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# NEW TECHNICAL CHALLENGES FOR OPERATORS

## Nowe wyzwania dla operatorów maszyn i urządzeń technicznych

***Abstract:*** *The subject of the article are new challenges for operators of machines and technical devices, in particular in the digital industry. The present reality of the environment in which man lives and works is increasingly complex. This results in certain disorders. Combined with the health, lifestyle and development aspects of medicine, shaping the operator's reliability, remains an extremely difficult challenge. Modern technologies have enabled older workers to function on the labor market, returning to work after successful treatment of illnesses, that have recently eliminated those group of man from labor market. The above results with the new set of requirements for the development of a reliable operator of various machines and devices. Significant dispersal of men health determinants from biological, environmental, social, cultural, economic and political causes with great difficulties in consolidating specific actions, which are also a challenge for years to come.*
**Keywords:** technology operator, human health, human machine interfaces

***Streszczenie:*** *Przedmiotem artykułu są nowe wyzwania dla operatorów maszyn i urządzeń technicznych w szczególności w przemyśle cyfrowym. Współczesne środowisko ludzkiej działalności w coraz większym stopniu wiąże się z koniecznością korzystania z nowoczesnej technologii i życia w złożonym i trudnym środowisku. Powoduje to określone niekorzystne zaburzenia u operatorów. Rozwój techniki umożliwia skuteczne przedłużenie życia człowieka i doskonalenia potencjału operatora i urządzeń technicznych. W połączeniu ze zdrowiem, stylem życia i rozwojem medycyny, kształtowanie niezawodności operatora maszyn i urządzeń jest nadal niezwykle trudnym wyzwaniem. Nowoczesne technologie umożliwiły również starszym pracownikom skuteczne funkcjonowanie na rynku pracy.*
**Słowa kluczowe:** operator środków transportu, zdrowie ludzkie, interfejs człowiek – maszyna

# 1. Introduction

The dynamic technology development in the past has enabled the several key industrial evolutions, has been completely transforming human life in many areas. Over time, changes have begun to accelerate and generate new challenges for future man generations. One remains unchanged - care for human health and life. Man has developed excellent equipment and engineering constructions and has done a lot to improve their own lives through it, as well as to make it easier or perhaps even more complicated.

More and more targeted activities with direct physical involvement have been supported or replaced by specialized techniques (machines, devices, autonomous units). More and more activities are being significantly assisted by specialized Human Machine Interfaces (HMI). More and more decision-making processes are implemented simultaneously in real and digital layers, also with a specific human participation (as operator of special machinery and technical equipment).

The present reality of the environment in which man lives is increasingly complex. Requires several rapid decision-making processes using a very large amount of data (big data) from different locations, acquired in real time, as well as historical data. This also applies to information that cannot often be simultaneously obtained directly by human organs as sensors. This results in the fact that human decision-making processes require increasingly important technical support, also new problems are generated for HMI type systems [5, 6, 7, 8].

Existing technical solutions and trends in the development of technical support of human life results in specific psychophysical requirements of machinery and equipment operators and their health conditions. The technique translates into the health functions of its operators in both positive and negative terms. Undoubtedly, evolutionary adaptation of man and his predisposition to technology is evident in this respect and vice versa. It seems that the technique significantly changes human health functions in a negative sense. This results in the need for a comprehensive look at the quality of human life.

Today's technology, in conjunction with the development of medical and technical sciences, opens up new opportunities for improving the quality of human life. This results in a better diagnosis of states and behaviors taken as normal, the possibility of substituting human organs for transplanted, and more effective support for human motor functions. These together result in a longer life time for a person who is capable of taking action with the technique and for purposeful and useful cooperation with the technique.

The today environment of human activities is increasingly connected with the necessity of using technology and living in a complex and difficult environment. This results in certain disorders. The above issues will be discussed base on the selected examples.

## 2. Selected epidemiological problems

For many years people have focused on upgrading their technical equipment and adapting it to the needs of the human needs. Man-made activities have become easier, as a result of their shift from physical work towards greater engagement of human mind and technology. Contrary to expectations, this did not diminish human involvement in the work process, but did generated new needs and problems. The current generation (2017) of people potentially active in the age range of 18-65 years is not homogeneous. The youngest group of employees has been educated with access to digital technology and often works with information technology. The group of middle-aged and retiree age groups (educated and starting work in the second half of the 20th century) was exposed to a number of technically and environmentally relevant changes. For example: robotisation and digitization of industrial processes, transformations of the education system, changes in the process of education of children and youth, changes in the inhabitants health system, impact of numerous scientific reports on lifestyle changes and treatments, as well as numerous transformations of the socio-political formations and other.

