

# Reflections on demographic theories

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## Abstract

The article presents the author’s reflections on theories in general and demographic theories in particular. The epidemiological transition, i.e. periodization of changes in the structure of causes of death, proposed by A.R. Omran in 1971 and later raised to the rank of theory, is taken as an example. The author points out the insufficiency of Omran’s concept to explain the contemporary mortality trends and suggests possible directions of theorizing that would enable correlating the new stage of life expectancy growth with the notion of “epidemiological transition”.

## Keywords

demographic theory, epidemiological transition, mortality reduction, avoidable causes of death

## JEL Codes: J10, J19

“The methodological basis of the research is the theory of epidemiological transition”  
*From the author’s abstract of the dissertation in one of social academic disciplines*

The citation taken as an epigraph impelled me to write these reflections. I confess that I do not know what the “research methodology” means, and Google and Yandex were unable to help me fill this gap. There was even a fear that if the collected facts prove to be contrary to the theory of epidemiological transition, the author would have to resolve this contradiction in favour of theory. But then I remembered that for many years in author’s abstracts instead of the theory of epidemiological transition the authors pointed at the Marxist-Leninist theory of population and works of classics of Marxism, and this didn’t affect the quality of the majority of dissertations. Poor dissertations remained poor, and the worthy ones remained so.

One thing is completely incomprehensible: how did the theory of epidemiological transition rise, at least in the minds of academic degrees seekers, to the level of “Marxism classics works”? A. Omran’s article “The epidemiologic transition: A theory of the epidemiology of

population change” (Omran 1971) was one of many articles dealing with reducing mortality in the developed world. I can’t guarantee, but according to my memories, *The Milbank Quarterly* did not enter any of Moscow’s libraries in the early 1970s. Anyhow, I read Omran’s article already in Russian translation, which was published in 1977 with the title “The epidemiological aspect of the theory of natural population movement” (Omran 1977). By this time I had read the chapters on mortality in a very fascinating book “The determinants and consequences of population trends” (United Nations 1973) and got acquainted with a huge collection of life tables by cause of death collected in Preston et al. (1972). The collection allowed the authors to clearly trace the link between life expectancy at birth and the structure of death by causes. Some journal articles have reached Moscow, including the works of J. Bourgeois-Pichat, who divided mortality causes into exogenous and endogenous (Bourgeois-Pichat 1952). It turned out that the main successes achieved by the developed countries by the early 1970s were related to the reduction of mortality from exogenous causes. Finally, in 1976 the “Demographic Revolution” by A.G. Vishnevsky was published (Vishnevsky 1976). In general, it seemed to me that I learned nothing or almost nothing new about the growth of life expectancy in Europe and overseas countries inhabited by Europeans, from Omran’s article. Now I understand that by not paying due attention to Omran’s article, I made a big mistake. It’s never too late to fix an error and I started reading it. *The Milbank Quarterly* recently released a reprint of the article, and A.G. Vishnevsky drew attention to the fact that in the Russian translation the title of Omran’s article is distorted (Vishnevsky 2015: 23), so I preferred to turn to the original. But I will start here not with my impressions of the article, but with a more general question — what is theory.

## 1. What is theory

“Take two numbers from those that again the same mathematicians call cubes (we, Tuscans, who do not have the right word, will call them squares)...”

*Agnolo Firenzuola, Ragionamenti*

Hubert Gérard, author of the chapter “Building theories in demography” in the famous treatise on population research (Gérard 2006), starts with the fact that in demography, as in social sciences in general, the term “theory” is very multifaceted, and each author interprets it differently. I turned to Gérard’s works because he’s really dealing with theories. Twenty years earlier, he wrote an article entitled “Theories and theoretisation” (Gérard 1987), where he described the construction of theories as a process of critical systematization of existing knowledge into a single whole, on the basis of which hypotheses can be empirically tested. According to this definition, theory is a hypothesis that has stood the test. In this definition, there is nothing specifically demographic, the same definition of theory can be used in natural sciences. To make it simple, we can say this: from the results of observations some doctrine is created, and it can pretend to be rated a theory. If it carries some previously unknown assumption, which can be verified empirically, then the doctrine is considered a hypothesis. If the test yields a positive result, the hypothesis is considered a complete theory.

