საერთაშორისო სამეცნიერო კონფერენცია „ბუნებრივი კატასტროფები საქართველოში: მონიტორინგი, პრევენცია, შედეგების შერბილება“, შრომები, თბილისი, საქართველო, 12–14 დეკემბერი, 2019 წ.
International Scientific Conference „Natural Disasters in Georgia: Monitoring, Prevention, Mitigation“, Proceedings, Tbilisi, Georgia, December 12-14, 2019

STUDIES IN THE FIELD OF THE INFLUENCE OF NATURAL AND ANTHROPOGENIC ENVIRONMENTAL FACTORS ON HUMAN HEALTH IN GEORGIA: CURRENT STATUS AND PLANNED WORKS

[*,]Japaridze N., [*,***]Khazaradze K.**

[*]*Ministry of Internally Displaced Persons from Occupied Territories, Labour, Health and Social Affairs of Georgia Tbilisi, Georgia*
[**]*Tbilisi State Medical University, Tbilisi, Georgia*
[***]*Georgian State Teaching University of Physical Education and Sport*
njaparidze@moh.gov.ge

Summary: *A review of the current state of research on the influence of natural and anthropogenic environmental factors (meteorological, climatic, geophysical, space, anthropogenic atmospheric pollution, etc.) on the health of people in Georgia is presented. Prospects for future research are discussed.*

Key Words: *Bioclimatology, medical meteorology, environment and human health*

Generally, the human health is primarily affected by the lifestyle (50 – 55%), then – by the environment (25 – 30%), and finally – by heritage and medical care. Additional anthropogenic load on the biosphere increases the level of above mentioned risk – factors influencing on human health and life (Fig.) [1].

In Georgia, as in many other countries, a long time ago the special attention has been paid to the analyses of the influence of the natural and anthropogenic factors of environment on the health of people. The brief survey of similar studies in Georgia in the last 15 years is given below [1-15].

The meteorological, bio meteorological, bioclimatic, geophysical and other parameters, which sufficiently affect the human beings, are the followings:

Separate meteorological and geophysical elements, space weather parameters and its combinations: air temperature, humidity, wind speed, atmospheric pressure, cloud cover, solar activity (Wolf's number), the geomagnetic fields, atmospheric electricity, thunderstorms, solar radiation, the cosmic rays, radioactivity, light ions, aerosols, ozone, other air toxic admixtures and etc. [1-5,9,10,13]

Different simple thermal indices involve more than one climatological parameter and consider the combined effects (air equivalent- effective temperature EET, Equivalent temperature (TEK), Wet-bulb-globe temperature (WBGT), Tourism Climate Index (TCI) [[8,11,12,14,16]) and others.

The effects of the action of environmental factors on human health have different scales – from minute, hour, day, decade and month to the seasonal and annual [7]. For example, periodicity of 7 and 3, 5 day of mortality from the cardiovascular diseases (CVD) is established in the work [13]. Results of investigation of influence of monthly average values of air Equivalent-Effective Temperature EET and is represented monthly duration of magnetic storms D on the health of the population of Tbilisi city [11]. The analysis of regression connections of mortality from the CVD with the EET and D showed that the contribution of each of the variables into changeability of mortality is the following. In the range EET from – 5º to 4.6º: EET – 8.6%, D – 22.2%; in the range EET from 5.2º to 21.8º: T – 26.3%, D – is insignificant [11].

It is found in the work [10], that the relationship between the average monthly air temperature in Kutaisi (Georgia) and such indices of the health of population as the total number of emergency medical

calls, cases of hospitalizations and deaths has the form of a third power polynomial. In general, in the warm months there is a decrease of the total number of emergency medical calls, cases of hospitalizations and deaths. In the hot months, there is a worsening in these indicators of health, comparable to the cold months of the year (increase of the emergency medical calls, cases of hospitalizations and deaths).

