Total population living in a dwelling with a leaking roof, exposure to air pollution, unmet need for medical care impact life expectancy

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Abstract
This study examines the pattern of Life Expectancy in European countries, which consists of 16 (sixteen) countries, by looking at the patterns of life expectancy for the last 4 (four) years. This type of research is causality research. The purpose of this study is to prove the effect of total population living in a dwelling with a leaking roof, exposure to air pollution, unmet need for medical care on the life expectancy in Europe. With the influencing variables are total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor, exposure to air pollution, unmet need for medical examinations and care, existing variables will be processed using the SmartPLS statistical tool. The results show that not all affect the life expectancy.

1. Introduction

Timely and adequate access to healthcare promotes better health and well-being. Inadequate access to care has been closely related to greater psychological distress, lower rates of physical health, higher levels of rehospitalization, and overall higher risks of morbidity and mortality. Moreover, a wide range of literature has showed the correlates and consequences of access to healthcare in a variety of settings and populations. Adequate access to healthcare is especially critical to maintaining health and preventing the outset of diseases through routine preventive care and treatments at older ages. In consequence, older people who lack access to healthcare are less probably to receive early diagnoses, timely treatments, and other resources for healthcare that ultimately put them at higher risks of death. With the rapid increase of populations aging all over the world, it would be valuable to examine to what level the timely and adequate access to healthcare among older people promotes health and lifespan, especially among older people in developing countries where healthcare resources are usually limited.

Air pollution is an important environmental factor. It is necessary to understand the causes of its formation, transportation and transformation in the atmosphere in order to take effective actions aimed at reducing the impact of air pollution on people, ecosystems and climate. Pollutants such as particulate matters (PM10, PM2.5), sulphur dioxide (SO_2), volatile organic compound (VOC), carbon monoxide (CO) and nitrogen oxides (NO_x) are mainly released from gasoline used in diesel-run vehicles, industrial plants and heating processes due to anthropogenic activities. Reducing the impact of air pollution on human health is necessary to develop long-term policies involving multiple sectors, such as transport, housing, energy production and industry. Air pollution is responsible for many diseases affecting the heart, skin, eyes and other organs, and exposure to smoke is the cause of various inflammatory responses. Therefore, it is of crucial importance to use ambient air quality measurements in order to get an insight into the air quality of a region.

Generally, having satisfactory accommodation is one of the most valuable aspects of people's lives and it is a major element of people's material living standards. It is essential to meet basic needs, such as being sheltered from extreme weather and climate conditions, and to offer a suitable place to sleep and rest, sense of personal security, privacy, personal space, where peoples are free of risk and hazards. Good housing conditions are also essential for people's health and affect childhood development. An ideal set of indicators to measure housing conditions should provide information about both the physical characteristics of the dwelling (e.g. availability of electricity, water supply, indoor flushing toilets, bathroom requirements, cooking facilities, the quality of materials and construction and whether parts of the dwelling are deteriorated or damaged) and the broader environmental characteristics of the areas where the dwellings are located (e.g. exposure to noise, indoor pollution, etc.). However housing costs make up a large share of the household budget, and low income population is often constrained by the level of resources left for other essential expenditures, such as food, healthcare and education.

On average, the difference in life expectancy seen between men and women across all European regions is in accordance with the worldwide trends of women outliving men. The average life expectancy at birth worldwide by income group shows that the gender life expectancy gap is not only a consistent trend across countries, but also income groups. Moreover, the higher life expectancy for those in high income groups may help to explain the lower average life expectancy for those born in Eastern Europe where average incomes are generally lower than other European regions. Although income and length of life are not directly correlated, higher income individuals are generally able to afford access to superior nutrition and healthcare as well as having leisure time for exercise.

2. Literature Review
2.1 Total Population Living in a Dwelling with a Leaking Roof and Damp Walls
Housing is an important determinant of health, and substandard housing is a major public health issue. A scientific evidence indicates solid relations between housing and health. The public health community is developing, testing, and implementing effective interventions that yield health benefits through improved housing quality. Public health agencies have valuable expertise and resources to contribute to a multisectoral approach to housing concerns. Public health has a history of involvement in the housing arena, and this involvement is generally accepted by other housing stakeholders (e.g., building departments, community housing advocates). Housing related health concerns such as lead exposure and asthma are highly visible. An increasing body of evidence has associated housing quality with morbidity from infectious diseases, chronic illnesses, injuries, poor nutrition, and mental disorders.