Gregor Mendel, a monk and a school mathematics teacher, studied how plant properties are inherited. He assumed that there were some carriers of properties — genes, and the

properties of the offspring depend on the properties of which parent pass to the offspring. In this case, inheritance can be modeled using the urn model. But if so, the distribution of plants by properties should be described by Bernoulli's known formulas. So Mendel's experiments with the colour of sweet pea flowers became the first experimental confirmation of the theory of genes, that is genetics.

To prove the relativity theory, it was necessary to make sure that the light flux is curved near the Sun.

So, natural science theory relies on all the available facts, gives them a general explanation, and predicts some new, previously unknown properties that can be experimentally verified. If verification is successful, the candidate for theory becomes a theory.

There are almost no theories (in natural science understanding) in demography, so there are a lot of theories, and, besides, many economic, sociological, epidemiological and medico-biological theories settled well and adapted in modern demographic literature.

As an example of specific demographic theory, let us recall formal demography — it is sometimes called “pure demography” — which is built around the Lexis diagram and describes the dynamics of the population and reproduction processes depending on time, age and other parameters having a dimension of time. Alfred Lotka and his followers enriched the formal demography with the strictly proven properties of ideal populations.

Among real demographic processes, the majority of theories seem to be dealing with fertility, namely with the questions why the birth rate has been so high in the past, why it declined, what prompts women to give birth, and a stumbling block — the negative link between fertility and family income. Some demographers claim that the connection is actually positive, others — that it is U-shaped. There is a point of view that the relationship refers only to the per capita (and not to the aggregate) income, and it is a consequence that the more children in a family, the more the denominator is, all other things being equal. In this case, theories seem being simply not able to explain the accumulated facts.

In the USSR and modern Russia, fertility theories based on the notion of “need for children” are very popular. The author of the theory, A. Antonov, uses very complex sociological questionnaires to measure the need for children (Antonov 1998: 254–294). The question “How many children would you like to have?” in the survey hardly makes it possible to reliably judge the need. But even if it was possible, theory takes the explanation to the next level. The questions on what determines the need for children, how it competes with other needs, etc., are put to the fore. Thus, the theory refers to something even more complex and unknown than the object under study. It should be noted that such situations also occur in natural sciences. For example, we still don't know why Newton's law of universal gravitation is true. But we have learned to measure the weight and distance appearing in the formula quite accurately, unlike the need for children.

There are three main theories explaining the differences in mortality between educational groups by natural and social selection, material and working conditions, and cultural and behavioural factors. Each theory has its own author, but all together they are considered in the work of Tapani Valkonen (2001) (Valkonen himself does not use the word “theory”, but in other publications it is widely used). Does this mean that when we find the difference in mortality between groups with different education, we may not seek for explanations, but refer to one well-liked theory or all three at once? However, in the former USSR educational differentiation of mortality was the same as in Western European countries, while differences between educational groups by income level were often opposite. The most massive professions involving higher education — doctors and teachers — were at the bottom of the income distribution.

The difference in mortality depending on marital status is explained by the theory of selection. Almost everywhere, mortality in unmarried men is higher than that of unmarried men. But in many countries, the mortality of divorced women is lower than married women, which means that the theory of selection cannot be seen as a universal explanation. On the other hand, the mortality of men in unregistered marriages is generally no lower than that of unmarried men (Hemström 1996; Soons and Kalmijn 2009).

