ENVIRONMENT, LIFESTYLE AND HEALTH STATUS: A EUROPEAN PERSPECTIVE

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Abstract Although population health cannot be measured in exact measurable form, a large number of concepts have been developed, and measurements have been framed through the presence of many different indicators. The impact of the environment on human health is well known. However, attention should be paid that no significant number of papers focused on the co-occurrence of environmental and lifestyle determinants on health status. This paper aims to emphasize the joint influence of environmental and lifestyle determinants on the European population's health status. The study was based on the World Health Organization statistical data, and 50 European countries were included. Three data sets were observed: Health status, Environmental, and Lifestyle indicators. Taking into account a large number of data, multivariate analyzes were applied. Results indicate that co-occurrence of environmental and lifestyle determinants have a significant impact on the health status in Europe.

Keywords: environmental exposure, health lifestyle, health status measurement

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1 Introduction

This paper aims to focus on the contribution of environmental and lifestyle factors to the European population's health status. It discusses the most critical determinants of the population's health status and concludes that indicator *Probability of dying before age 5 per 1000 live births* is most important. Furthermore, it suggests which environmental and lifestyle determinants have the most significant impact on the population's health status, their combined influence, and how these numerous determinates can be converted into the essential factors that impact the population's health status.

The environment is shaping our health every moment of every day. How we live, what we eat, and how we interact with the world around us can tip the scales (sometimes literally) between healthy or not (Corell, 2020). The interaction between human health and the environment has been extensively studied. Environmental risks have been proven to significantly impact human health, either directly by exposing people to harmful agents or indirectly by disrupting life-sustaining ecosystems (Kyriaki et al., 2009). The World Health Organization (WHO) defines environment, as it relates to health, as "all the physical, chemical, and biological factors external to a person, and all the related behaviors." Maintaining a healthy environment is central to increasing the quality of life and years of a healthy life. Globally, 23% of all deaths and 26% of deaths among children under age 5 are due to preventable environmental factors (World Health Organization [WHO], 2006). Low environmental quality has its most significant impact on people whose health status is already at risk. Therefore, environmental health must address the societal and environmental factors that increase the likelihood of exposure and disease (Office of Disease Prevention and Health Promotion [ODPHP], 2020).

Lifestyle is a way of living characterized by identifiable behavior patterns based on an individual's choice, influenced by the individual's characteristics, social interactions, and socioeconomic and environmental factors. A lifestyle is based upon an individual organization and expressive arrangement of everyday life. It forms a synthesis of conscious intentions and unconsciously experienced behavior, attitudes and objectives, contacts, and interactions with other people (Hillger, 1982). Determinants such as an unbalanced diet, a lack of physical activity, and substance abuse can be linked to several major health problems (Stringhini et al., 2017).

Behavioral and environmental risk factors are germane to public health interest and efforts. Focusing on these factors provides a different perspective on personal and public health enemies than that conveyed by disease-specific incidence or mortality data. The relationship between health outcomes and the facts that influence them is complicated, often confounded by different understandings of the concepts in question and measured. Health is difficult to define and more difficult yet to measure (Parrish). Moreover, health status is a multidimensional concept, requiring multiple indicators and multiple methodologies for adequate measurement (Madans et al., 2015).

2 Method

In this paper, we acquired data from WHO »European Health for All database (HFA-DB)« and the Organisation for Economic Co-operation and Development (OECD) database, as well. Data were obtained for 2015, for the total number of 53 countries of the WHO European Region (by WHO definition). Countries with insufficient data (Luxemburg, Vatican, and San Marino) were excluded[125]. We selected three data sets of variables:

- Health status (Gericke, 2005),
- Environment and
- Lifestyle,

with a total number of 32 variables. A large number of variables we had under consideration required the application of methods to reduce the problem's dimensions. In this paper, a multi-stage factor analysis with varimax rotation was applied, with the Kaiser criterion for determining the number of factors. In all cases, more than 70% of the variability was covered. Within each group, Bartlett's Test of Sphericity was significant $p<0.05$, which speaks in favor of the procedure's validity.
We analyzed data using the SPSS program for Windows, version 27.

[125] https://gateway.euro.who.int/en/country-profiles/

3 Results

Mortality/longevity indicators are imperfect indicators but remain the best available proxies for the population's health status (Joumard et al. 2008). We started precisely from the first group of six variables, representing health status (Table 1). The conducted factor analysis reduced the dimensions of the problem by 83%. The obtained factor can be considered as a *mortality factor* (F1-1) and is the only factor that stands out according to Kaiser's criterion.

