

Energy poverty and health: the effect of poor housing on people's wellbeing

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RSE – Ricerca sul Sistema Energetico



MISSION

Research about energy system for the benefit of all consumers



PEOPLE

320 employees
2/3 M.Sc./Ph.D, 80% researchers;
Headquarter: Milano



PROPERTY

Private company owned by the Ministry of Economy and Finance and held by GSE, financed by Ministry for the Ecological Transition



ACTIVITIES

Research on Energy System

Energy Efficiency

Regulation and normative
Technology
Industry
International activities

Energy Poverty and health: why?

Dampness



Too cold house



Too hot house



Issue analysed in:

- UK (originally)
- France
- Spain

**Premature
death**

**Cardiovascular
diseases**

**Respiratory
diseases**

**Pregnancy
Issues**

Mental Health

**Dehydration
(hot) or
hypothermia
(cold)**

Range of indoor thermal comfort: **18°C – 24°C (WHO)**

*for children and the elderly a minimum temperature of 20°C is suggested

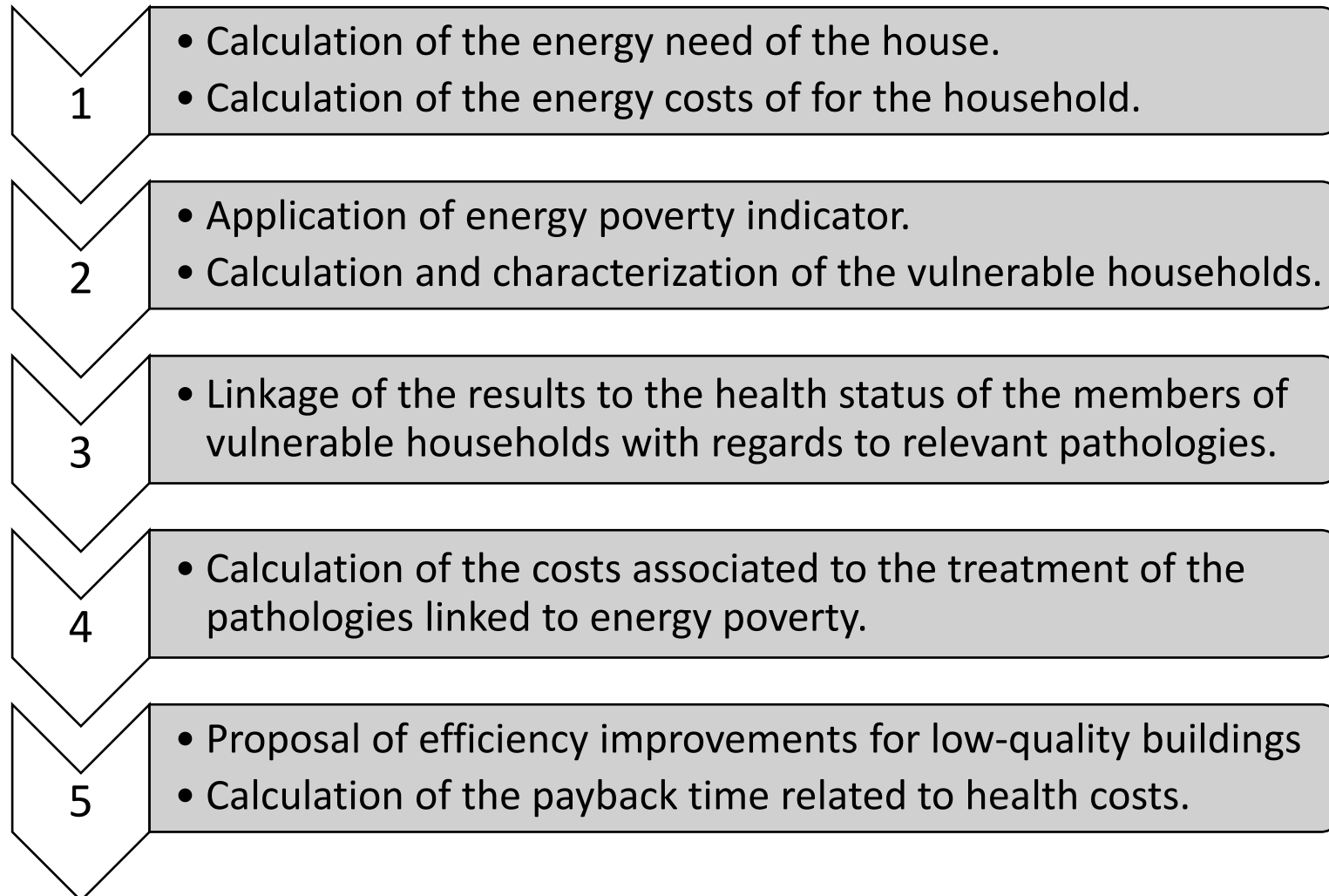
Objective causes:

- Air temperature
- Surface temperature
- Air movement
- Relative humidity
- Mechanical ventilation

Subjective causes:

- Age
- Gender
- Health status
- Activity levels
- Clothing
- Local climate adaption
- Habits

Goal of the study: estimate the health impact of energy poverty in Italy and its financial implications



Energy poverty indicator: RSE proposal

Italian National Energy
Strategy (2017):

$$EP_i = I[(E_i^{tot} - E_i^{minheat}) < \sigma]$$

- EP_i is the energy poverty condition of i-family;
- E_i^{tot} is the total monthly expenditure of the i-family;
- $E_i^{minheat}$ is the minimum heating need expenditure of the i-family over the year, divided by twelve;
- σ is the expenditure threshold that identifies a family as poor according to ISTAT, varying with the number of family members.