But the theory of epidemiological transition stands out even against this background of not very successful theories. The fact is that Omran does not explain anything, but only describes the general changes in mortality during its decline. He calls these changes an epidemiological transition, for which in the early 1970s he had certain reasons, and his description names “the theory of epidemiological transition,” for which he, in my opinion, had no reason. I would call Omran’s work “The Doctrine of Epidemiological Transition”. Or it is possible to leave the “doctrine” to the church and Marxism and following D.Valentiy use the word “concept”.

## 2. The essence of the doctrine of A. Omran

“I tell them: it is this and that,  
and if not so, then it is deception.  
And they yell: “And where are the facts, eh, facts?  
Put the arguments over on the spot”

*Yuli Kim, Song of the teacher of social science*

Only a small part of Omran’s rather extensive article is devoted to morbidity and mortality. A.G. Vishnevsky is absolutely right arguing that “the use of the phrase “epidemiological transition” in the title of the article was a successful “marketing” strategy that allowed Omran to firmly associate his name with this concept” (Vishnevsky 2015: 24).

The article contains five basic propositions. Here is a summary of them.

Mortality is a fundamental factor in population dynamics.

1. During the transition period, there is a shift in mortality and morbidity patterns, with infection pandemics being replaced by degenerative and man-made diseases. The author shapes three Ages (eras, epochs): the Age of pestilence and famine, the Age of receding pandemics, and the Age of degenerative and man-made diseases.
2. During the transition, the health of children and young women improves most significantly.
3. Shifts in morbidity and mortality are closely linked to demographic and socio-economic transitions.
4. There are three models of transition: classical / Western model; accelerated / Japanese model; contemporary / delayed model, typical for third world countries.

Omran writes that the transition begins when the country reaches a certain stage of socio-economic development. But the determinants of the transition are not simple, and their detailed description goes beyond the scope of his article; that is, the author did not intend to explain the transition mechanism. As an illustration, he returns several times to the topic of ending plague diseases in Europe.

Thus, the description of the epidemiological transition by Omran is that this is a transition from pandemics of infectious diseases and hunger as the main causes of death to the

era of degenerative diseases, in which children and young women gained the most. He also estimates life expectancy before transition in between 30 and 50 years.

A lot is surprising in Omran's text. For example, speaking about pre-transition mortality, he did not mention everyday violence, which even in the 19th century was an important cause of death in Western Europe and Russia.

It seems to me that the word "pandemic" is not very appropriate in the description of the situation before the 19th century. It is associated with an emerging and spreading disease, and plague in Europe in the 14th–17th centuries or cholera in Russia in the 19th century were common. In the 14th century the characters of Boccaccio hide from the plague in a country estate to give the world "Decamerone". Three centuries later on 27 February 1661 John Graunt presented his book on "Natural and Political Observations Upon the Bills of Mortality..." at the Royal Society of London. All this happened during the plague epidemic. The data collected by Graunt suggest that life expectancy in London at that time was 18 years. The epidemic was still in force a year later, when Graunt was elected a member of the Royal Society of London.

Many years ago I was had a chance to visit the anti-plague station in the south of the USSR. Air-locked boxes and suits made an unforgettable impression. But reading the works of historians and just books written several centuries ago, shows that very dangerous infections have long been human companions.

Omran does not explain in his article what degenerative diseases are. For example, in the mentioned book by Preston et al. (1972) there is classified a group "Some degenerative diseases", which includes jade, liver cirrhosis, stomach and duodenal ulcer, diabetes. Omran hardly meant these diseases. It seems that he attributed the circulatory system diseases and neoplasms to degenerative diseases, but remains unclear whether it is so. In general, the division of diseases into infectious and degenerative is very conditional.

The repeated argument that degenerative and man-made diseases are displacing the pandemic of infection as the main causes of morbidity and mortality suggests that the transition is linked to growth of mortality from "degenerative and man-made diseases". In fact, mortality caused by infections decreased, and against this background, the proportion of deaths from "degenerative and man-made" causes increased, but all available data show that the increase in mortality rates by certain causes occurred only due to improved diagnosis. Mortality from technogeneous accidents, which had simply not existed before because of the lack of appropriate technical means, had increased.

