CURRENT INFECTIOUS THREATS ASSOCIATED WITH THE DEVELOPMENT OF CIVILIZATION AND PROGRESS IN MEDICINE - METHODS OF PREVENTION AND EDUCATION

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Summary: The development of civilization, economic growth, urbanization, industrialization and progress in medicine bring to the society an improvement in the quality of life, but at the same time caused changes in lifestyle, environmental conditions, and changes in the natural environment. All of these led to develop civilization diseases which have critical impact and the adverse effect on our health, about what we not always realize. In the past fifty years, about 30 new pathogens appeared causing diseases such as legionellosis, Lyme disease, and increase unexpectedly tuberculosis incidence which in some regions is associated with HIV infections. Also widespread use of antibiotics caused and still causing bacterial resistance increase to most of them. With the development of medicine and surgery, parallel effects of surgical areas and infections associated with implanted cardiac devices in the majority of the life-saving ones appeared. The development of research techniques allowed for the finding of new relationships between ecosystems in the microbiome of the gastrointestinal tract with of obesity in the society. The presence of new health aspects of civilization diseases impose pressure to create new prevention methods and public education.

Keywords: Lyme disease, legionellosis, tuberculosis, microbiome, antibiotic resistance

Civilization human health was changing over the centuries as a response to the processes of urbanization, industrialization and environmental change. It was related with development and size of infections epidemics, and mortality. During that time we observed progress in medical knowledge, prevention methods, and generally accepted public health status. Traces of the effects of infection are visible in prehistoric anthropological research, and they concern tuberculosis changes in bones, smallpox. The first mention of the epidemic was recorded in the fifth century BC, and its direct cause was crowding inhabitants and troops within the area of Athens. Mortality rate was high, and the main reason for that was the lack of awareness of proper hygiene. In the Middle were great epidemics of smallpox, plague, cholera, influenza which destroyed entire cities and the states. They were largely caused by overcrowding of cities and increased migration of the population. In the subsequent centuries the scale of infectious diseases was modified by the process of urbanization development of industry (late nineteenth and twentieth century). Progress of microbiological knowledge fallowed by discoveries of Louis Pasteur, Robert Koch and Ilya Mechnikov. The first preventive vaccinations against smallpox were introduced thanks to the observations of Edward Jenner in the eighteenth century.

Modern civilization is still not free from infectious diseases in spite of significant progress in medicine economic, and social achievements. We observe important changes in the profile of infections, prevention methods, species of pathogenic microorganisms and their sensitivity to antibiotics. At the end of the twentieth century infections of humans and animals with new species of bacteria and viruses occurred, and in some parts of the world long forgotten diseases returned. Human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) spread on a large scale, as well as encephalitis and tick-borne tires, hemorrhagic viral diseases, viral gastrointestinal infections, prion diseases, new forms of influenza, avian and swine flues, SARS (severe acute respiratory

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syndrome), Lyme disease, and legionellosis. The advancement of medicine brought along widespread infectious diseases. Transmission of microorganism can happen by air inhalation, tissues or blood (hepatitis B, C virus). Bacteria and virus cause infection of patients also known as nosocomial infection. A separate problem is rapid and wide increase of antibiotic resistance in bacteria especially multidrug resistance (MDR). Another threat is military action involving the collection and modification of biological weapons including the most dangerous species of bacteria and viruses like: anthrax, smallpox, tularemia, and others. There is also a worrying return of tuberculosis. The new image of tuberculosis infection is primarily within multidrug- resistance strains, infection of the youth, and elderly people in countries with a high degree of civilization. We observe severity of tuberculosis as an epidemic in Asia and Africa, especially in conjunction with HIV infections.

In Poland, the significant newly emerging problems associated with contemporary processes of civilization are tuberculosis, Lyme disease, legionellosis and threats infections caused by multidrug-resistance bacteria. Also along with the advances in medicine nosocomial infections became a leading problem, particularly those infections associated with complex operations for eg. abdominal, orthopedic, infections of implantable devices for heart and vascular surgeries. The subject involving infectious risks in the era of modern civilization is multifaceted and includes various infections. There exist strong relationship and cause between development of various diseases in many aspects of life in the modern world.