Table 1: Correlations between the component(s) and independent variables that represent health status

No	**Health Status**	**F1-1**
1	Probability of dying before age 5 per 1000 live births	**0.945**
2	Probability of dying from any CVD, cancer, diabetes, CRD between age 30 and exact age 70	**0.908**
3	Life expectancy at birth (years)	**-0.902**
4	Estimated infant mortality per 1000 live births	**0.848**
5	Estimated maternal mortality per 100 000 live births	**0.836**
6	Healthy life expectancy at birth (HALE) (years)	-0.475

Source: https://gateway.euro.who.int/en/datasets/european-health-for-all-database/

Environmental determinants represent the second group of variables that have been included in factor analyses. A total of eight variables were observed and based on factor analysis, three factors were identified. Table two shows the resulting factors.

Table 2: Correlations between the component(s) and independent variables that represent the environment

No	**Environment**	**F1-2**	**F2-2**	**F3-2**
1	Population with access to a sewage system or other hygienic means of sewage disposal	**0.869**	-0.268	0.026
2	Population with homes connected to the water supply system	**0.763**	0.047	0.321
3	People injured due to work-related accidents per 100 000	**0.705**	0.366	-0.210
4	Deaths due to work-related accidents per 100 000	-0.176	**0.797**	0.139
5	Greenhouse gases	0.090	**0.764**	-0.093
6	Fine particulate matter (PM2.5)	-0.538	**-0.623**	-0.099
7	Salmonellosis cases per 100 000	0.156	0.065	**0.779**
8	Microbiological foodborne diseases per 100 000	-0.040	-0.015	**0.777**

Sources: https://gateway.euro.who.int/en/datasets/european-health-for-all-database/; https://stats.oecd.org/

Conducted analysis showed a reduction in the dimensions of the problem by more than 62%. Based on the obtained results, the procured factors could be defined as:

- F1-2- *Living and working conditions*;
- F2-2- *Risks arising from industrialization*;
- F3-2- *Food safety factor*.

Finally, the third group of variables consisted of a group of behavioral factors, representing the lifestyle of the population. A total of 18 variables were included, and by implementing the method of factor analysis, six new factors were obtained (Table 3).

After factor analysis performing, dimensions of the problem were reduced by 67%, and the following six factors can be defined as:

- F1-3- *High energy and fat-based foods*,
- F2-3- *Traffic lousy behavior*,
- F3-3- *Alcohol use habits*,
- F4-3- *Addictions*,
- F5-3- *Eating habits* and
- F6-3- *Cigarettes per person per year*.

Carrying out factor analysis to reduce the problem's dimensions is not possible with many observed variables and a limited number of entities (the number of entities is limited by the real situation, i.e., the total number of countries in one region). Stratification of variables according to their purpose annuls the problem of the singular matrix. Through ten obtained factors (1 + 3 + 6), a new picture of the European region's perception due to the researched problem was achieved. The problem's dimensions have been drastically reduced, from a total of 32 variables (6 + 8 + 18) to a new 10, which is more than 69% of the reduction. The total variability affected was more significant than 70%. According to the groups of factor analysis, the participations of generalized variance are 4.175, 1.800, and 2.383, respectively. By analyzing the generalized variance for each group of variables, the order of factor analysis in considering the entire issue is the following: health status, lifestyle, and living and working conditions.

Table 3: Correlations between the component(s) and independent variables that represent the lifestyle indicators