Despite the years and numerous changes in the surrounding environment, it is always up to date to maintain human well-being and technical devices operational capability as one well operating sustainable system: both human health and technology (devices) health conditions. Health and disease by their opposing meaning define the ability or lack thereof to maintain the balance of the human body in contact with the outside environment. Health of man is a condition for the adaptation of man in ever-changing reality and is a universal value in the individual and social dimension. Man adjusts to the surrounding reality. In practice this process is much slower than in the case of technical equipment, with which it comes to interact. Therefore, it (man) requires constant care of all kinds.

The lifestyle, physical environment, biological factors, health care are the most important factors for shaping human health according to the Lalonde concept [4]. Over the years, research has confirmed the overwhelming impact of human behaviour on health. In studies conducted by the for Public Opinion Research Center[1], in 2016, Poles pointed out that nutrition can be the most important contributor to nutrition, or lifestyle component. Health is the most important value for 57% of the respondents, and family happiness has been assessed above as indicated by 79% of respondents. The following included: education (13% of respondents), contact with culture (11%), and success and fame (3%). Most Poles are satisfied with their health condition, which is expressed by 55% of respondents. Unsatisfied with their state of health is 9% of the respondents. Among people 65+ negatively assessed their health 18% of respondents [1].

Major health problems, that are at the same time the cause of death in developed countries (including Poland), include cardiovascular disease and cancer, as well as external causes of morbidity and mortality (figs. 1, 2).

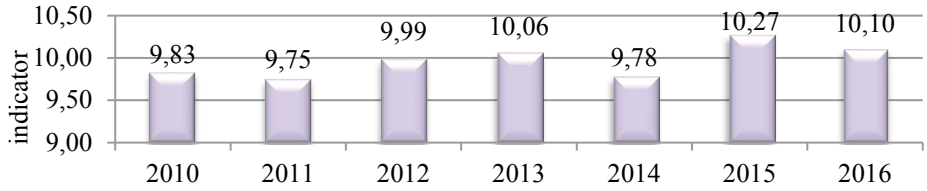


**Fig. 1.** Deaths per 1000 population in Poland in years 2010-2018 [3]

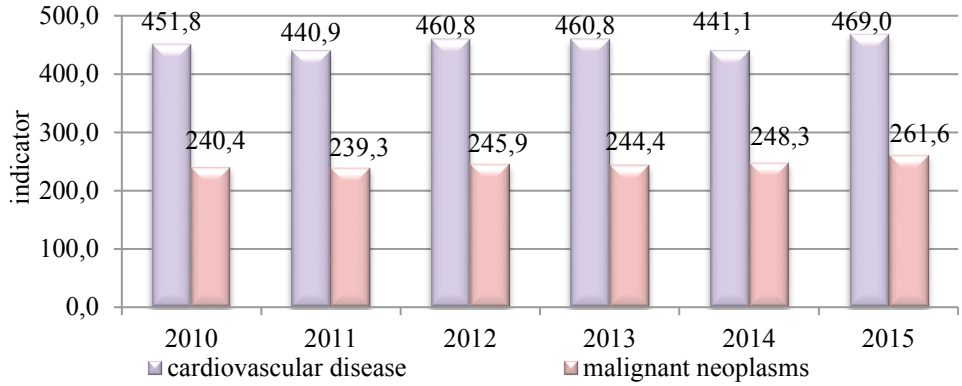


**Fig. 2.** Deaths by caused cardiovascular disease and malignant neoplasms per 100.000 population in Poland in years 2010-2017 [3]

Despite the persistently high death rates for cardiovascular disease, especially among men up to 65 years, the average life expectancy in Poland is steadily increasing (in 1995: 67,6 years for men and 76,4 years for women). However, the difference between the length of life of a man and a woman has not decreased significantly. In 2017, the average life expectancy for men in Poland was 74 years, and for women – 81,8 years. The average life expectancy of women in Poland is about 8 years longer than men's lives [3], fig. 3.

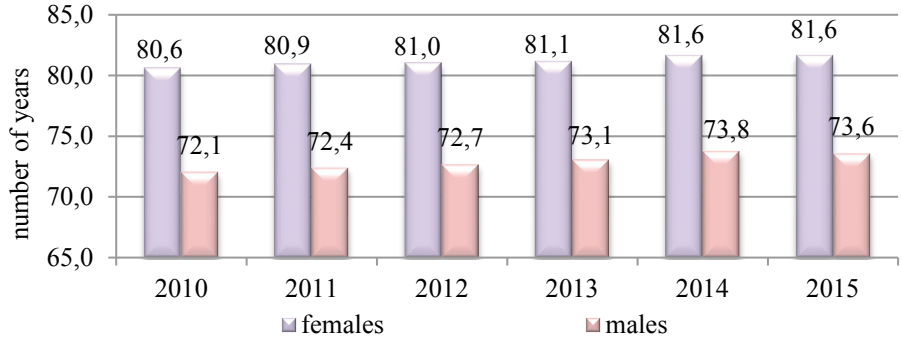


**Fig. 3.** Life expectancy females and males in Poland in years 2010-2017 [3]

Demographic trends aimed at prolonging life, decreasing fertility and migration, contribute to the need for a long-term maintenance of a human being (an operational potential of the operator of machinery and technical devices) in good health, allowing for longer working lives in difficult professional situations (including requiring collaborations with technical facilities in systems anthropocentric). Combined with the health, lifestyle, and development aspects of medicine, the reliability of the operator remains an extremely difficult challenge [7, 9].