Tuberculosis as a significant threat to the society in conjunction with economic state

Global threat of tuberculosis (TB) is expressed clearly, depending on the economic status of the region showing in a direct way economic dependence on the level of the civilization. The largest number of TB cases in the world in 2012 were recorded in South-East Asia (29%), Africa (27%) and the Western Pacific region (19%). India and China accounted for 26% and 12% of all cases, respectively. Compared to countries with high economic level where the incidence of tuberculosis constitutes a small percentage and the main groups of patients are immigrants from poor countries in terms of economy. Despite the undertaken efforts and huge financial outlay, tuberculosis remains a major global health problem. In 2012, the number of people who developed tuberculosis was estimated at 8.6 million and the number of deaths caused by tuberculosis at 1.3 million people (including 320 000 deaths among people infected with HIV). Since the announcement in 1993 by the World Health Organization (WHO) that tuberculosis was a global threat to the health of the population, the epidemiological situation of tuberculosis in the world is gradually improving. This is the effect of the Stop TB Strategy, implemented within the framework initiated in 2000, the Global Plan to Stop Tuberculosis (TB Stop Global Plan). Stop TB Plan was created as a response to formulated by the UN Millennium Development Goals involving the reduction in the incidence of tuberculosis by 2015 by about half as well as the change to the growth trend of TB in relation to diseases such as AIDS and malaria.

The current epidemiological global situation of TB shows the continuing downward trend, although not quite as fast as desired. In 2012, the number of people with TB, HIV-infected was estimated at the level of 1.1 million, which accounted for 13% of new cases of tuberculosis in the world. Three-quarters of the number of the cases were recorded in the African region. In 2012 all around the world 450 000 people with tuberculosis multidrug-resistant (MDR-TB) were recorded, and the number of deaths caused by this type of tuberculosis amounted to 170 000 people.

Epidemiological situation of tuberculosis in Poland is monitored by the Institute of Tuberculosis and Lung Diseases in Warsaw (Polish abbreviation: IGiChP), conducted by the National Register of Tuberculosis (Polish abbreviation: KRG). Annual IGiChP newsletter presents the most recent data on the incidence of tuberculosis reported to the KRG. In Poland, for the past number of years there has been a downward trend in the incidence of TB. In 2012 in Poland there were 7542 new cases and incidence rate was calculated at 19.6 /100 000 inhabitants. Most cases of TB were reported in the age group between 45 and 64 years of age (3404), while least cases were reported among children under 14 years of age (95). For several years a wide variation in cross-provincial maturity has been observed. In the year 2012 the highest incidence rates were reported in the provinces of Lublin and Świętokrzyskie (30.2/100, 000 and 29.3 /100, 000), and the lowest in the provinces of Lubuskie and Greater Poland (10.6/100, 000 and 10,9/100, 000).

One of the reasons for the slow decline in epidemiology of tuberculosis is still a large number of cases of latent tuberculosis infection (LTBI), estimated by (WHO) to 1/3 of the population of the world. Detection and treatment of LTBI is currently in the recommendations of the Centers for Disease Control and Prevention (CDC), which are related to new risk groups, resulting from the progress of civilization. These groups are health workers, HIV positive, patients qualified for biological therapies, patients who have undergone organ transplants, people with diabetes, dialysis patients, alcoholics and others with immunosuppression or treated with immunosuppressants (Jagielski

T. 2010). On the basis of recent studies, the number of latently infected persons in each group is from 20 to 50% depending on the characteristics of the group and the incidence rate for the entire population. Despite the existence of effective prophylactic treatment, there is no appropriate procedure for administration of people from all risk groups which is not conducive to stopping the transmission of infection. There are also no medical procedures to monitor people at high risk of developing TB. A particular threat are multidrug resistance strains (Augustynowicz-Kopeć E., Zwolaska Z. 2008).