No	**Life style**	**F1-3**	**F2-3**	**F3-3**	**F4-3**	**F5-3**	**F6-3**
1	The total energy available from fat (%)	**0.894**	0.157	0.040	-0.069	0.296	0.130
2	The average amount of cereal available per person per year (kg)	**-0.859**	0.032	-0.245	-0.115	-0.085	0.049
3	Fat available per person per day (g)	**0.779**	0.270	0.040	-0.137	0.486	0.024
4	Wine consumed in pure alcohol, liters per capita, age 15+	**0.583**	0.483	0.192	-0.074	-0.175	0.123
5	Road traffic accidents with injury per 100 000	0.146	**0.891**	0.027	-0.006	0.267	0.058
6	People killed or injured in road traffic accidents per 100 000	0.137	**0.890**	0.026	0.014	0.266	0.050
7	Number of road traffic accidents involving alcohol	0.131	**0.569**	0.246	0.334	-0.232	-0.323
8	Pure alcohol consumption, liters per capita, age 15+	0.356	0.170	**0.858**	0.175	0.105	-0.009
9	Beer consumed in pure alcohol, liters per capita, age 15+	0.194	0.280	**0.802**	0.004	0.244	-0.058
10	The average amount of fruits and vegetables available per person per year (kg)	-0.010	0.024	**-0.753**	0.072	0.285	-0.381
11	Spirits consumed in pure alcohol, liters per capita, age 15+	-0.074	-0.398	**0.664**	0.435	0.089	-0.024
12	Age-standardized prevalence of current tobacco smoking among people aged 15 years and over	-0.017	0.212	0.087	**0.895**	0.177	0.054
13	% of regular daily smokers in the population, age 15+	0.042	-0.102	0.118	**0.827**	-0.167	0.267
14	First admissions to drug treatment centers per 100 000	0.262	0.150	0.066	**-0.493**	0.366	0.447
15	Age-standardized prevalence of overweight in people aged 18 years and over	0.197	0.165	0.101	0.163	**0.805**	0.144
16	The average number of calories available per person per day (kcal)	0.248	0.359	0.077	-0.174	**0.740**	-0.209
17	% of total energy available from protein	0.126	-0.283	-0.085	-0.333	**0.443**	-0.292
18	Number cigarettes consumed per person per year	0.078	-0.004	0.085	0.253	-0.055	**0.778**

Source: https://gateway.euro.who.int/en/datasets/european-health-for-all-database/

Methods of factor analysis within one group of variables are orthogonal, while between groups of correlations, it shows certain degrees of significance. When the experimental factors are compared, significant correlations between individual factors are observed. Strong correlations are between F1-1 and F1-2 (r = -0.875; p = 000), intermediate between F1-1 and F1-3 (r = -0.634; p = 0.000), F1-2 and F1-3 (r = 0.587; p = 0.000). Other correlations are of minor importance or do not show statistical significance.

To determine the impact on the health factor F1-1, the backward stepwise method's regression analysis method was applied. The aim was to what factors are essential for health status prediction. The basis of the backward stepwise method is to start from the fact that all factors are essential and then exclude those that have the least impact, provided that they are not statistically significant p> 0.05. The initial correlation was r = 0.931, and after the procedure of dropping the variables, a final solution of r = 0.927 was reached. A loss of 1% to reduce the problem's dimensions by more than 60% is quite a satisfactory level.

Table 4: Regression model based on given factors

Model	Std.Coef. Beta	t	Sig.
F1-2	-.554	-6.265	.000
F1-3	-.309	-4.021	.000
F5-3	-.249	-3.952	.000
F3-3	-.162	-2.814	.007

Table 4 shows the values of standardized regression analysis coefficients. F1-2 and F1-3 have the most significant influence, while factors F5-3 and F3-3 have a slightly smaller influence. If the mentioned influences on the observed entities are considered, ie the countries of the European region (Figure 1), it can be concluded that, except Kirgizstan, they are all in the area of 95% trust, and as far as predictions are concerned, only Turkmenistan is outside the specified level. Countries of central Europe are concentrated mainly around one area, while the eastern part of Europe is in the regression line's direction. However, according to mentioned significance values of these factors, a conclusion can be drawn, that there is a significant conjoint influence of environmental and lifestyle determinants on the health status of the population. According to the obtained results, the greatest impact on health has the following factors: living and working conditions and high energy and fat-based foods. Moreover, it has to be mentioned that similar environmental and behavioral risks among different European countries have a similar influence on the health population's health, as well.