2.2 Air Pollution in European Countries
Emissions of many air pollutants in Europe have decreased significantly over the last decades, which has contributed to the improvement of air quality. Much progress has been made in tackling air pollutants such as SO_2, CO, lead (Pb), and benzene (C_6H_6). On the other hand, road transport, industry, power plants, households and agricultural activities continue to emit significant amounts of air pollutants. Consequently, concentrations of air pollutants are still too high and problems with air quality persist. A significant part of the European population lives in areas where air-quality standards are constantly exceeded.

2.3 Medical Care in Europe
Healthcare in Europe is provided through a wide range of different systems run at individual national levels. Most European countries have a system of tightly regulated, competing private health insurance companies, with government subsidies available for citizens who cannot afford coverage. Many European countries (and all European Union countries) offer their citizens a European Health Insurance Card which, on a reciprocal basis, provides insurance for emergency medical treatment insurance when visiting other participating European countries.

2.3.1 Unmet Need for Medical Care
More than 3 % of the EU-28 population aged 16 and over had an unmet need for a medical examination or treatment in 2018. In 2018, 3.2 % of the population aged 16 and over in the EU-28 reported that they had unmet needs for a medical examination or treatment, a share that ranged from 0.4 % in Spain and Austria to 18.9 % in Estonia. As regards reasons related to the organisation and functioning of health care services financial reasons (too expensive), transportation (too far to travel), or timeliness (long waiting lists), 1.8 % of the EU-28 adult population reported they had unmet needs, a share that ranged from 0.1 % in Austria to 16.4 % in Estonia. Being too expensive is the most common main reason for unmet medical treatment needs in 2018. Overall in the EU-28, the most common main reason for not having a medical examination or treatment was that it was too expensive; this reason alone accounted for more than one third of all the people who reported an unmet need for medical care, equivalent to 1.1 % of the population. The next most common main reasons given were waiting lists or wanting to see if the problem got better on its own: these two reasons were each reported by about 0.6 % of the population. Less common reasons were lack of time, a fear of doctors, hospitals, examination or treatment, that it was too far to travel, or that the person did not know a good doctor or specialist, each of which were reported by between 0.1 % and 0.3 % of the population. Aside from these seven specified main reasons, a further 0.3 % of the population indicated another (unspecified) reason for an unmet need for a medical examination or treatment.

2.3.2 Relationship between economic hardship and unmet needs for medical healthcare
The relationship between economic hardship and unmet needs for medical health care becomes apparent when comparing people from different income quintiles. The more people are faced with economic constraints, the more often they report unmet medical needs. The lower their income, the more likely people are to report long-standing health issues.

2.4 Definition of Life Expectancy
Life expectancy is the important parameter for evaluate population health. Broader than the narrow parameter of the infant and child mortality, which focus solely at mortality at a young age, life expectancy captures the mortality along the entire life course. It tells us the average age of death in a population

3. Method
This study uses data analysis methods using SmartPLS software running on the computer media. Secondary data on total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor, exposure to air pollution, unmet need for medical examinations and care and life expectancy in Europe for 2015-2018 are sourced from the European Statistical Recovery Dashboard. Measurement models are used to test validity and reliability, while structural models are used to test causality (hypothesis testing with predictive models).