The results of various studies show that low socio - economic status increases the likelihood of developing tuberculosis and progression of latent to active tuberculosis disease. In the United States it has been shown that the risk of tuberculosis depends on each of the indicators used to determine the status, that it is the density of housing, poor education, low income, use of welfare and unemployment care. Density of housing plays the role of the risk factor of the most paramount importance for tuberculosis. In the large cities of Western Europe dozens of differences in the incidence of tuberculosis between rich and poor districts of the city are observed. According to the results of tests for tuberculosis long-term unemployed persons suffer from it more frequently. According to U.S. data, more than half of the patients had remained without work for at least two years before the diagnosis of tuberculosis. In Estonia, a country more similar to Poland than the countries of Western Europe as far as the level of economic development is concerned, a risk factor for tuberculosis was loneliness, low levels of educational attainment, alcohol consumption, smoking, and periodic food shortages. The risk was higher for those with low income or without regular income, also among the unemployed and former prisoners. According to recent research carried out in Russia, greater risk of the disease coincided with low levels of wealth, lack of financial stability, living in crowded areas, drug addiction, imprisonment, and with diabetes and residing with a person with tuberculosis. The risk of tuberculosis among the unemployed was six times higher than among economically active people.

A special group exposed to mycobacterial infections is formed by the homeless. The United States is a country where the problem of homeless with tuberculosis was analyzed in several studies. Homeless shelters are often a place where the disease is transmitted. One of the residents of such shelters in Syracuse, New York, was the source of infection for 10 months before he began treatment, causing various new infections in the meantime. This hostel did not have a good ventilation, its inhabitants were often malnourished, HIV carriers or drug addicts, and all these factors contributed to the development of the disease.

In prisons, reformatories high rates of TB are noted which is associated with a low level of living conditions of prisoners from different backgrounds and communities. Conditions in the prison make both the infected and the healthy people remain in close proximity for a given time. At least three factors contribute to the high rate of tuberculosis in the closed facilities. Firstly, different numbers of incarcerated people are exposed to tuberculosis (eg, users of illicit substances, people with low socio-economic status, and people with HIV). Secondly, the physical structure of facilities contributes to the transmission of disease through inadequate ventilation of rooms which are closely adjacent. Thirdly, the movement of prisoners to overcrowded cells in conjunction with existing TB infection increases the risk of transmission of *M. tuberculosis* (Recommendations from CDC 2006).

On the basis of existing scientific knowledge and the applied experience of public health officials, the basic steps necessary to prevent tuberculosis in closed facilities were set out. These basic steps can be divided into the following recommendations: 1. screening tests (finding people with the disease and with latent tuberculosis), 2- stopping (preventing the transmission of tuberculosis and treatment of patients with the disease), 3- evaluation (monitoring and evaluation of the performance of screening), 4- cooperation of prisons and the health service in the control of TB. Overriding targets can best be achieved with the cooperation, action and shared responsibility of both the prisons, and the relevant departments of medical services (WHO Report 2010). The above included recommendations can help health professionals, objects enclosed in preventing the transmission of tuberculosis and its control among inmates and personnel of the institution.

Lyme disease - new infections and their relationship with ecological changes of the environment

Civilization changes indirectly affect environmental change and the causes of the observed increase in the incidence of Lyme disease are multi-faceted and include the etiological agent, vector and reservoir of spirochetes. The spread of *Borrelia burgdorferi* promotes broad geographical reach of ticks that are the carriers of these pathogens. Increasingly, their presence is noted within the cities (parks, private estates, gardens) and industrialized areas. A major role in the expansion of ticks is attached to wandering hosts, and in particular birds. The occurrence of ticks in new habitats is also the result of climate change and changes in land use (Rizzoli A. et al. 2011, Wójcik-Fatla A. et.al. 2009). In terms of climate change, the attention is paid to higher minimum temperatures (at night time and in the winter) and early spring. Changes in land use conversion of farmland into fallow fields and

woodlands promote development of tick populations. Another important factor that have strong influence for the increase in the incidence of Lyme disease is rising popularity of active, outdoor recreation and tourism. It is often associated with the penetration of ecosystems seldom previously visited. In the absence of a vaccine against Lyme disease only the non-standard prevention is possible. Educational activities seems to be very important aspects to prevent infection of *B. burgdorferi* (Rizzoli A. et al. 2011). In particular, these activities should be addressed to the inhabitants of endemic areas and persons occupationally exposed to ticks for example foresters, hunters, groun cover gatherers, farmers and many other professions that require work in the open air.

