Pathologies Related to Fuel Poverty

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Abstract Fuel Poverty is a phenomenon that interests both warm and cold climatic areas and has a greater influence on the health of households with elderly, children and people with chronic diseases and long-standing illness (LSI). Climate change has worsened health problems for those families living in energy poverty. In particular, in elderly and pediatric population, the main disorders related to insufficient heating and in lack of air conditioning are cardiovascular diseases and respiratory tract infections, respectively. Fatalities related to both hot and cold indoor environments are also linked to cardiovascular and respiratory disorders. Moreover, depressive symptoms may also occur regardless of age, gender, height and smoking habit. In the world's poorest countries, the use of biomass or solid fossil fuels for cooking, heating and lighting is widely practiced leading to severe lung diseases. In conclusion, cardiovascular diseases and respiratory problems are the main pathologies related to fuel poverty.

To ensure everyone's health there is the need to have in the homes where we live a sufficient level of heating, cooling and lighting.

In the EU, more than 50 million households have energy poverty problems and live in energy inefficient buildings, with high energy costs and low household incomes.[1]

According to the World Health Organization (WHO): 'A household is said to be in fuel poverty if it needs to spend more than 10% of its income on fuel to maintain an adequate level of warmth (usually defined as 21 degrees for the main living area, and 18 degrees for other occupied rooms'.[2]

Low income, energy price and energy inefficiency are common factors for evaluation of potential health impact for fuel poor households. It's a phenomenon that interests both warm and cold climatic areas.[3]

Fuel poverty has a greater influence on the health of those people who stay at home for a long time such as elderly, children and people with chronic diseases and long-standing illness (LSI).[4]

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[1] Available at https://ec.europa.eu/energy/topics/markets-and-consumers/energy-consumer-rights/energy-poverty_en?redir=1 (last visited 7 December 2020).

[2] World Health Organization, *Housing, Energy and Thermal Comfort: A Review of 10 Countries within the WHO European Region* (Copenhagen: WHO Regional Office for Europe, 2007).

[3] V. Condemi et al, 'Health Impact of Fuel Poverty' 98 *Bulletin of rehabilitation medicine*, 135, 135-143 (2020).

[4] K. O'Sullivan et al, 'Child and youth fuel poverty: assessing the known and unknown' 10 *People, Place and Policy*, 77, 77-87 (2016). A. Pollard et al., 'Use of Simple Telemetry to Reduce the Health Impacts of Fuel Poverty and Living in Cold Homes' 16 *International Journal of Environmental Research and Public Health,* 2853 (2019).

The elders and rural people are the most exposed to fuel poverty because they are reluctant to show their health trouble and suffering.[5]

Recent epidemiological studies have shown the seasonal variability in morbidity and mortality with winter and summer peaks also due to climate change.[6]

An epidemiological study conducted in 15 European cities, showed that the decrease of 1-degree centigrade between October and March led to an increase total natural deaths of 1,35% and increase in cardiovascular deaths of 1.72%, in respiratory deaths of 3.30% and cerebrovascular fatalities of 1.25%, however, these percentages are higher for the elderly population.[7]

The conclusions of a study conducted on 12 European cities, found an important impact on hospital admissions to respiratory diseases in conditions of high ambient temperatures, particularly in the elderly population. The same study also showed an increase in cardiovascular mortality, however, corresponding to a non-increase in cardiovascular morbidity.[8]

In a more recent study published in *The Lancet* in 2015, 74 million deaths have been observed between 1985 and 2012 in 384 locations in different countries (Australia, Brazil, Canada, China, Italy, Japan, South Korea, Spain, Sweden, Taiwan, Thailand, UK, and USA). This study showed that 7.71% of deaths were related to a non-optimal temperature of the environment, establishing the optimal temperature such as that with minimum effects for various health outcomes.[9]

These climatic effects are probably reflected with a greater impact on families living in energy poverty environments. Fatalities related to both hot and cold indoor environments are also linked to cardiovascular and respiratory disorders.[10]

It has been estimated that 30% of *excess winter deaths* (EWD) is due to inadequate housing conditions with temperatures below 18 ° C.[11]

The result of a study reports that about 50-70% of EWD is related to cardiovascular conditions and about 15-33% to respiratory diseases.[12]

The main cardiovascular consequences observed in both conditions of insufficient heating and lack of air conditioning in the elderly population are increased blood

[5] V. Condemi et al, n 3 above.

[6] A. Analitis et al, 'Effects of cold weather on mortality: results from 15 European cities within the PHEWE project' 168 *American Journal of Epidemiology,* 1397, 1397-1408 (2008).

[7] ibid.

[8] P. Michelozzi et al, 'High temperature and hospitalizations for cardiovascular and respiratory causes in 12 European cities' 179 *American Journal of Respiratory and Critical Care Medicine*, 383, 383-389 (2009).

[9] A. Gasparrini et al, 'Mortality risk attributable to high and low ambient temperature: a multicountry observational study' 386 *The Lancet,* 369, 369-375 (2015).

[10] V. Condemi et al, n 3 above.

[11] ibid.