4. Result and Discussion
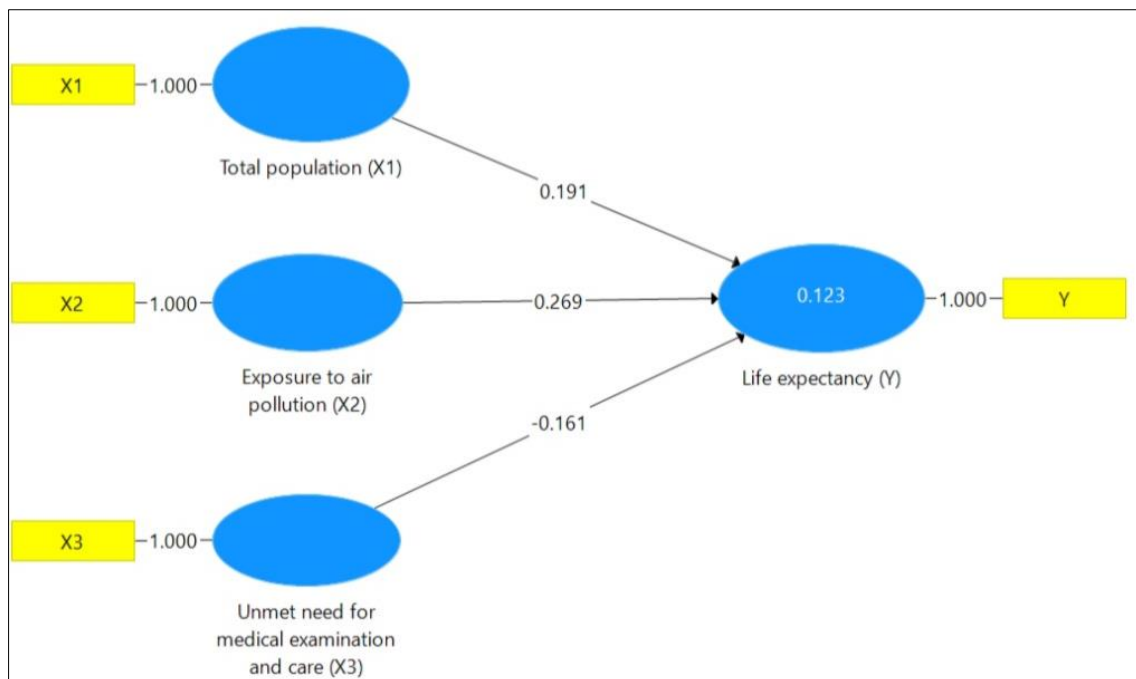## 4.1 Result
4.1.1 Descriptive Data

Table 1: Descriptive Statistics

No	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
X1	130.453	133.000	8.000	241.000	41.045	2.665	-0.952
X2	121.016	128.000	10.000	238.000	58.226	-0.489	-0.332
X3	37.609	14.000	1.000	219.000	50.877	2.295	1.749
Y	715.000	814.000	7.500	835.000	241.431	3.381	-2.278

Source: Results of processing with SmartPls (2021)

Based on Table 1, it can be seen that the average value for total population living in a dwelling with a leaking roof (X1) is 130.453 and a minimum value of 8.000 and the highest value is 241.000. Exposure to air pollution (X2) with an average value of 121.016 with the highest value of 238.000 and the lowest value of 10.000. The unmet needs for medical care (X3) with an average value of 37.609 with the highest value of 219.000 and the lowest value of 1.000. Life expectancy (Y) with an average value of 715.000 and the lowest value of 7.500 with the highest value of 835.000

The results of the t-statistic value in the path coefficient table are presented in Figure 1 below:

Source: Results of processing with SmartPls (2021)

Fig 1: Overall model with coefficients

Based on the model in Figure 1, it can be seen that the Total Population Living in a Dwelling with a Leaking roof affects Life Expectancy by 0.191, Exposure to air Pollution affects Life Expectancy by 0.269, and Unmet Need for Medical Examintaion affects Life Expectancy by -0.161.

The results after we process Figure 1 into bootstrapping can be seen on Table 2 below:

Table 2: Model-Bootstrapping

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values
Exposure to air Pollution (X2) →Life Expectancy (Y)	0.269	0.261	0.135	1.989	0.047
Total Population Living in a Dwelling with Leaking Roof (X1) → Life Expectancy (Y)	0.191	0.176	0.130	1.472	0.142
Unmet Needs for Medical Care (X3) → Life Expectancy (Y)	-0.161	-0.168	0.164	0.984	0.326

Source: Results of processing with SmartPls (2021)