Researches are focused on antigenic variation of spirochetes, the location of the pathogen in tissues, and generation of persistent clinical manifestations of infection and issues post treatment of Lyme disease syndrome (PTLDS). In Europe exist 3 species of *Borrelia*, which were considered to be pathogenic: *B. burgdorferi* s.s.*, B. garinii, B. afzelii* and 4 potentially pathogenic: *B. valaisiana, B. spielmanii, B. bissettii* and *B. lusitaniae.* In recent times another species became known - *B. bavariensis*. It is therefore necessary to take account of all the species in the generation of infections on an individual basis, participation in mixed infections and their impact on the clinical manifestation (Ruderko et al. 2009 Tijsse-Klasen et al. 2013).

In relation to the necessity of remaining in organisms with different immune potential (ticks, the reservoir species, men) spirochetes have developed mechanisms enabling them to adapt to these different micro-environments. The complexity and specificity of the processes that occur during infection with *B. burgdorferi* of different hosts is therefore observed. *Borrelia* spirochetes have a set of proteins to help them to adapt to the microenvironment in the body, to survive in these conditions, the colonize tissue but also they possess the ability to change the host.

Proper diagnosis and treatment does not always guarantee an effective eradication of the pathogen and the total elimination of symptoms of the disease. Approximately 10-20% of patients diagnosed with Lyme disease have non-specific clinical symptoms despite use of long antibiotic treatment (Lakos et al. 2012). This aspect should be considered in the context of (PTLDS). The cause of PTLDS occurrence is not entirely clear. It is believed that these symptoms may be related to tissue damage or dysfunction of the elements in immune system during infection.

Researches can better understand infection processes caused by *B. burgdorferi* using most modern technology. One of the method is atomic force microscopy (AFM). By using these technique we can visualize the changes that can occur on the surface of the bacteria by the action of lytic potential factors and to assess their effects. Young's module measurements allow for determining changes in the flexibility of the surface. The measurement of the coefficient of adhesion provides information on the adhesion ability of the pathogen. Precise measurements of the mechanical properties of cells allow in a very precise way to assess the size, intensity and extent of changes in the cells of pathogenic microorganisms thereby creating a new face of microbiology (Sapi et al. 2012).

Legionellosis new disease disclosed in connection with urbanization and industrialization

The first epidemia of legionellosis was reported in 1976 among the participants of the convention of U.S. veterans of the American Legion of Pennsylvania in Philadelphia in the United States. There was a sudden change of pneumonia which was subsequently called Legionnaires' disease (Abigail A et al. 2005). The cause of the infection was the presence of bacteria in the hotel air conditioning system. The disease affected the 186 people, both of the hotel guests, as well as the staff of this hotel, on the end 34 people died. In view of industrialization and urbanization lead to liberation of wide variety infectious agents. These pathogens are low pathogenicity, however, in patients with impaired immune system, can cause serious infections which are often life threatening. That kind of microorganism are *Legionella* spp. They are responsible for legionellosis, which can take the form of as clinically atypical pneumonia and Pontiac fever. The development of the infection and its clinical form depends on the interaction between the pathogen and macroorganism. The main role plays immune status of a person and risk of exposure to pathogen. The virulence and number of bacteria penetrating the lungs are also important. Especially the most virulent is strain – *L. pneumophila* serogroup 1 (SG 1) (Sikora A and Inn.2013). In Europe, the incidence of Legionnaires' disease is between 3-8% of the exposed people, while the incidence rate in the case of Pontiac fever is much higher, around 80-95%. In approximately 20% of the elderly people *Legionella* antibodies is detectable. It indicates the presence of exposure to the pathogen (Ciechomski P et al. 2005). *Legionella* colonize hot and cold water supply system in large public buildings, households, and industrial systems. The water distribution systems used not continuously are hazards for *Legionella* infection. Additionally other risk is connected with water distribution system with "dead legs" of the installation and the intake of water, eg. dredging taps, shower strainers pose a threat. *Legionella* spp. can colonize in medical equipment (e. g. dialyzers, respirators, spirometry, inhalers, dental turbines), equipment for hydrotherapy and balneotherapy, air conditioning systems, and cooling towers in industrial plants, and shopping centers. *Legionella*