RSE 2021:

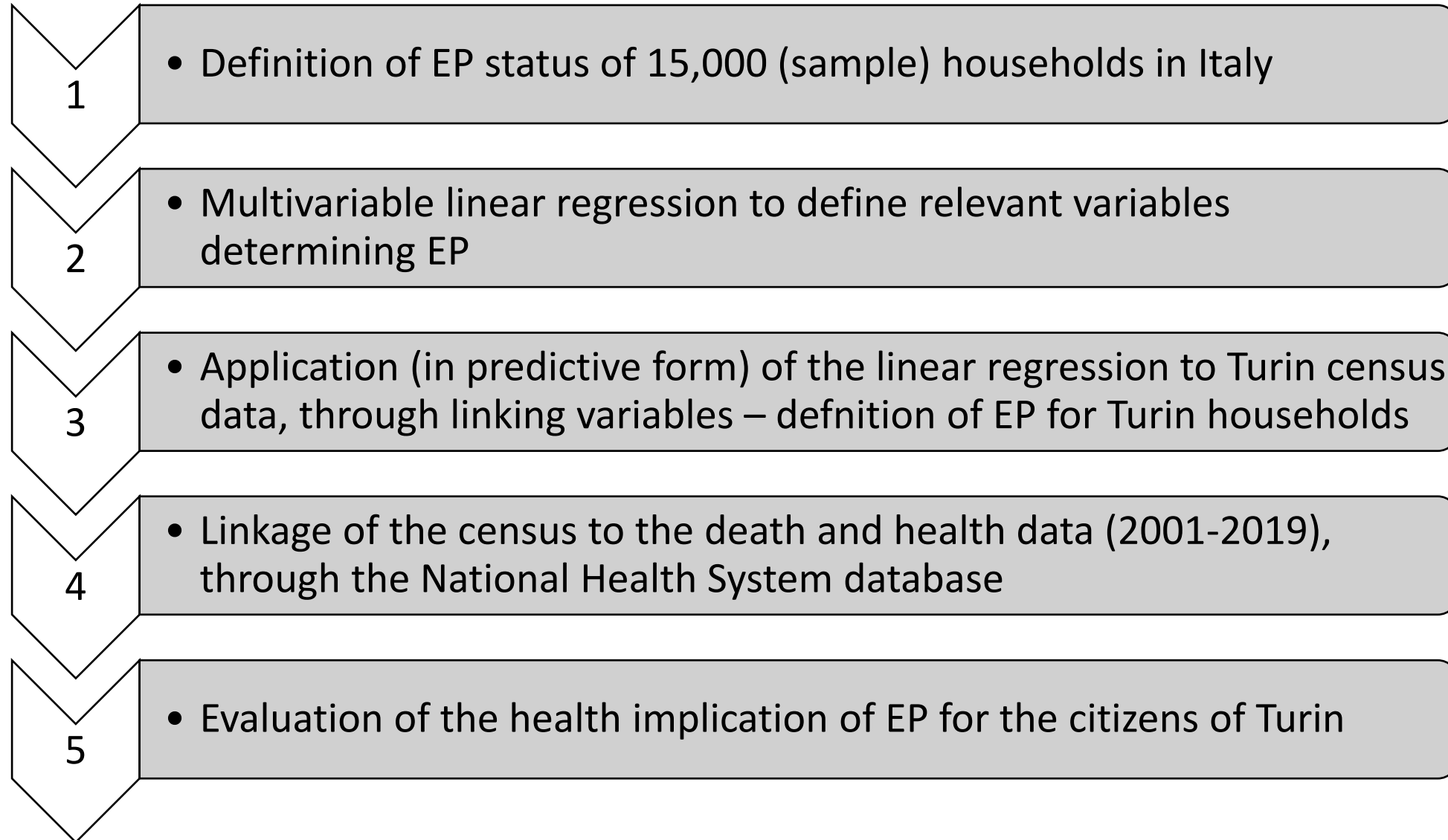
$$EP_i = I[(E_i^{tot} - E_i^{minenergy}) < \sigma]$$

$E_i^{minheat}$ is replaced by $E_i^{minenergy}$, that takes into account both heating and cooling needs of the family, including cooling systems installation and maintenance (for families that didn't have one, ~64%)

Energy poverty results - Italy

Case	Households (x1000)	Consumers (x1000)
Heating	3,303	9,678
% on Italian families	13%	16%
Heating + cooling	3,808	10,660
% on Italian families	15%	18%
Total difference	505	982
% difference	15%	10%