From Table 2, it can be seen that Exposure to Air Pollution (X2) as an independent variable has positive and significant effect towards Life Expectancy (Y). The P value for Exposure to Air Pollution (X2) is 0.047. Since the P value is below $\alpha 5\%$, it can be concluded that Exposure to Air Pollution (X2) has significant effect towards Life Expectancy (Y). Total Population Living in a Dwelling with Leaking Roof (X1) is not significant towards Life Expectancy (Y). The P value is 0.142. Since the P value is above $\alpha 5\%$, it can be concluded that Total Population Living in a Dwelling with

Leaking Roof (X1) has no significant effect towards Life Expectancy. Unmet Needs for Medical Care (X3) is not significant towards Life Expectancy (Y). The P value is 0.326. Since the P value is above α5%, it can be concluded that Unment Needs for Medical Care (X3) has no significant effect towards Life Expectancy (Y).

4.1.2 Predictive Relevance

Table 3: Predictive Value

	Exposure to Air Pollution (X2)	Life Expectancy (Y)	Total Population Living in a Dwelling with Leaking Roof (X1)	Unmet Needs for Medical Care (X3)
Exposure to Air Pollution (X2)		0.269		
Life Expectancy (Y)				
Total Population Living in a Dwelling with Leaking Roof (X1)		0.191		
Unmet Needs for Medical Care (X3)		-0.161		

***Source*:** Results of processing with SmartPls (2021)

From table 3, it shown that the coeffiecient values of Exposure to Air Pollution (X2) towards Life Expectancy (Y) is 0.269, which means the increase of Exposure to Air Pollution (X2) will lead to higher Life Expectancy (Y). The coefficient values of Total Population Living in a Dwelling with Leaking Roof (X1) towards Life Expectancy (Y) is 0.191, means the increase of Total Population Living in a Dwelling with Leaking Roof (X1) will lead to higher Life Expectancy (Y). The coefficient values of Unmet Needs for Medical Care (X3) towards Life Expectancy (Y) is -0.161, which means the decrease of Unmet Needs for Medical Care (X3) will lead to higher Life Expectancy (Y).

4.1.3 Determination Coefficient Test Results

Table 4: R Square

	R Square	R Square Adjusted
Life Expectancy (Y)	0.123	0.079

***Source*:** Results of processing with SmartPls (2021)

The results of testing the coefficient of determination in Table 4, the R Square value is 0.123 and the Adjusted R Square value is 0.079. Thus, the value of R Square Adjusted illustrates that all of the independents consisting of the Total Population Living in a Dwelling with Leaking Roof (X1), Exposure to Air Pollution (X2), and Unmet Needs for Medical Care (X3) in this study are able to represent Life Expectancy (Y) as the dependent variable of 7.9 %. While the remaining 92.1% is influenced by other variables outside this equation or the variables studied.

4.1.4 Prediction values

Table 5: Q Square

	SSO	SSE	Q^2
X2	64.000	64.000	
Y	64.000	65.864	-0.029
X1	64.000	64.000	
X3	64.000	64.000	

***Source*:** Results of processing with SmartPls (2021)

From Table 5, it can be seen that Exposure to Air Pollution (X2), Total Population Living in a Dwelling with Leaking Roof (X1), and Needs for Medical Care (X3) can predict the Life Expectancy (Y) by 2.9%.

4.2 Discussion

A dwelling with leaking roof, damp walls and floors/fundation often found in slums area. It could lead to many possibilities that can threaten somebody's life. Poor design or construction of homes is the cause of most home accidents. In some European countries, home accidents kill more people than do road accidents, the use of proper building materials and adequate ventilation could prevent indoor pollution or mould that can lead to asthma, allergies or respiratory diseases.

About every tenth lung cancer case results from radon in the home, appropriate design can prevent both exposure and the risk to health. Urban pollution such as noise and emissions from transport lead to a range of diseases and significantly affect life expectancy and quality of life. In most countries of the WHO European Region there are strong environmental inequalities, with higher and more frequent harmful exposure affecting especially vulnerable population groups (such as migrants or persons with low socioeconomic status).