infection is caused by the inhalation of aerosol water and air containing by bacteria (Gordon M. 2007, Bartram J. et al. 2006). Factors contributing to the colonization of artificial water distribution systems are: increased temperature (optimal temp. 20°C-45°C), the presence of sludge, mud, corrosion products, biofilm, and biological agents (other bacteria, protozoa), the stagnation of water installation (no recirculation, "dead legs" of the installation), and too low concentration of the disinfectant. In Poland, the epidemic outbreak of Legionnaires' disease was diagnosed between December 2006 and March 2007 in the Regional Specialist Hospital in Jastrzębie Zdroj (Department of Ophthalmology). 4 persons were infected, of which 3 people died (Antończyk M. et al. 2009). Another outbreak of *Legionella* was the case in Czeladź, where 23 people got ill. There were detected 10 cases of Legionnaires' disease in 2013 in Poland (data from National Institute of Public Health - National Institute of Hygiene). Researches show that in Poland hot water distribution system in hospitals other public buildings are the most frequently colonized by *L. pneumophila* (Matuszewska R. et al. 2009). In Polish law exist regulation for legionellosis which should be reported, and registered by the State Sanitary Inspection according to «Act on the Prevention and Control of Infections and Infectious diseases in humans» (from 5 December 2008).

Problems of nosocomial infection

With the development and progress in surgery operations that were previously impossible or too much of a risk are presently carried out. Operated patients are getting older, have many underlying diseases, with were considered non-operational (Halabi WJ et al. 2013). Nowadays, we have to deal with newly emerging threats such as fungal infections or surgical site infections (SSI). Developed schemes of actions in the prevention of bacterial and fungal infections tend to be less according to growing number of cases of SSI. The so-called Bayesian networks are helpful, also called as conviction networks. They are used to predict performance in the collective tests (eg, for a group of patients) and help to develop new workflows in the prevention of the aforementioned infections. It is possible that developing standards of advanced algorithms based on Bayesian networks- may allow for a significant reduction in the number of complications after surgery, shorter hospital stay, and reduced treating cost (Druzdzel M. 1999). Advanced statistical methods are also the neural networks. They were created as a result of research conducted in the field of artificial intelligence. They relate to the construction of models of the basic structures that occur in the brain. Bayesian networks and neural networks can give an answer to two important questions: 1) what factors are most important for the development of SSI in patients undergoing abdominal surgeries, and 2) whether the set of these factors is the same for bacterial infections and fungal infections.

In the group of civilization diseases important place take a part heart diseases. It is connected with dynamic progress in cardiology and cardiac surgery, in the range of clinical diagnostic and treatment methods. The main role play cardio-implants widely used in interventional cardiology. These include: permanent pacemakers (PM), implantable cardioverter defibrilators (ICD), cardiac resynchronization therapy (CRT), stents supporting light narrowed coronary arteries, artificial heart valves, and self-expanding occluders closing defects in the heart. A growing number of treatments help to expand the indications for their conduct, improve quality, and extend the life of patients. What is more it can cause of increased incidence of clinical important infections. Worldwide, there are about 3.25 million patients with PMs and 180 thousand with an ICD (Chua J.D et al. 2000). In 2011 in Poland over 36 thousand devices were implanted. It accounted for 250% increase in the number of procedures performed in the country in the past 10 years (Kuśnierz J. 2012). Unfortunately, this correlates with the increasing number of infections. The incidence of infection for PMs is set at 0,13-19,9% and 0.8% for the ICD (Sohail M.R. et al. 2007). In patients with PMs / ICDs early local complications in the form of a box of infection may occur. At the first year after surgery can occur early complication in form of a box infection and late complications like Cardiac Device Infective Endocarditis (CDIE). CDIE is one of the most serious systemic complications in this group of patients and is estimated at 6,4-23% (Greenspon A.J. et al. 2012). Microorganisms that infect PMs / ICDs systems are characterized by a broad spectrum of species and different sources. The group of microorganisms colonizing most of these devices includes: *Staphylococcus epidermidis* - 42-68%, *Staphylococcus aureus* - 24-45%, *Escherichia coli* - up to 22%, *Klebsiella* spp. - up to 9%, to 8% *Enterococcus* spp., *Streptococcus* spp. - 6% and other constituting 14%. *S. epidermidis* constitute the physiological skin flora of humans. It has been shown that *S. epidermidis* constituting is the most common isolated pathogen of areas around PMs / ICDs pockets. This species has the ability to produce mucus matrix, which is an early stage of the biofilm formation. This structure of closely adjacent to each other bacteria is formulated on the elements of the PMs / ICDs and significantly impairs the penetration of antibiotics (Chua J.D et al. 2000, Sohail M.R. et al. 2007).