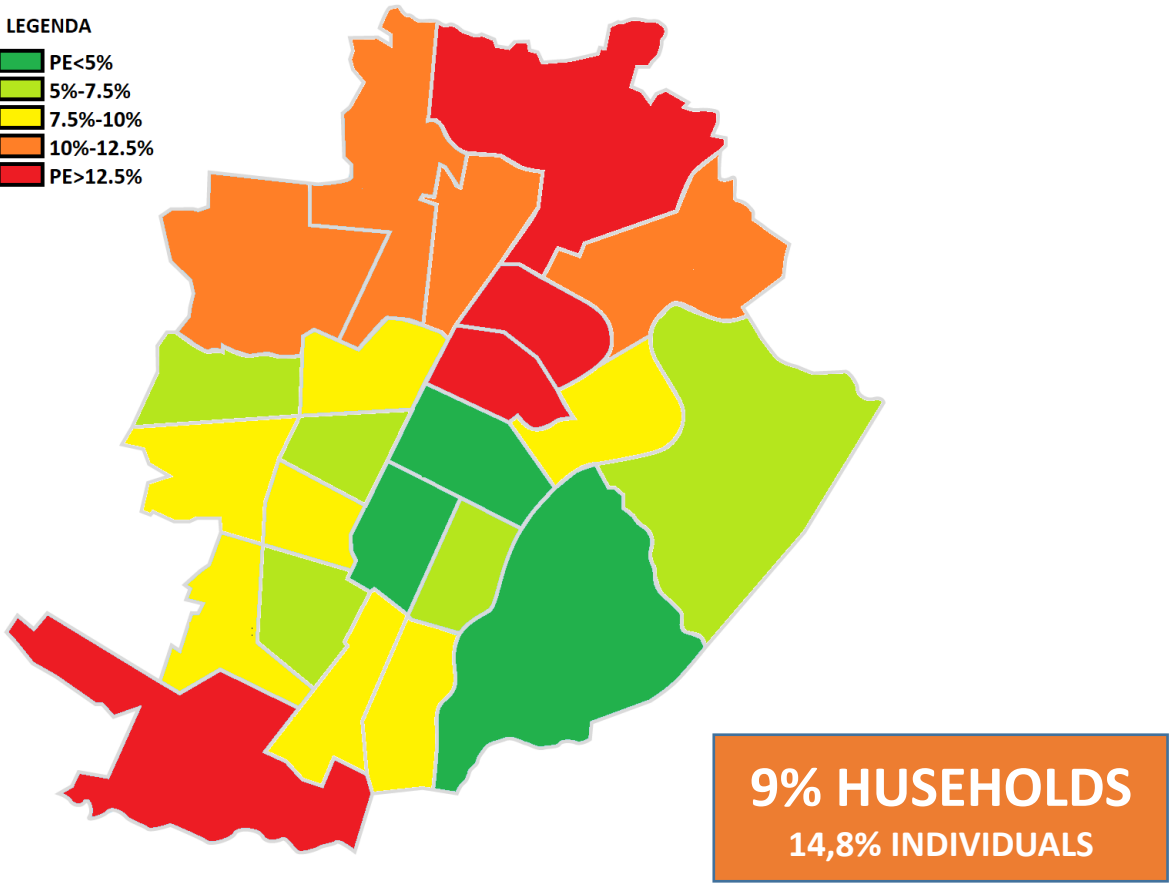
Energy poverty and health – Turin case study



Energy poverty and health – Turin case study

EP distribution in Turin

Turin city	Households (thousands and %)	
Analysed cases	385	100%
Energy poor households	34.6	9.0%
Non-vulnerable households	349.6	90.8%
Not defined	0.8	0.2%



Energy poverty and health – Turin case study



Input data:

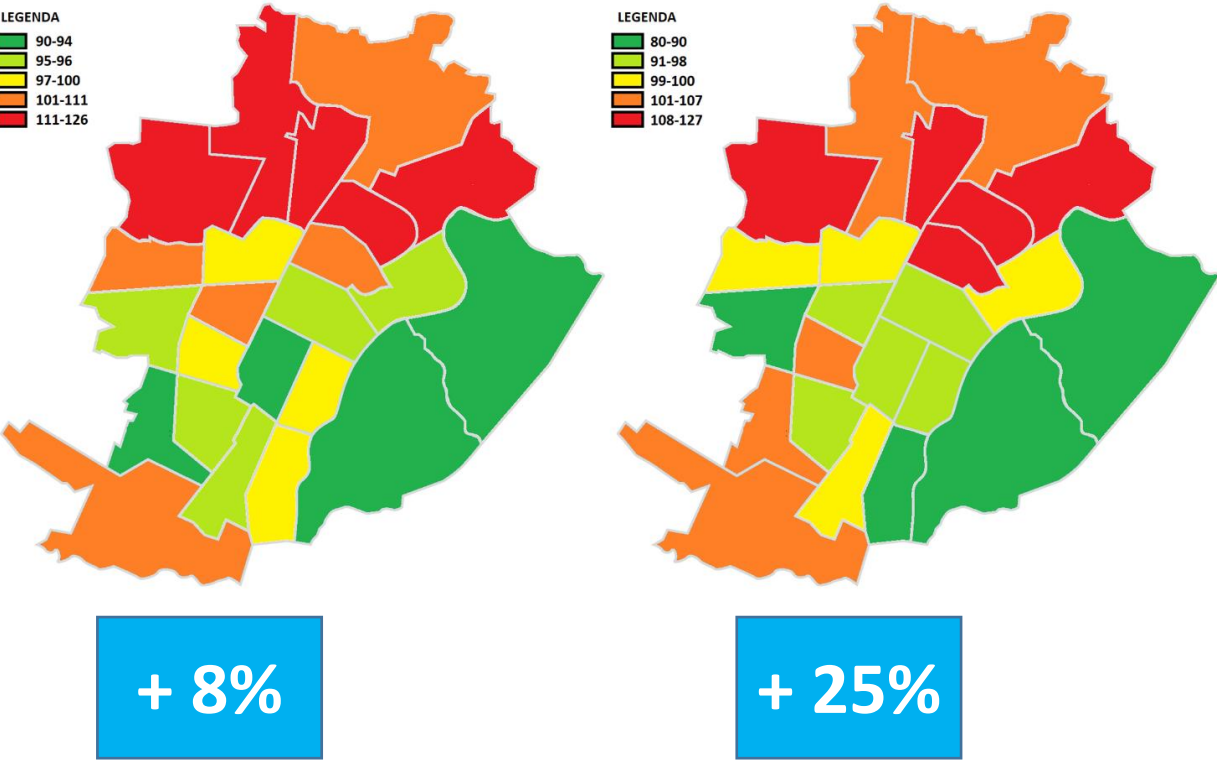
- ISTAT «Household budget survey» 2015 → definition of EP.
- Studio Longitudinale Torinese (SLT)
- 2001 and 2011 census data.
- National Health System database 2001-2019.