# 3. Problems in health

Positive man functioning in the human – environment - engineering system fosters the development of knowledge and technology, that supports both human operational potential and equipment. For example: theoretical and practical preparation, compliance with workplace procedures, supporting and improving the functioning of the human body by means of auxiliary, maintaining proper posture while performing targeted activities, lifestyle-related health behaviours. Nevertheless, the number of degrading factors and their strength does not decrease. The situation is, among other things, the result of: lack of proper knowledge or misapplication, failure to follow procedures, excessive overloading of the human body and new work-related illnesses and conditions.

The development of more and more complex technology eliminates many of the disadvantages associated with working and maintaining human well-being. It does not completely remove them, but only shifts the weight of the species and contributes to the development of new ailments. The cause of more than half (54%) of the 56.4 million deaths worldwide in 2015 was 10 significant identifiable diseases, particularly ischemic heart disease and cerebral stroke (responsible for 15 million deaths). Other causes include chronic obstructive pulmonary disease, lower respiratory tract infections, lung (including tracheal and bronchial) cancers, diabetes mellitus, dementia, diarrhea, tuberculosis, road accidents. Of the 1.3 million victims of road accidents, 76% were men and boys. A comparison of the causes and the number of deaths in the world in 2012 indicates that for the 1,000 deaths, the 514 were caused by illnesses that were among the top 10 causes of death[10].

Modern technologies have enabled the functioning of the labour market for older workers, people with disabilities, returning to work after successful treatment of illnesses (that have recently eliminated labour market participants), and has set new requirements for the development of a reliable technician.

Poland, as a country aiming to improve the quality of life in society through sustainable development, with the problems of aging, the migration of specialists in many key areas, will face new issues in the coming years to safeguard people's lives in the environment of life and work.

# 4. Conclusion

Thanks to the technique, life expectancy has increased and quality of life has improved. Despite this, there has been a great deal of difference in the number of years of life between men and women for many years. The challenge in the future should be to increase the prevention of diseases that have the greatest impact on human occupational activity (cardiovascular, cancer, skeletal-musculoskeletal, respiratory, mental and other diseases).

It is important to make the best use of the potential for human interaction in the environment of his or her life and work in order to shape healthy behaviors, which promotes the balance between the human operator (including operators of the technical devices) and the device (technically unable device - a rested man, a technically able device - a healthy man, as well as other variants).

Significant dispersal of men health determinants from biological, environmental, social, cultural, economic and political factors, causes great difficulties in consolidating specific actions, which are also a challenge for years to come.

# 5. References

1. CBOS, Zdrowie i prozdrowotne zachowania Polaków, Centrum Badania Opinii Społecznej, komunikat nr 138/2, Warszawa, 10. 2016, www.cbos.pl/SPISKOM.POL/2016/K_138_16.PDF (in Polish).
2. Gliwiński M., Janusz Szpytko J.: Approach to increase both operator's safety and devices' availability under operation. Journal of KONES, 17 (1), 2010.
3. GUS (Bank Danych Lokalnych), opracowanie własne na podstawie danych dostępnych na: https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica.
4. Lalonde M.: A New perspective on the heath of Canadians. A Working document, Ottawa, 1974.
5. Smalko Z., Szpytko J.: The man – machine type systems modeling approach. Journal of KONBiN, No. 5, 2008.
6. Szpytko J.: Human reliability model. Journal of KONBiN, No. 5, 2008.
7. Szpytko J.: Kształtowanie procesu eksploatacji środków transportu bliskiego. Biblioteka Problemów Eksploatacji, ITE, Kraków–Radom 2004.
8. Szpytko J.: Reliability model of transport devices' human operator. 24th ISPE international conference on CAD/CAM robotics & factories of the future, Koriyama, Japan, 29–31 July, 2008.
9. Woźniak D.A: Styl życia człowieka jako źródło czynników kształtowania niezawodności operatora. Materiały 37 Zimowej Szkoły Niezawodności pt.: Niezawodność Systemów Antropotechnicznych, PAN, Szczyrk, 2009.
10. WHO, Fact sheet, updated January 2017: http://www.who.int/mediacentre/factsheets/fs310/en/