According to Omran transition is a transition from infections to degenerative diseases. But the successes of that period are associated not only with infections. At that time effective obstetrics and antiseptic surgery with anesthesia were created. Maternal mortality declined sharply (it is strange that Omran does not mention this in connection with the mortality of young women and children), people became less likely to die from appendicitis or cholelithiasis, etc.

The word "transition" implies that the process of change has not only a beginning, but also an end. Based on Omran's proposed periodization of the transition, we can assume that Omran associated the end of the transition with the period of deceleration of the decline in mortality, which was observed in the developed Western countries in the late 1950s and early 1960s. But by the early 1970s, it became clear that the slowdown was a temporary phenomenon. Between 1960 and 1970, women's life expectancy increased in all Western countries, and men's life expectancy did not increase only in Australia, the Netherlands, New Zealand

and Norway. That is, the United States, Canada and major European countries had already emerged from the period of stagnation.

The decline in mortality in Western countries and changes in the structure of causes of death continue to this day. There are no signs that this process will soon stop, if ever. In this point, I am much closer to the position of James Vaupel (Oeppen and Vaupel 2002) that there is no limit to the growth of human life expectancy. Even if the point of view of Vaupel's main opponents, S.J. Olshansky et al. (1990) is true, then this does not mean an end to the growth of longevity, but only a slowdown as some threshold is approached. I am sure that humanity will not stop at genetic self-modification but it is the issue of future.

As soon as it became clear that the decline in mortality in the developed countries of the West continues even after the epidemiological transition, as described by Omran, was completed, the question arose as to how a new stage of growth of life expectancy correlates with the Omran's doctrine. Vishnevsky (2014: 8-10) proposed two ways of possible action: prolong the epidemiological transition in the light of new developments or assume that the new decline in mortality is beyond the Omran's epidemiological transition. Omran himself adhered to the first idea (Omran, 1998), but the second one prevailed. Demography was supplemented with various concepts such as sanitary transition, second epidemiological transition, cardiovascular revolution (Vallin and Meslé 2004), reverse epidemiological transition (Semenova 2005)], the first and second epidemiological revolution and others. The common between these works, including Omran's own work, was that they were focused on describing current or ongoing changes in mortality in general or from particular causes of death. The authors described and classified changes in mortality trends while the reasons for change were disregarded.

I do not fully understand what the second epidemiological transition and the first and second epidemiological revolutions are. But not so long ago we divided the causes of death into endogenous and exogenous, today hardly anyone remembers that. The definition of the second epidemiological transition includes the term "non-communicable causes of death". The implication is likely that infectious causes have been defeated, and non-infectious ones must be combated. Knowledge about the etiology of diseases changes so often that this division seems to be soon forgotten.

Many times I was one of the authors of articles or books dealing with epidemiological transition, but my misunderstanding did not diminish, and my co-authors wrote the corresponding pieces. For myself, if I wrote on similar topics, which happened a long time ago, the term "demographic transition in mortality" was sufficient.

### 3. Attempt to theorize

— While swimming, have you noticed the rats dancing?  
The chief mate helplessly looked at the ship's doctor, then  
looked into Maksimov's eyes and threateningly whispered:  
— I would ask you to take me seriously."

*Vasily Pavlovich Aksyonov. Colleagues*

In my opinion, the main change that occurred in the mortality in the 19th century is related not to a decrease in mortality from some, albeit very dangerous and taking many lives, groups of causes, but to the emergence among human communities of conscious and effec-

tive ability to influence mortality rates from certain specific causes of death. It is this event that should be called the epidemiological revolution.

Smallpox mortality was defeated by smallpox inoculation. Quarantine and sanitary measures managed to cope with cholera. Only what happened to plague in Europe is not known. The authors of the above-mentioned volume “The determinants and consequences...” referred the disappearance of the main plague carrier, the black rat, to the intensive development of empty lands in Eastern Europe. In any case, the population of Europe was for a long time afraid of the return of the danger that disappeared for unknown reasons, which was manifested in anti-plague stations and quarantine instructions.