[12] K.J. Collins, 'Low indoor temperatures and morbidity in the elderly' 15 *Age and Ageing*, 212, 212-220 (1986).

pressure, ischemic heart disease and exacerbations of stroke ulcer. Heart failure, in particular, can be caused by electrolyte imbalances associated with excessive sweating Hydro-salt imbalances in older people lead to a decrease in renal function, reduced renal clearance, calculi urinary, falls, fractures (hypotension) and chronic intestinal diseases with diarrhoea.[13] Other disorders related to inadequate heating in the elderly were arthro-rheumatic effects such as exacerbation of arthritis and rheumatisms with strength and dexterity reduction.[14]

A retrospective observational study conducted between 2007-2010 in Cuneo (Italy), have shown a link between rising summer temperatures and the likelihood of developing urinary calculi. Living the summer period in an environment without air conditioning and with other structural problems has been seen to increase the risk of this pathology.[15]

The main respiratory effect observed in the elderly and pediatric population in hot and cold environments was upper and lower respiratory tract infection. Worsening of chronic obstructive pulmonary disease (COPD) can be a consequence in older people living in energy poverty conditions. A large percentage of childhood asthma cases is attributable to exposure to indoor moisture and mould inside inadequately heated homes.

There are also scientific works that highlight the effects on morbidity and mortality related to heat waves with high humidity levels, frequently due to climate changes.[16]

Health problems due to hot weather are immediate and exponential, while those due to very cold temperatures have a prolonged effect with a linear dose-response ratio.[17]

However, it is necessary to carefully evaluate the observed contexts because atmospheric pollution, active smoking, smoking in pregnancy are confounding factors and risk causing incorrect interpretations of the results of research conducted indoors on subjects in energy poverty with respiratory disorders.[18]

In energy poverty conditions, independent to age, gender, height and smoking habit, is more likely to have depressive symptoms and disorders such as stress, anxiety, irritability.[19]

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[13] V. Condemi et al, n 3 above.
[14] ibid.
[15] V. Condemi et al. 'Association with meteo-climatological factors and daily emergency visits for renal colic and urinary calculi in Cuneo, Italy, A retrospective observational study 2007-2010', 59 *International Journal of Biometeorology*, 249, 249-263 (2014).
[16] V. Condemi et al, n 3 above.
[17] ibid.
[18] ibid.
[19] R. de Vries and D. Blane, 'Fuel poverty and the health of older people: the role of local climate' 35 Journal of Public Health, 361, 361-366 (2013). World Health Organization, *Burden of disease from environmental noise* (Copenhagen: WHO Regional Office for Europe, 2011).

In addition to climate risks, Carbon Monoxide (CO) exposure is the first cause of acute poisoning produced by the gas or solid fossil fuels combustion especially for households living in energy poverty with obsolete or inadequate heating systems.[20]

Another aspect of energy poverty is the use of biomass or solid fossil fuels for cooking, heating and lighting, it is a widespread practice in the world's poorest countries. The use of solid fossil fuels or biomass produces indoor air pollution (IAP). IAP indiscriminately affects the health of women, children, the elderly and people with the cardiopulmonary illness. Acute respiratory infections, chronic obstructive pulmonary disease, pneumoconiosis, cataracts and blindness, pulmonary tuberculosis, adverse effects on pregnancy, cancer and cardiovascular and cerebrovascular diseases are some health effects to indoor IAP exposure.[21]

Recently, a study carried out in Malawi (sub-Saharan Africa) on 16079 subjects with 30 median age and equal distribution of male and female showed that the main fuels used at home were Charcoal (81.5% of households), wood (36.5%), respectively. Only 3,9% of households could afford electricity.[22]

Kerosene is another combustible used for cooking in many poor areas of the world. A study conducted in the city of Pune (India) on 192 families (96 matched couples), showed a link between the use of kerosene indoor and the risk of developing tuberculosis.[23]

In rural and poor areas of Nepal, dung-briquettes are used for cooking. Using biomass as fuel and specifically, dung-briquettes can cause serious damage to health. In 2009, research associated the use of manure briquettes with the onset of related diseases. The use of manure tile increases the risk of developing asthma by 1.5% while the probability of developing eye diseases is 4.7%.[24]

[20] World Health Organization, n 19 above.

[21] A. O. Mocumbi et al, 'Cardiovascular Effects of Indoor Air Pollution from Solid Fuel: Relevance to Sub-Saharan Africa' 6 *Current Environmental Health Reports*, 116, 116-126 (2019).

[22] ibid. See also: K.C. Piddock et al, 'A cross-sectional study of household biomass fuel use among a periurban population in Malawi' 11 *Annals of the American Thoracic Society*, 915, 915-924 (2014).

[23] J.L. Elf et al, 'The association of household fine particulate matter and kerosene with tuberculosis in women and children in Pune, India', 76 *Occupational and Environmental Medicine,* 40, 40-47 (2019).

[24] K.P. Pant 'Cheaper Fuel and Higher Health Costs Among the Poor in Rural Nepal' 41 *Ambio*, 271, 271-283 (2012).