The growing problem of bacterial resistance to antibiotics

An extremely important problem of modern civilization is the sharp increase in bacterial resistance to antibiotics. The discovery of antibiotics was a turning point in medicine and it completely revolutionized medicine. Unfortunately, nowadays the widespread overuse and inappropriate use of antibiotics with a broad spectrum of activity is of overwhelming and considerable size. As estimated by the *CDC* about one third of the prescribed antibiotics per year is not justified. The use of antibiotics without justification of the necessity of their administration, different patterns of conduct of empirical antibiotic therapy, failure to comply with the dosage by patients, and arbitrary shortening the therapy after resolution of clinical signs in the ambulatory treatment leads to their ineffectiveness. The rapid development of bacterial resistance to antibiotics is thus observed, and medical experts continue to warn of a return to the pre-antibiotic era (J. Davies and D. Davies, 2010; Brisht R. et al. 2009).

Drug resistance of microorganisms to antibiotics leads to serious consequences, ranging from no response to treatment in prolonged illness, thereby increasing the risk of death, the increase in the number of infected people in the environment of the patient, and a significant prolong hospitalization. The hospital environment plays a special role in the development of resistance, since about 70% of microorganisms that cause hospital-acquired infections are resistant to at least one of the antibiotics used in medicine. The use of combined therapy, although it is effective in many cases, further complicates this problem, cause it leads to selection of MRD bacteria (Brisht R. et al. 2009).

Most therapeutically problems are related with: methicillin-resistant and vancomycin- resistant *Staphylococcus aureus* (MRSA, VRSA), vancomycin-resistant *enterocossus* (VRE), clinical isolates with cross resistance to marcolides, lincosamides and spectogramins B (MLSB), *Enterobacteriaceae* with extended-spectrum β-lactamase (ESBL), strains producing carbapenemase (KPC – *Klebsiella pneumoniae carbapenemase*) and metalo-β-laktamase (MBL) (Bassetti M. and Righi E. 2013; Dzierżanowska D. 2009). Some strains may be resistant to all approved antibiotics, so only effective way of elimination seems to be the use of experimental and potentially toxic drugs (Brisht R. et al. 2009).

Excessive and irrational use of antibiotics for empiric therapy not only in medicine may have a negative impact on the quality of public health. The increasing use of tetracyclines and other antibiotics outside of medicine, like in animals, leads to their appearance in food of animal origin which entails a negative impact on the health of consumers. Residues of medicines consumed with food for a long time, even in small doses, can contribute to the creation and spreading of resistant strains of micro-organisms (selective pressure). Consequently, the possibility of failure of antibiotic therapy in clinical situations among humans increases (Gajda A. et al. 2012).

Growing microbial resistance to drugs is a priority in terms of public health. In numerous reports of international, national and local agencies attention is drawn to that serious multidrug-resistance problem. In spite of the proposed relevant resolutions and recommendations, we are observing quick development of antibiotic resistance (J. Davies and D. Davies, 2010). In order to hinder this disturbing phenomenon in Poland the National Program for the Protection of Antibiotics has been launched (www.antybiotyki.edu.pl). There is a need for continuous education in both the social and professional scope towards the rational use of medicines, improvement of medical and veterinary guidelines, reduction in the use of antibiotics as agents stimulating food and animals, as well as the further development of new therapeutic agents (Brisht R. et al. 2009).