Another example is the reduction of tuberculosis mortality. In England, in the late 1920s and early 1930s, tuberculosis mortality declined so much that subsequent discoveries in prevention and drug therapy had little impact on it. Tuberculosis as a cause of death has almost disappeared. The reason for this is a significant improvement in the standard of living of the population (McKeown et al. 1975). In Russia between 1946 and 1955, tuberculosis remained the main cause of death of relatively young men. Only universal vaccination and the massive use of antibiotics changed the situation. However, in the early 1990s tuberculosis became a real cause of death again and this needed medication counteractions.

It is obvious that the decline in mortality occurs mainly through progress in the fight against specific causes of death. From this point of view, Omran correctly mentioned changing the structure of causes of death. Deaths of plague, cholera and smallpox have ceased to be affected, and other causes, including tuberculosis, have come to the fore. Many years later, in the most developed countries, advances in the treatment of circulatory called to turn to diabetes and Alzheimer’s disease. In Russia, in the 1960s, progress in the fight against tuberculosis and some other infectious diseases put the problem of accidents and circulatory diseases among young men on the agenda.

In my opinion, the concept of avoidable mortality (Nolte and McKee 2004) helps to understand what is happening. But it still requires consideration of more detailed causes than is usually accepted by demographers. From the standpoint of avoidability, it is impossible to speak about the circulatory system diseases in general and the ischemic disease in particular. In the most developed countries, some circulatory system diseases are not now the cause of death in all ages but those most senior; others continue to significantly affect life expectancy

Avoidability of causes of death eliminates the treatment of mortality reduction in different countries as movement at different speeds, but in the same direction, as follows from the concept of epidemiological transition. Even in different social groups of the same country, trends in reducing mortality by causes of death differ (Jasilionis et al. 2014). Progress in the fight against stroke will have little impact on mortality in populations or countries with excessive alcohol consumption and high accident mortality.

In my opinion, only when speaking about some specific cause of death it is possible to mention advance or delay. For example, in the treatment of stroke, Russia is far behind the advanced countries of the West.

Defining “avoidable causes of death” is not easy, and the list of avoidable causes is constantly changing. But it seems natural to imagine the process of reducing mortality as an expansion of the range of avoidable and partially avoidable causes of death.

## 4. Some conclusions

*Old gentleman* (to Logic): My dog has four legs too.

*Logic* (to Old gentleman). Hence, it's a cat.

*Eugène Ionesco. Rhinoceros*

It seems to me that the search for an answer to any demographic question should begin with an analysis of real data, not a search for the right theory. The more data is involved for analysis, the better. However, I am talking about real empirical data, since numerous data published worldwide by international agencies are not intended for scientific purposes. For many countries, these are the results of assessments based on some theories, which will be confirmed by that very assessments. I note that in his work of 1971, Omran refers not to real data, but to the first model tables of mortality made by the UN.

Having finished the work, it is useful to compare your conclusions with the conclusions of theory. If the conclusions differ, it is necessary to check who is right.

Recently, an article on the average age of death of children who died in the first year of life was published (Andreev and Kingkade 2015). For a long time, it was believed that the lower the infant mortality rate, the lower is the average age of death; this fact is reflected in textbooks. But it turns out that when infant mortality is low, this rule does not work. On the contrary — with the declining infant mortality, the average age at death in infancy grows. It was very difficult for authors to convince reviewers that they, not the textbook, were right.

The world of demographic theories is really in motion, some of them become fashionable, others are forgotten. Some transform beyond recognition and serve to reinforce a particular point of view. I do not reject all demographic theories at all. For example, the theory of demographic transition seems very fruitful to me. With one caveat. As the population of the Earth grows as fast as it grows, it is still not a theory, but a not fully-proven hypothesis.

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