**. but this is not guaranteed.

Fertility

Fertility rates in pre-industrial populations ranged between 30 and 50 births per 1,000 people, which translates to a total fertility rate of between 3.5 and 10 births per woman. These rates are expressed as births per woman **[25,26]**. The majority of pre-industrial societies' pre-industrial populations experienced a nutritionally mediated low point in conception rates during times of famine. This led to birth rates that were highly seasonal **[27]**. The duration of lactational amenorrhea (the temporary infertility that occurs with breastfeeding), nuptiality (the proportion married), fecundability (the probability of pregnancy in one menstrual cycle), age at menarche, proportion of women who were sterile, age at menopause, rate of fetal loss, and length of gestation were the proximate determinants of fertility. The length of lactational amenorrhea (the temporary in These considerations were arranged from most important to least important **[28]**.

A shift from a high fertility rate to a low fertility rate is one of the defining characteristics of a demographic shift. Another defining characteristic is a shift from an older population to a younger population. A defining characteristic of this shift was how it initially manifested itself in France in the decades after the French Revolution and then spread throughout the majority of Europe by the year 1940 **[29]**. The crude birth rate in high-income countries in 2015 was 10.9 births per 1,000 people, which is equivalent to 1.7 births per woman. The crude birth rate in low-income and middle-income countries was 20.6 births per 1,000, which is equivalent to 2.6 births per woman. Countries with high levels of income had a lower birth rate, at 19.4 births per 1,000. By the year 2003, the birthrate had either reached or fallen below the replacement level of 2.1 children per woman in sixty countries, which accounted for 43 percent of the world's total population. These countries make up sixty percent of the world's total population **[30]**.

Age at menarche decreased by approximately 5 years across the TTM, from 17–18 years in pre-industrial populations to 12–13 years in post-TTM populations. This represents a decrease from the average age at which women reached menarche in pre-industrial populations. In the pre-industrial era, the ages ranged from 17 to 18. The age at which a woman goes through the natural process of menopause is dependent on a wide variety of lifestyle, sociodemographic, and reproductive factors. Menopause is a natural process that occurs when a woman's reproductive years come to an end. The average age of women when they went through natural menopause was found to be 48.8 years, according to a recent meta-analysis of studies that were carried out on women who were born during the 20th century in 24 different countries and on 6 different continents. The average age of women when they entered natural menopause ranged from 46 to 52 years. 38; after accounting for the other factors that were mentioned, levels of economic development accounted for a difference of 2 to 3 years in age at menopause, which suggests that the age at menopause increased with the TTM **[5]**.

It is possible that the potential reproductive lifespan could be extended by more than ten years if the current trends in menarche and menopause continue. This would be the result of an increase in longevity. However, during this time period, women had a shorter actual lifespan when it came to their reproductive potential. This was due to the fact that they gave birth more frequently. It was in the 1960s39 that certain Scandinavian countries were the first to observe a trend of a woman delaying the age at which she had her first child. By the year 2000, this trend had spread throughout the entirety of Europe. This trend has been accompanied by a decrease in fertility, which reflects a conscious limitation of family size driven by the perceived costs and value of children **[30]**. In other words, fewer children are being born into families. In addition, factors such as an increase in life expectancy and literacy, a better understanding of the risks associated with pregnancy and childbirth, as well as cultural factors such as who controls female reproduction **[31]**, are all factors that have contributed to this phenomenon. Other factors that have contributed to the rise in the overall fertility rate since 1941 include the development of highly effective methods of birth control, involuntary infertility as a result of delayed marriage or divorce and shifts in the stability and nature of sexual

unions. These factors have all taken place since 1941 **[5]**.

Changes in the prevalence of disease throughout the population: Alterations in the patterns of death, longevity, and fertility that occur in populations that are undergoing the TTM have resulted in a change in the age structure of the population. This change has been brought about as a direct result of the TTM. The infectious diseases that were common in childhood have given way to the non-communicable diseases that are associated with getting older as the leading causes of death in the general population. Getting older is also associated with an increased risk of developing non-communicable diseases. This is as a result of a larger proportion of the general population reaching older ages over the course of their lives. According to the Global Burden of Disease (GBD) database, four out of the top five causes of death around the world in 2016 were non-communicable diseases. These include cardiovascular and chronic respiratory diseases, neurodegenerative diseases, diabetes mellitus, and cancer. This is the case in spite of the fact that infectious diseases continue to be a major concern for public health and a major cause of mortality and morbidity, particularly in developing countries (Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA). According to the World Health Organization (WHO), in 2015, non-communicable diseases accounted for nine of the top ten leading causes of death in high-income countries **[32]**.

It is possible that the absolute increase in non-communicable diseases can be halted if efforts are coordinated on both the national and international levels. The most recent GBD study reveals that there was a decrease of 12.1% in the global mortality rate due to non-communicable diseases between the years 2006 and 2016 **[33]**. The marked socioeconomic inequalities that exist within countries have an effect on both the rate at which this decline is occurring as well as the magnitude of it **[34]**. Even though the impact of preventive programs in low-income countries has only been modest so far, the decline can be attributed to both preventive programs like smoking cessation and effective medical treatment **[35]**. The deterioration can be traced back, in particular, to cardiovascular disease. As the mortality rate from cardiovascular disease has decreased, particularly in developed countries47, the relative contributions to mortality of other non-communicable diseases associated with aging, such as cancer and dementia, have increased **[36]**. This is because these diseases are associated with aging. Despite the fact that the death rate from cardiovascular disease has gone down, this continues to be the case.