Health indicators:

- Premature death (under the age of 70)
- Cardiovascular diseases
- Heart attacks
- Cerebrovascular diseases
- Respiratory diseases
- Chronic obstructive pulmonary disease (COPD)
- Children asthma (*not significant – results not presented*)

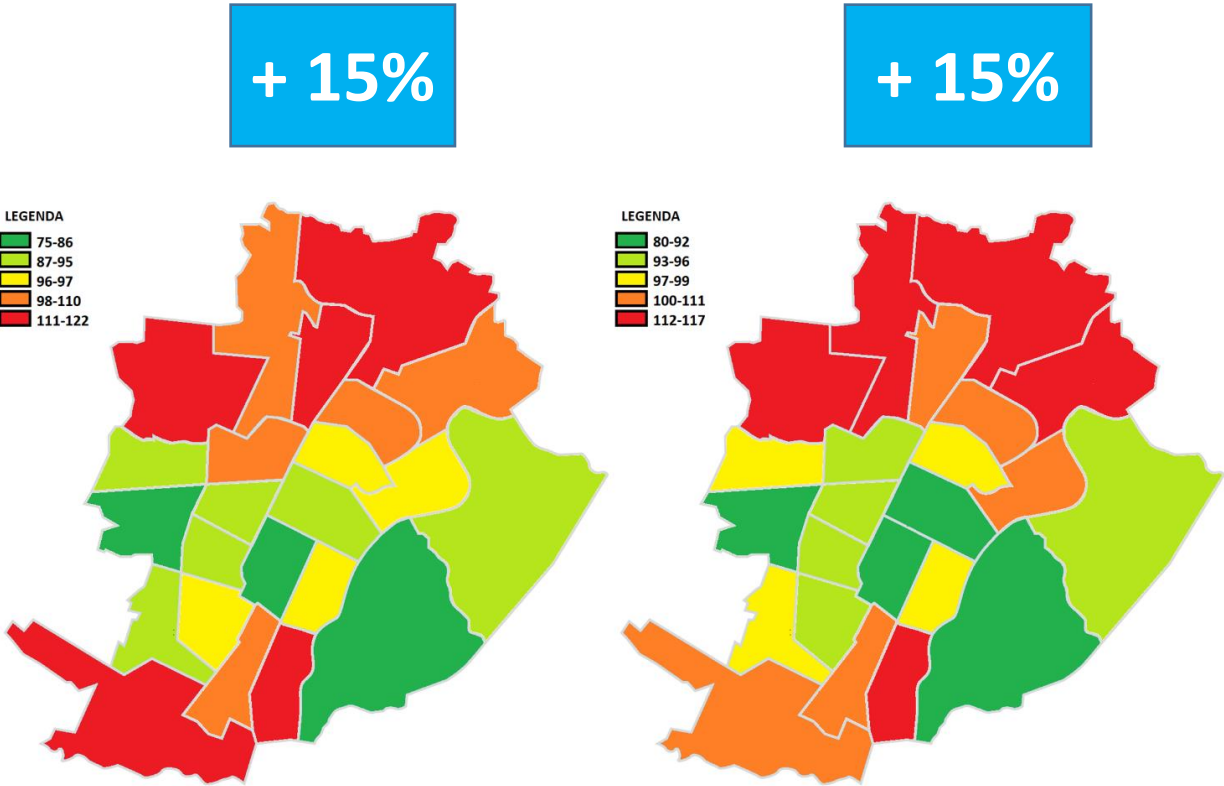
Energy poverty and health – Turin case study