Changes in nutrition-changes of the microbiome of the gastrointestinal tract, obesity as the cause of diseases of civilization

With the rapid changes in human lifestyle, including dietary habits we can observe alarming increase of obesity. This is all the more worrying that affects young people. Nowadays, obesity is classified as a civilization disease. Obesity is associated with an increased risk of many metabolic diseases, including cardiovascular diseases e.g. hypertension, dyslipidemia. A new research direction, which stems from the progress in the development of genetic methods, is the research on microbiome. Intestinal flora contribute towards the regulation of metabolic endotoxemia and play a role in pathogenesis of obesity (Cani P.D. et al. 2007). With regards to obesity, it has been shown that a relationship exists between the composition of gastrointestinal flora and nutrient absorption in the gastrointestinal tract (Jumpertz R. et al 2011).

Studies have shown the special relationship between the diet-induced obesity and the reduced amount of *Bifidobacterium* spp., *Bacteroidetes* and *Eubacterium rectal*e (Cani P.D., et al. 2007). It has also been proven that there is an effect of bacteria colonizing the gastrointestinal tract on the control ofexpression of the lipid metabolism regulator Angiopoietin-like protein 4 (Angptl4). Function of that protein is regulation fatty acid oxidation in muscle

and adipose tissue (Bäckhed F. et al. 2007). These results suggest that species composition of the microflora, as well as the entire network of microbial mechanisms regulating homeostasis (eg. inflammation regulators, hormonal game or the state of immune system) are important factor in overweight and obesity. Looking at impact of the microorganisms on homeostasis and the development of certain pathological changes, new possible treatment options like use of pre- and probiotics should be considered.

Changes in microflora of the digestive tract are related to inflammatory bowel diseases (IBD) which are a group of diseases characterized by the presence of chronic inflammation of the gastrointestinal tract. The most common disease entities rated in this group are: ulcerative colitis (CU) and Crohn's disease (CD). In recent years we have seen a significant increase in the incidence of inflammatory bowel diseases - especially in Crohn's disease. The incidence varies in different regions of the world, but the highest range of new cases is found in countries of North America and Europe. According to the currently available data, the highest incidence rates for CU are recorded in Iceland 24,3 per 100000/per annum, while in Great Britain it is 12, 7 per 100000/per annum (Molodecky N. et al. 2012). Understanding the role of microflora in the development of IBD may help to create a new therapeutic options, and appropriate composition of microbiome can lead to reducing the incidence of these diseases.

Public education in the prevention of civilization diseases

An important role in the prevention of infectious diseases plays health education. Health care should start in childhood and to be continue for the entire life of any person. If health is the social value then the entire society ought to be involved in health education. Responsibility for healthy behavior ought to be accepted by the school while health education in nurseries and kindergartens extends the awareness of the parents. To prevent infectious diseases, educational activities must therefore be directed at all members of society. The scope and nature of its contents must be selected according to the needs of individuals and groups. Often the objectives and content are subordinated to health promotion programs (Ciechaniewicz et al. 2009). The concept of health promotion was established relatively recently. It appeared in the mid-70s of the last century. It is defined as activities aimed at raising awareness of health, promoting healthy lifestyles and creating conditions conducive to health. In Poland, for many years certain programs have been realized to prevent the negative phenomena related to health (Ślusarska B. 2004). Reliable implementation of prevention programs has a significant impact on public awareness about the nature of diseases. The first signs of the disease would convince people to go to the doctor, and thus there would be an increase in early detection. A special role in educating the public on the prevention of infectious diseases is thus served by public health workers. They are responsible for the transfer of knowledge to patients about the disease, recovery and prevention. Public education thus plays a major role in the prevention of infections. It shapes the habits of healthy lifestyles and pro-health behaviors towards infections, prevention methods in relation to the risks arising from the development of civilization

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