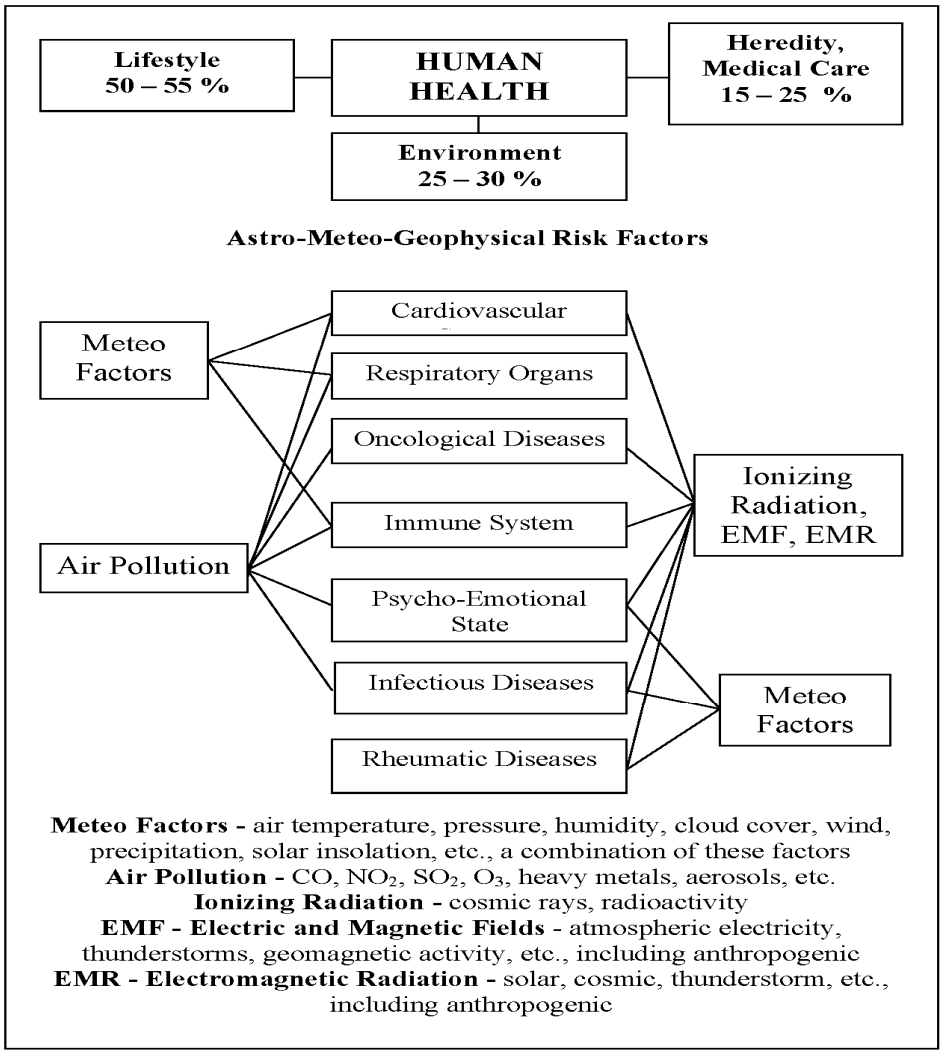

Fig. Human Health Risk Factors [1].

In the works [1,2] it is shown, that days situation together with air pollution by ozone in smog, the ozone forming gases and the aerosols under the conditions of Tbilisi an essential effect on human health have a variation in such factors as the thermal regime of air, atmospheric pressure, cosmic rays. Thus, increased surface ozone concentrations on the average growth of annual mortality of the inhabitants of Tbilisi city by 1680 people. This is equal to 14.1 % of entire average annual mortality of the population of Tbilisi, which is approximately 3 times higher than the same indices for the advanced countries [1,2].