In the WHO European Region, exposure to particulate matter (PM) decreases the life expectancy of every person by an average of almost 1 year, mostly due to increased risk of cardiovascular and respiratory diseases, and lung cancer. Furthermore, a recent study using data from 25 cities in the European Union has estimated that life expectancy could be increased by up to approximately 22 months in the most polluted cities if the long-term PM2.5 concentration was reduced to the WHO guideline annual level. Some 40 million people in the 115 largest cities in the European Union (EU) are exposed to air exceeding WHO air quality guideline values for at least one pollutant. Children living near roads with heavy-duty vehicle traffic have twice the risk of respiratory problems as those living near less congested streets. Indirect effects of air pollution, such as climate change, are becoming increasingly evident. Transport is the fastest growing source of fossil-fuel emissions of carbon dioxide ($CO2$), the largest contributor to climate change. Ozone pollution causes breathing difficulties, triggers asthma symptoms, causes lung and heart diseases, and according to statistics is associated with about 21 000 premature deaths per year in the Region.

Accessibility to health care can be limited for a number of reasons, including cost, distance to the closest health facility and waiting times. Unmet care needs may result in poorer health for people forgoing care and may increase health

inequalities if such unmet needs are concentrated among poor people. There are many ways to seek information from the population about unmet health care needs that will provide different results.

In all European countries, most of the population in 2018 reported that they had no unmet care needs for financial reasons, geographic reasons or waiting times, based on EU-SILC. However, in Estonia and Greece, at least 8% of the population reported some unmet needs for health care, with the burden falling mostly on people from low-income households, particularly in Greece. Nearly one in five Greek people in the lowest income quintile reported going without some medical care when they needed it, these unmet needs were mainly for financial reasons. In Estonia, long waiting times are the main reason for people to report unmet care needs, which are partly explained by the limited volume of some services (such as specialist consultations) fully reimbursed by public health insurance. The Estonian Health Insurance Fund provided additional funding in 2018 to improve the availability of specialist services and treatments, which resulted in a reduction in waiting times for at least some services.

Indicators of self-reported unmet care needs should be assessed together with other indicators of affordability and accessibility to care, such as the extent of health care coverage, the amount of out-of-pocket payments, and the actual use of health services. Strategies to improve access to care for poor people and disadvantaged groups need to tackle not only affordability issues, but also effective access to services by promoting an adequate supply and distribution of health workers and services throughout the country

5. Conclusion

The exposure to air pollution has a significant effect on the formation of life expectancy. The emission air pollutants have decreased significantly over the last decades, the improvement of air quality lead to higher life expectancy. However the total population living in a dwelling with a leaking roof and unmet needs for medical care showed no significant effect towards life expectancy. Given the importance of air quality as well as health awareness, it is necessary to identify the main problems that affect the life expectancy, and how to reduce rate of people getting medical examination or care in order to increase lifespan.

6. References

1. Anonymous. Environmental health inequalities in Europe. World Health Organization, 2012.
2. Anonymous. Review of evidence on health aspects of air pollution – REVIHAAP (interim report). World Health Organization, 2016.
3. Anonymous. Your Key to European Statistics. Retrieved from European Statititical, 2019. https://ec.europa.eu/eurostat/statistic-sexplained
4. Duffin E. Life expectancy in Europe, 2020.
5. Eurostat: Your Key to European Statistics. (n.d.). Retrieved from European Statistical: https://ec.europa.eu/eurostat/data/database
6. Hao L, Xu X, Dupre M, Guo A, Zhang X, Qiu L, Gu D. Adequate access to healthcare and added life expectancy among older adults in China. BMC Geriatrics, 2020, 129.
7. Higgins D, Krieger J. Housing and Health: Time Again for Public Health Action. Am J Public Health, 2002, 758-768.
8. Kolasa-Więcek A, Dariusz S. Air pollution in European countries and life expectancy-modelling with the use of neural network. Air Quality, Atmosphere & Health, 2019, 1335-1345.
9. OECD. Health at a Glance: Europe 2020: State of Health in The EU Cycle. Paris: OECD Publishing, 2020.
10. OECD. Waiting Times for Health Services: Next in Line. Paris: OECD Publishing, 2020.
11. Streimikiene D. Quality of Life and Housing. International Journal of Information and Education Technology. 2015; 5:140-145.