Premature death – 2001-10 and 2011-19



Eccess risk for people in EP

Eccess risk for people in EP

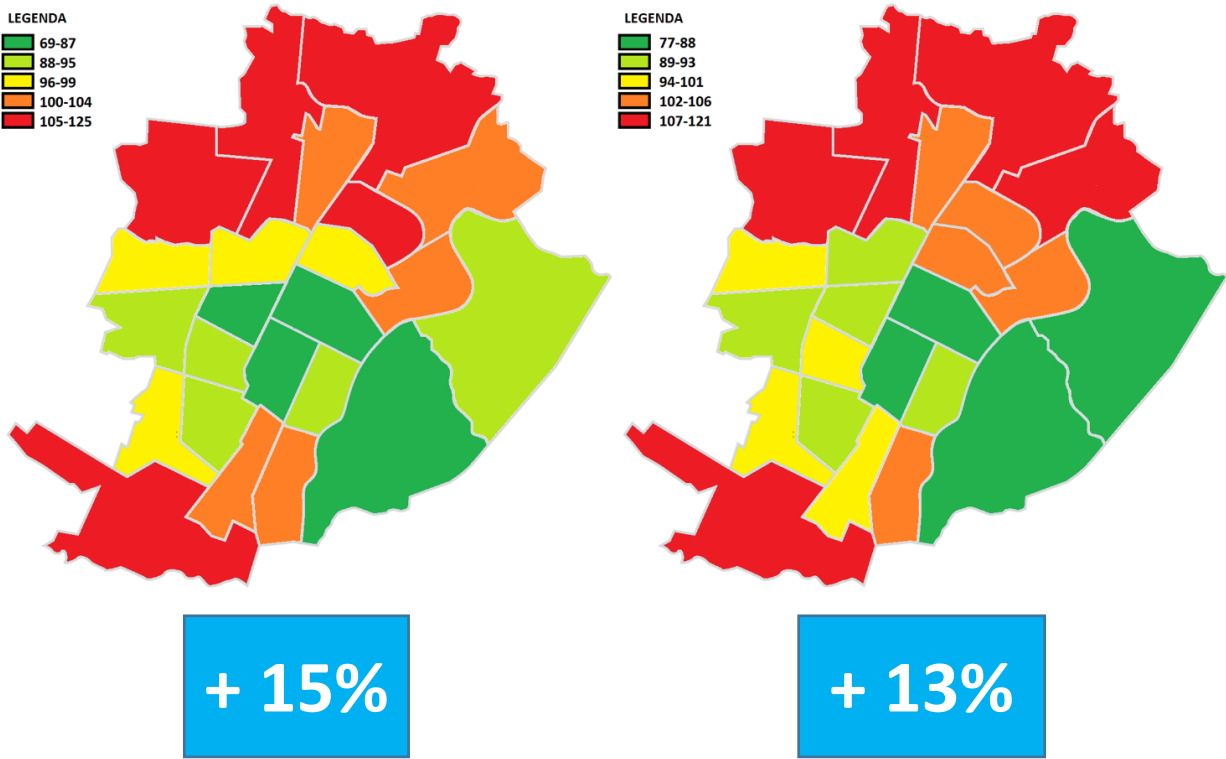


Cardiovascular diseases – 2001-10 and 2011-19

Energy poverty and health – Turin case study



Heart attacks – 2001-10 and 2011-19

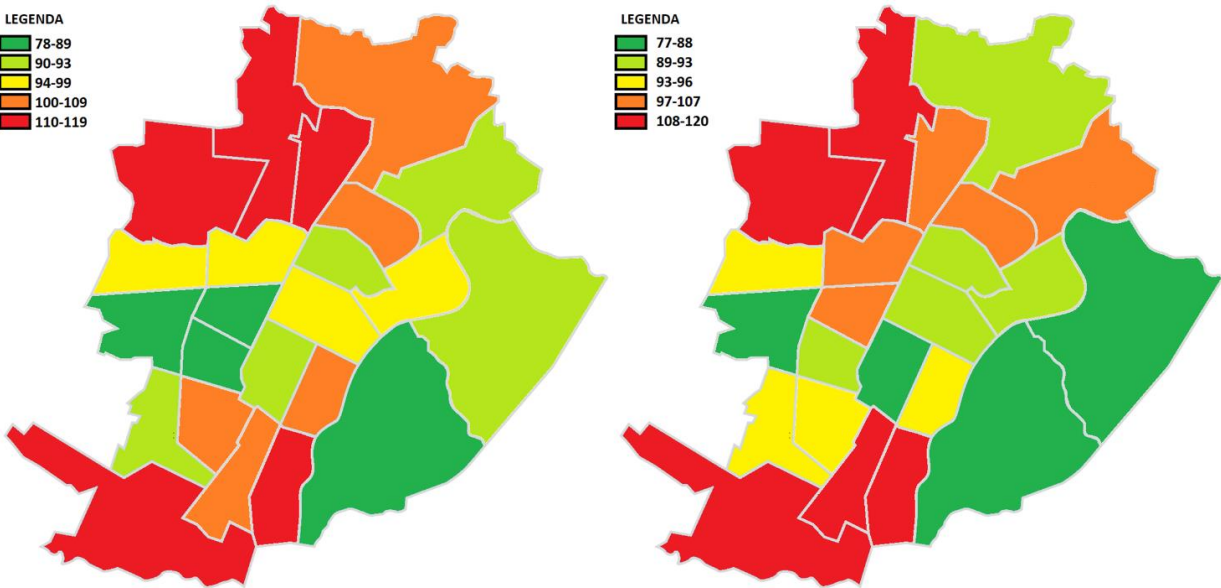


Eccess risk for people in EP

Eccess risk for people in EP

+ 17%

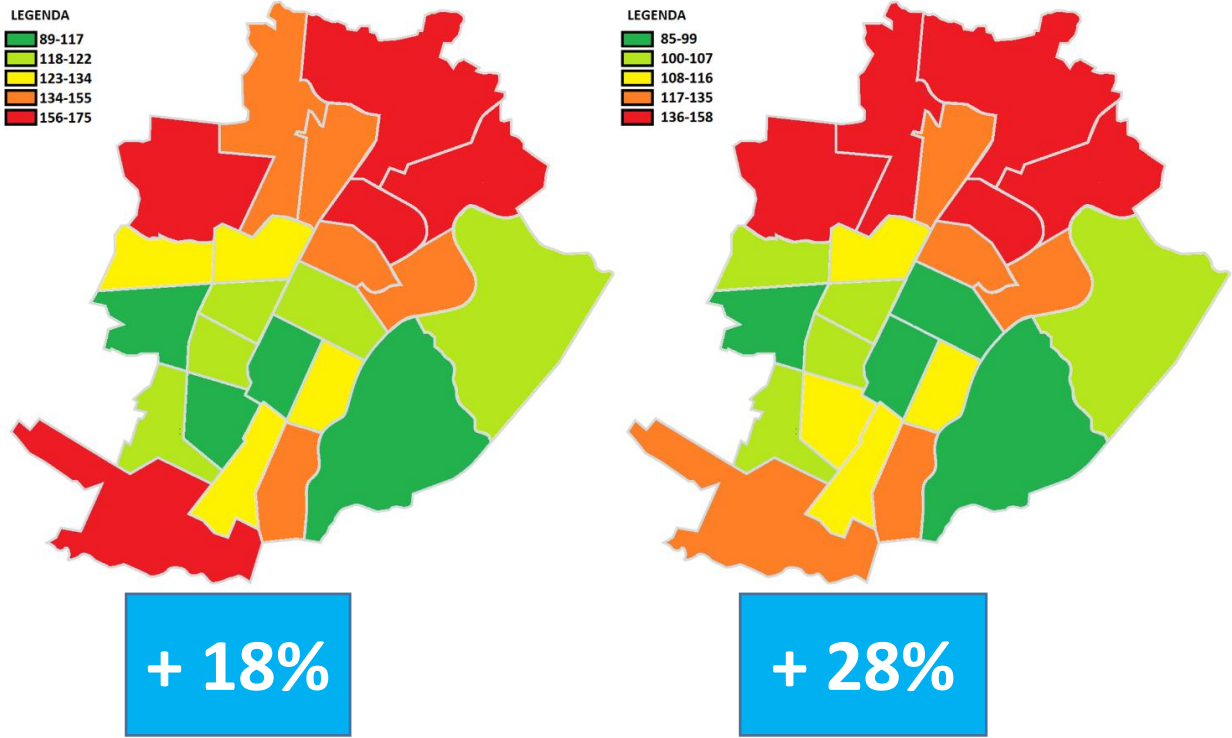
+ 17%



Cerebrovascular diseases – 2001-10 and 2011-19

Energy poverty and health – Turin case study

Respiratory diseases – 2001-10 and 2011-19