In the work [7] the results of a study of the effect of the annual changeability of air temperature, surface ozone concentration and neutron component of galactic cosmic rays intensity on the mortality of the population of Tbilisi city in 1984-2010 are presented. The statistical characteristics of the investigated time-series are studied. In particular, it was found, that within the variation range of the contribution of the studied parameters to mortality variability is as follows: a random component of air temperature – 8.5%, real values of surface ozone concentration and cosmic ray intensity – 20.9% and 16.5%, respectively.

Results of studying of connection of TCI and its simple and combined components with the mortality of population for reasons the cardiovascular diseases based on the example of Tbilisi city in [8] are represented below. It is shown that value of the coefficient of linear correlation between the average

monthly decade mortality of the population of Tbilisi for reasons the cardiovascular diseases and simple and complex components of TCI and TCI are found in the range from – 0.66 to +0.44 (all values of the correlation coefficients are significant).

The comparative analysis of the connection of eight simple thermal indices and Tourism Climate Index (TCI) with the monthly mortality of the population of Tbilisi city apropos of cardiovascular diseases is represented in [16]. The values of simple thermal indices were calculated with the use of mean monthly and mean monthly for 13 hours data of meteorological elements. Between all studied simple thermal indices practically direct functional connection with the coefficient of linear correlation not lower than 0.86 is observed. The connection of simple thermal indices with the TCI is nonlinear and takes the form of third power polynomial.

The possibility of using the standard scales and categories of the indicated indices as the bioclimatic indicator in monthly time scale is studied. As a whole, all indices adequately correspond to the degree of the bioclimatic comfort of environment for the people – with an increase in the level of comfort the mortality diminishes. The representative for this purpose is Missenard air effective temperature in 13 hours [16].

Conclusion

In the future, together with M. Nodia Institute of Geophysics TSU, we plan to conduct research on the impact on human health of such indices derived from energy budget models, as: Physiologically Equivalent Temperature (PET), Standard Effective Temperature (SET), Physiological Subjective Temperature and Subjective Temperature (MENEX), the Universal Thermal Climate Index (UTCI) etc. [16]).

References

1. Amiranashvili A., Bliadze T., Chikhladze V. Photochemical smog in Tbilisi. //Monograph, Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, vol. 63, Tb., 2012, 160 p., (in Georgian).
2. Amiranashvili A., Khurodze T., Shavishvili P., Beriashvili R., Iremashvili I. Dinamics of the Mortality of the Population of Tbilisi City and its Connection with the Surface Ozone Concentration. // Journ. of Georgian Geophysical Soc., Iss. (B), Physics of Atmosphere, Ocean and Space Plasma, vol.16b, Tbilisi, 2013, pp. 31-38.
3. Amiranashvili A.G. Increasing Public Awareness of Different Types of Geophysical Catastrophes, Possibilities of Their Initiation as a Result of Terrorist Activity, Methods of Protection and Fight With Their Negative Consequences. //Engaging the Public to Fight Consequences of Terrorism and Disasters.NATO Science for Peace and Security Series E: Human and Societal Dynamics, vol. 120. IOS Press, Amsterdam•Berlin•Tokyo•Washington, DC, ISSN 1874-6276, 2015, pp.155-164. http://www.nato.int/science; http://www.springer.com; http://www.iospress.nl
4. Lagidze L., Matchavariani L., Tsivtsivadze N., Khidasheli N., Paichadze N., Motsonelidze N., Vakhtangishvili M. Medical Aspects of Atmosphere Pollution in Tbilisi, Georgia. //Journal of Environmental Biology, Vol.36, Special Issue, 2015, pp. 101-106.
5. Amiranashvili A., Chikhladze V., Kartvelishvili L., Khazaradze K. Expected Change of the Extremal Air Temperature and its Influence on the Mortality (Based on the Example to Tbilisi City). //International Cooperation Network for East European and Central Asian Countries: EECA Conference – October 7-8, 2010, Yerevan, Armenia, http://be.sci.am/.
6. Amiranashvili A.G., Gogua R.A., Matiashvili T.G., Kirkitadze D.D., Nodia A.G., Khazaradze K.R., Kharchilava J.F., Khurodze T.V., Chikhladze V.A. The Estimation of the Risk of Some Astro-Meteo-Geophysical Factors for the Health of the Population of the City of Tbilisi. // Int. Conference "Near-Earth Astronomy 2007" Abstract, Terskol, Russia, 3-7 September 2007, p. 86.
7. AmiranashviliA.G., Bakradze T. S., Berianidze N.T., Japaridze N.D., Khazaradze K.R. Effect of Mean Annual Changeability of Air Temperature, Surface Ozone Concentration and Galactic Cosmic Rays Intensity on the Mortality of Tbilisi City Population. // Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v.19B, Tbilisi, 2016, pp. 135-143.
8. Amiranashvili A.G., Japaridze N.D., Kartvelishvili L.G., Khazaradze K.R., Matzarakis A., Povolotskaya N.P., Senik I.A. Tourism Climate Index of in the Some Regions of Georgia And North Caucasus.// Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v. 20B, 2017, pp. 43–64.