Diabetes type 2 diabetes

It is now widely accepted that type 2 diabetes has reached epidemic proportions in the United States because the risk of developing the disease among people in our society is so high **[37]**. The number of individuals who were diagnosed with type 2 diabetes increased by a factor of six between the years of 1958 and 1993 **[38]**. In the past, type 2 diabetes was thought of as a condition that primarily afflicted adults and people of advanced age, and not children or young adults. However, recent research has shown that type 2 diabetes can develop at any age **[39]**. However, **[40]** discovered that the prevalence of Type 2 diabetes among adolescents increased by a factor of ten between the years 1982 and 1994. This finding was made public in the journal Diabetes Care. In addition, type 2 diabetes was the cause of 33% of newly diagnosed cases of diabetes in people aged 10 to 19 years old in the year 1994. These people were diagnosed with diabetes for the first time that year. As a result, the rise in the overall prevalence of Type 2 diabetes is not solely attributable to the fact that people in the United States are living longer past the middle age demographic. Rather, both of these factors are contributing factors. This means that our children will experience conditions related to type 2 diabetes much earlier in life, such as retinopathies, myocardial infarctions, and strokes. This is because our children have a higher risk of developing type 2 diabetes than the general population does. It is possible that our families and our society will go through significant financial strain as a result of the requirement to provide medical treatment to a subpopulation at such an early stage in that population's life. This is because the subpopulation in question is at such an early stage in its life. The greatest tragedy, on the other hand, is that diseases that have traditionally been thought to only affect people in their middle age or older will now affect our children at a much earlier age, thereby drastically lowering their quality of life over a much longer period of time than what previous gene-

-rations have experienced. According to estimates provided by the American Diabetes Association, diabetes is responsible for the deaths of 193,000 people in the United States each year. It's almost certain that we'll see an increase in this number **[38]**.

In industrialized societies, there are very few jobs left that require a significant amount of physical labor, and the ones that do exist are almost exclusively reserved for young men with little or no education. This event will go down as a watershed moment in the annals of human history. As a result, our ancestors evolved as a result of living in an environment that required significantly more effort physically than what is seen in the industrialized societies of today. Additional evidence in support of this statement can be found in the levels of activity that have been recorded for the remaining contemporary hunter-gatherer societies as well as agricultural societies. As just one example, a study that was carried out in Peru in 1978 on the Machiguenga Indians found that the men of that tribe had an average daily energy expenditure of 60 kilocalories per kilogram, whereas the value for men in the United States is 39 kilocalories per kilogram **[41]**. This represents a staggering 35% decrease in individual energy turnover that has the potential to be the result of the industrialization of society (1,600 kcal/day or 167 lb. of body fat/yr for an individual who weighs 75 kg)! It is highly likely that there was no such thing as obesity in ancient hunter-gatherer and/or agrarian societies, just as there is no such thing as obesity among Machiguenga Indians today. This is because hunter-gatherer and/or agrarian societies tend to have lower rates of obesity. In addition, Eaton and Konner (1985) conducted a review in which they demonstrated that chronic diseases such as coronary heart disease, hypertension, diabetes, and certain types of cancer are virtually unheard of in modern hunter-gatherer societies, even in individuals who are over the age of 60. These diseases include: coronary heart disease, hypertension, diabetes, and certain types of cancer. This was true even of the oldest members of the societies in question. These findings provide evidence to support the hypothesis that the rising incidence of chronic diseases in industrialized societies may be the result of a phenomenon related to rising levels of sedentary behavior. In addition, they offer a counterargument to those who contend that the only reason chronic diseases are on the rise is because people are living longer **[42]**.

Historical perspectives of Tuberculosis

Because tuberculosis was likely the leading cause of death throughout much of the 18th and 19th centuries in Northern and Western Europe, its history has been studied in great detail **[43]**. Because of this, there has been a significant amount of research done on the history of tuberculosis **[43]**. In major metropolitan areas like London, Paris, The Hague, and Stockholm, the most common form of tuberculosis, which is known as tuberculosis of the lungs, was responsible for between 10 and 25 percent of all deaths **[43,44]**. In the course of the 19th century, national cause-of-death statistics were first made available; these statistics revealed somewhat lower but still astoundingly high figures for the world as a whole. These statistics applied to the various nations. Young adults had the highest mortality rate, which led to enormous demographic, economic, and social repercussions **[43]**. The highest mortality rate was found among young adults. Since that time, the mortality rate that is directly attributable to tuberculosis has decreased by a sizeable amount. The investigation into the reasons for this decline has turned into something of a scientific battleground between those who have argued that the decrease in mortality from tuberculosis is primarily due to improvements in living standards and those who have emphasized the contribution of public health and other interventions **[45]**.

Other health aspects have been associated with modernity including abortion and the recent COVID-19. Increasing cases of abortion have been extensively discussed due to medical or social needs **[46,47]**.

Conclusion

When it comes to medical knowledge, history is advantageous because it enables the identification of the origins and bases of changes associated with diseases. An excellent illustration of a social shift that contributed to the emergence of chronic diseases such as diabetes is the Industrial Revolution.

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