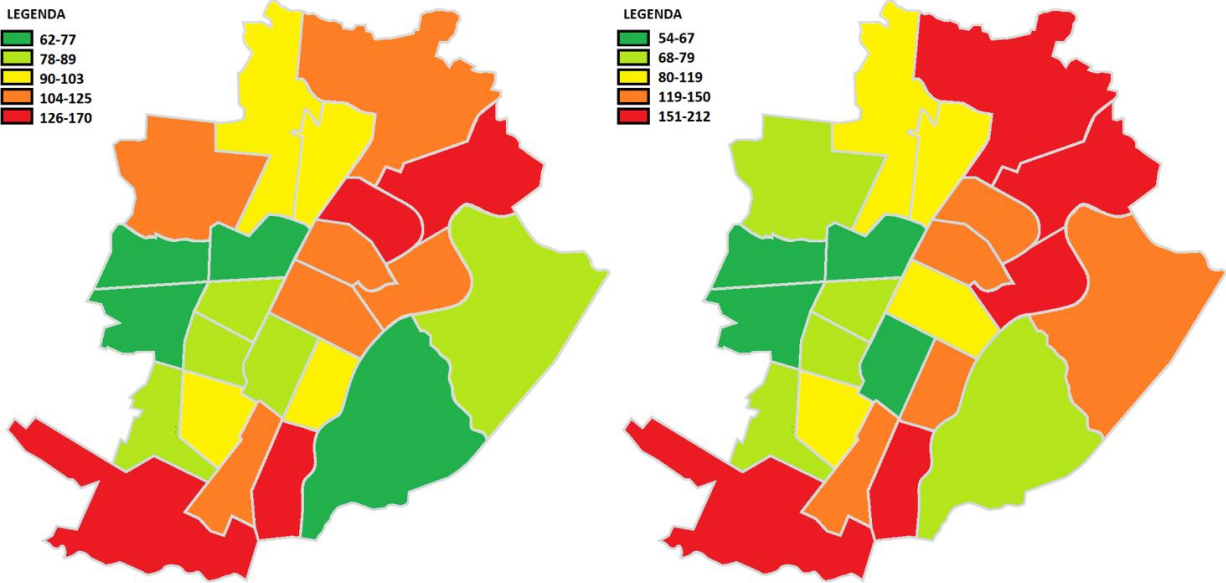


Eccess risk for people in EP

Eccess risk for people in EP

+ 23%

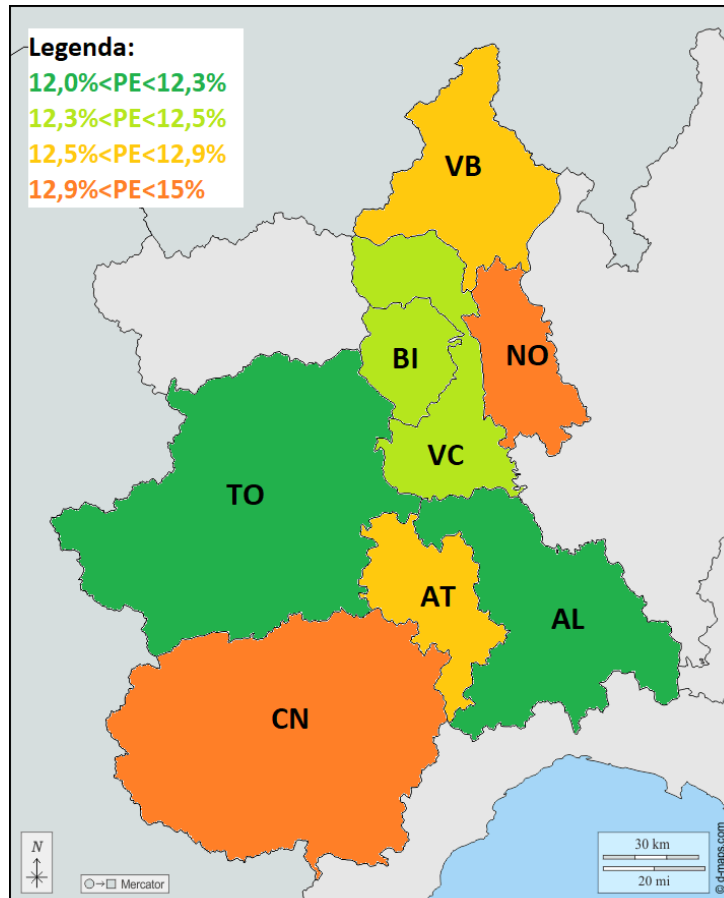
+ 55%



COPD – 2001-10 and 2011-19

Energy poverty and health – extension to Piedmont Region

Distribution of EP in Piedmont



Province	EP households [%]	EP individuals [%]
Alessandria	12.0%	20.0%
Asti	12.7%	20.9%
Biella	12.4%	21.2%
Cuneo	13.8%	23.0%
Novara	15.0%	24.3%
Torino	12.0%	19.7%
Verbano-Cusio-Ossola	12.7%	20.9%
Vercelli	12.4%	20.4%

Treatment costs for the national health system



Province	Cardiov. diseases [€/y]	Heart Attack [€/y]	Cerebrov. Diseases [€/y]	Respiratory diseases [€/y]	COPD [€/y]
Alessandria	1,004,209	250,622	311,108	597,910	85,254
Asti	617,926	154,217	191,436	367,916	52,460
Biella	455,159	113,595	141,010	271,004	38,641
Cuneo	1,553,171	387,627	481,180	924,765	131,859
Novara	917,585	229,003	284,272	546,334	77,900
Torino	5,355,987	1,336,702	1,659,310	3,188,978	454,705
VCO	396,327	98,912	122,784	235,975	33,647
Vercelli	436,094	108,837	135,104	259,652	37,023
Total	10,736,459	2,679,515	3,326,204	6,392,534	911,489