9. Amiranashvili A., Chikhladze V., Bliadze T. Contemporary State of a Question about the Action of Photochemical Smog and Surface Ozone on Human Health. //Trans. of M. Nodia Institute of Geophysics, v. LXII, ISSN 1512-1135, Tbilisi, 2010, pp. 177-188, (in Russian).
10. Amiranashvili A.G., Japaridze N.D., Kartvelishvili L.G., Khazaradze K.R., Khazaradze R.R. Effects of Variations of the Monthly Mean Air Temperature on the Population Health of Imereti Region of Georgia. // International Scientific Conference „Modern Problems of Ecology“, Proceedings, ISSN 1512-1976, v. 6, Kutaisi, Georgia, 21-22 September, 2018, pp. 38-41.
11. Amiranashvili A., Amiranashvili V., Kartvelishvili L., Nodia Kh., Khurodze T. Influence of Air Effective Temperature and Geomagnetic Storms on the Population of Tbilisi City. // Trans. of the Institute of Hydrometeorology, v. No 115, ISSN 1512-0902, Tbilisi, 2008, pp. 434 – 437, (in Russian).
12. Amiranashvili A., Danelia R., Mirianashvli K., Nodia A., Khazaradze K.,Khurodze T., Chikhladze V. On the Applicability of the Scale of Air Equivalent-Effective Temperature in the Conditions of Tbilisi City. // Trans. of M. Nodia Institute of Geophysics, v. LXII, ISSN 1512-1135, Tbilisi, 2010, pp. 216-220, (in Russian).
13. Amiranashvili A.G., Cornélissen G., Amiranashvili V., Gheonjian L., Chikhladze V.A., Gogua R.A., Matiashvili T.G., Paatashvili T., Kopytenko Yu.A., Siegelova J., Dusek J., Halberg F. Circannual and circadecennian stages in mortality from cardiovascular causes in Tbilisi, Republic of Georgia (1980-1992). // Scriptamedica (Brno), 75, 2002, pp. 255-260.
14. Khazaradze K. R. Comparative Analysis of Mean-Daily Value of Air Equivalent-Effective Temperature in Tbilisi and Kojori. // Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v. 20B, 2017, pp. 65–72.
15. Amiranashvili A., Chargazia Kh., Chikhladze V., Japaridze N., Khazaradze K. The monthly variations in mortality from the cardiovascular diseases in Tbilisi. // Georgian Medical News, N 5 (242), 2015, pp. 53-59.
16. Amiranashvili A.G., Japaridze N.D., Khazaradze K.R. On the Connection of Monthly Mean of Some Simple Thermal Indices and Tourism Climate Index with the Mortality of the Population of Tbilisi City Apropos of Cardiovascular Diseases. // Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 21(1), 2018, pp.48-62