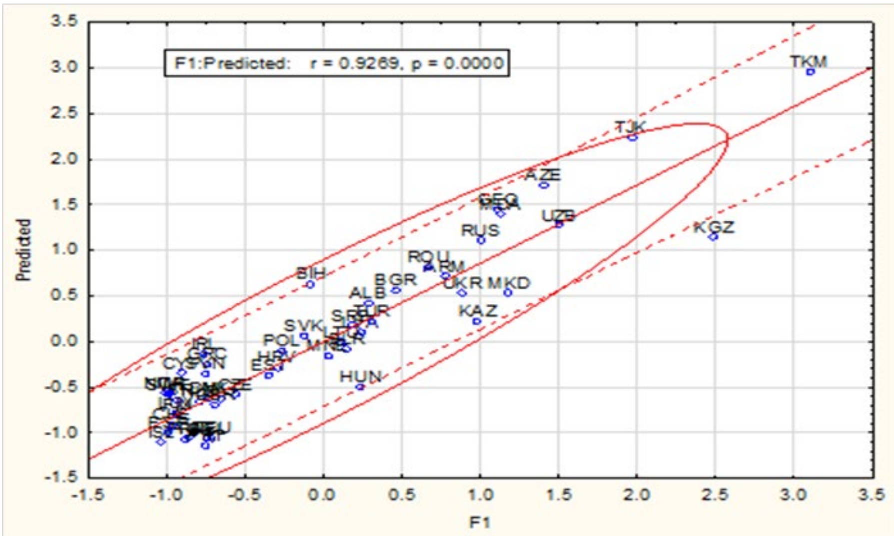

Figure 1: European countries' position based on given factor analysis

Source: own

From a social and ecological perspective, the health status of a population is influenced by many factors drawn from biology, behavior, the physical and social environment. With the increasing availability of data on health status, as well as on determinants and contributing factors, the potential for more rational policies and interventions has increased (Mathers, et al., 2003). However, it is critical to determine which diseases, injuries, and risk factors are related to the greatest losses of health (Murray, 2013). The ability to measure and quantify outcomes and risks is essential for rational decisions and actions.

References

Clewlow, R. R. (2016). Carsharing and sustainable travel behavior: Results from the San Francisco Bay Area. *Transport Policy*, 51, 158-164. doi:10.1016/j.tranpol.2016.01.013

Corell, R. (2020). How Environmental Health Impacts Our Quality of Life and Health. How Environmental Health Impacts Our Quality of Life and Health. Available at: https://www.verywellhealth.com/what-is-environmental-health-4158207. Cited on: 23. Dec 2020.

Gericke, C. (2004). Comparison of health care financing in Egypt and Cuba: Lessons for health reform in Egypt. Eastern Mediterranean health journal = La revue de santé de la Méditerranée orientale = al-Majallah al-ṣiḥḥīyah li-sharq al-mutawassiṭ. 11. 1073-86.

Hillger, C. (n.d.). Lifestyle and Health Determinants. Encyclopedia of Public Health, 854–861. doi:10.1007/978-1-4020-5614-7_1982.

Joumard, I. et al. (2008), "Health Status Determinants: Lifestyle, Environment, Health Care Resources and Efficiency", OECD Economics Department Working Papers, No. 627, OECD Publishing. DOI: 10.1787/240858500130

Kyriaki, R. Phoebe K. Environmental Effects on Public Health: An Economic Perspective. Int J Environ Res Public Health. 2009 Aug; 6(8): 2160–2178. Published online 2009 Jul 31. DOI: 10.3390/ijerph6082160PMCID: PMC2738880

Madans, J.H, Webster, K. M. (2015), International Encyclopedia of the Social & Behavioral Sciences, 2nd edition, Volume 10, Pages 725-730. National Center for Health Statistics, Hyattsville, MD, USA. Elsevier.

Mathers, C.D., Murray, C.J., Ezzati, M, et al. (2003). Population health metrics: crucial inputs to the development of evidence for health policy. Popul Health Metrics 1,6.Availableat: https://pophealthmetrics.biomedcentral.com/articles/10.1186/1478-7954-1-6#citeas. Accessed January 11, 2021

Murray, C. J. L. (2013). The State of US Health, 1990-2010. JAMA, 310(6), 591. doi:10.1001/jama.2013.13805

Office of Disease Prevention and Health Promotion (ODPHP). Environmental Health. Available at: https://www.healthypeople.gov/2020/topics objectives/topic/environmental-health. Cited on 22. Dec 2020.

Parrish R. G. (2010). Measuring population health outcomes. Preventing chronic disease, 7(4), A71

Stringhini, S, Carmeli, C, et al. (2017). Socioeconomic status and the 25 × 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1·7 million men and women. The Lancet. Vol 389, 10075, 1229-1237

World Health Organization (WHO). Preventing disease through healthy environments. Geneva, Switzerland: WHO; 2006.