24 M€/y

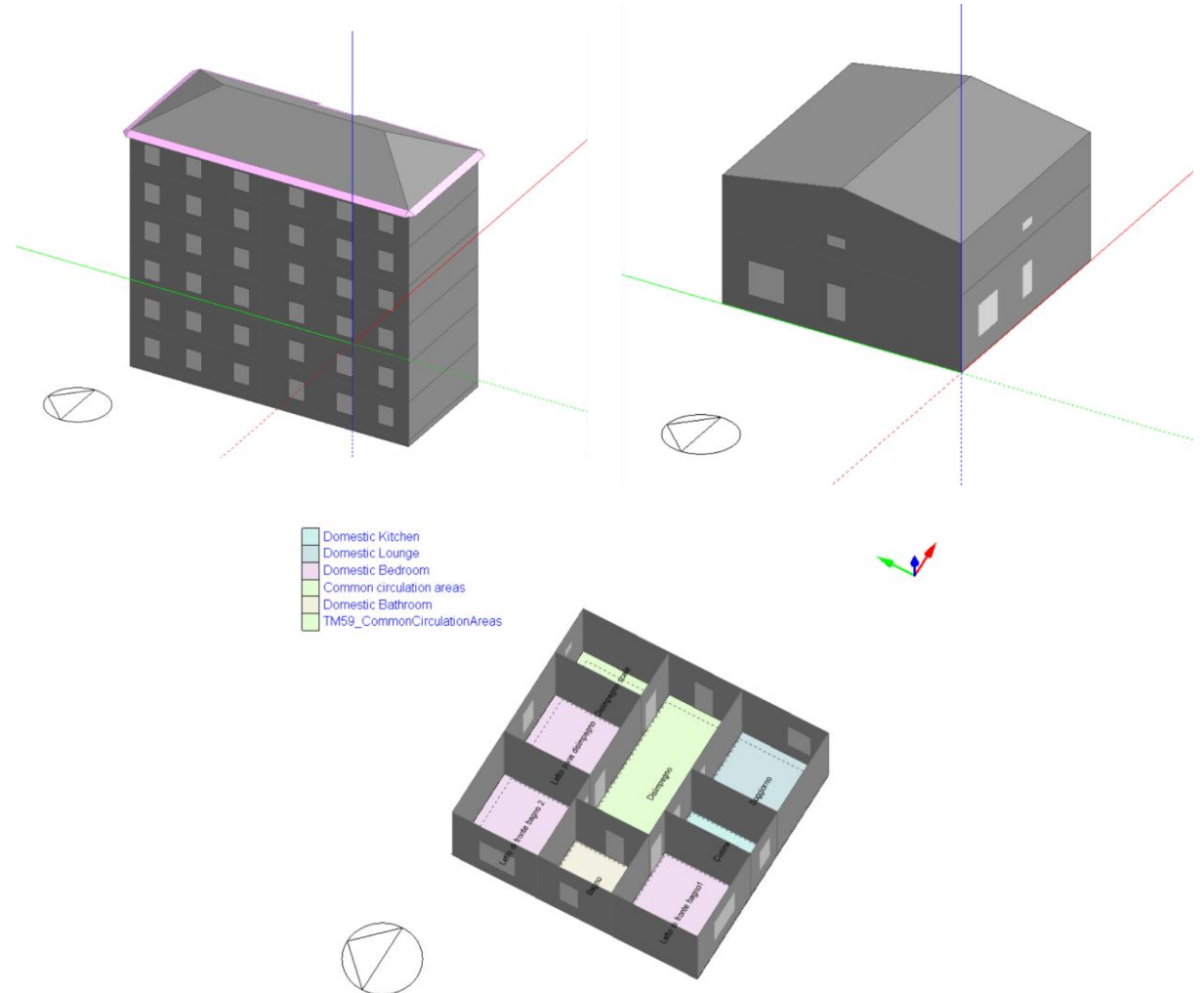
Building renovation

Input data: BIM MODEL of 2 average buildings – replicable for other buildings

Building characteristics:

- Single-family and small condominium (9-15 apartments)
- Climate zone E
- Construction time 1961-1975 (non-renovated since then)

Heating and cooling time and temperatures according to italian legislation (DPR 74/2013) and UNI TS 11300-1.



Building renovation



Foreseen interventions:

- Thermal insulation of vertical walls
- Thermal insulation of the roof
- Windows and doors replacement
- Complete retrofit (all the above)

Cost of interventions: maximum allowed under the Superbonus 110% (conservative, they are very high)

	Single family	Small condominium
Walls insulation [€]	37,230	196,965
Roof insulation [€]	10,720	27,350
New windows/doors [€]	7,800	83,785
Complete retrofit [€]	55,750	308,100

Cost analysis



Piedmont:

Intervention	Single family building		Small condominium			Total		
	Cost [€]	Number of interv. 2022-30 [households]	Total cost [€]	Cost per apartment [€]	Number of interv. 2022-30 [households]	Number of interv. 2022-30 [households]	EP households reduction [%]	Energy savings 2022-30 [MWh]
Walls insulation	37,230	756	196,965	19,697	9,559	10,315	4%	65,613
Roof insulation	10,720	2,624	27,350	2,735	68,842	71,466	29%	70,999
New windows/doors	7,800	3,607	83,785	8,379	22,472	26,079	11%	31,084
Complete retrofit	55,750	505	308,100	30,810	6,111	6,616	3%	42,685

Conclusions



- EP and health are related and the higher risk of contracting several pathologies for vulnerable people leads to a higher cost for the national health system.
- The UK methodology is not applicable to the Italian case, due to the lack of statistical data to link all the required household and building characteristics, so a new methodology had to be built, using the available data.
- To test the methodology, a case study in Turin has been proposed: in those areas of the city where energy poverty is more spread, there is also a higher risk of hospitalization related to several pathologies. In these areas of higher risk, the energy efficiency of the building stock is poorer than in the “richer” areas of the city.
- The main buildings in the poorest areas are those built during the '50s-'70s financial “boom”, where a lot of social housing and company blocks for blue collar workers were erected in a short time and with a low cost/low thermal quality approach.
- Analysing the household budget survey, not all energy-poor families were also income-poor families (~545 thousand households in Italy) and v.v.

Conclusions



- An effective way to reduce EP households is to renovate buildings and increase their energy efficiency, thus impacting also on the health system.
- [RSE](#) tried this approach on the cases of Turin and Piedmont region, with typical buildings: single house and small condominium, built between 1961-1975, climate zone E (it includes Turin and 74% of Piedmont municipalities, covering 91% of the population).
- The results are quite satisfactory, but, to extend the study beyond Piedmont borders it is necessary to get more data (not available at the moment):
 - Census data for each region (detailed per municipality, in order to know the climate zone), to evaluate EP incidence;
 - Health data, relatable to the census, to calculate the number of hospitalizations for both EP and non-EP individuals;
 - Data about the average cost per hospitalization for each EP-related pathology;
 - Building census, relatable to the individuals, to calculate the number, age and type of buildings in which EP-consumers live.

Policy suggestions



- The current energy efficiency funding system is non-effective to renovate the buildings in which EP consumers live:
 - It covers only part of the expenses → access to different financing is needed;
 - The consumers shall anticipate the costs → again, access to different financing is needed;
 - Bureaucracy is quite complex → several professionals needed, with high costs.
- Moreover, many EP consumers live in rented houses: they can't renovate and the owner doesn't have interest in renovating.
- How to overcome these barriers?
 - Progressive renovation incentives based on income level (inversely proportional, the lower the income, the higher the incentive);
 - Specific funding for owners that renovate houses with EP consumers, to avoid an increase of the rent fee when the house is renovated.
- How to finance this?
 - Social bonds;
 - Energy Efficiency Obligation Schemes dedicated to Energy Poverty.



Thanks for attending

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