Corso di aggiornamento per consulenti in materia di Radon: aspetti medici

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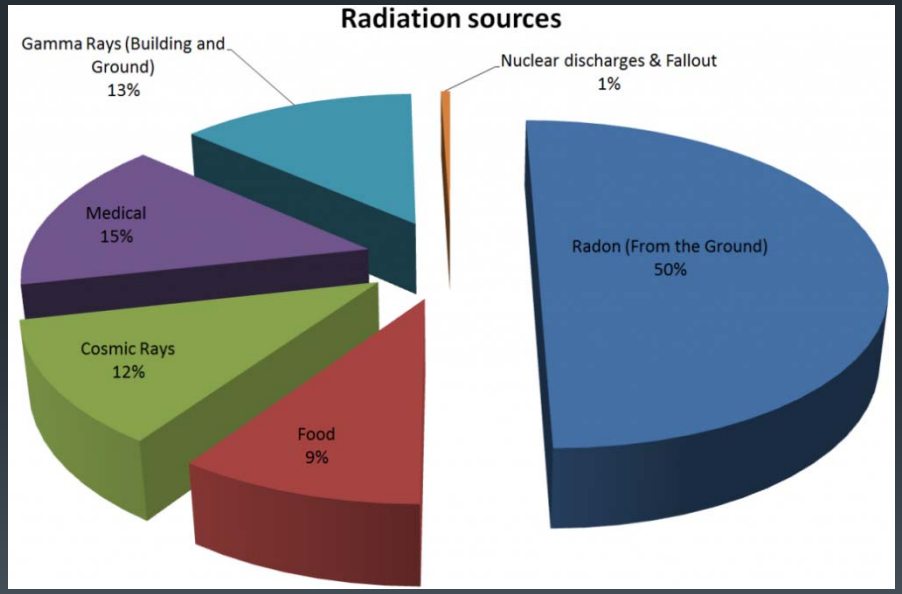
22.03.2018

Registro Tumori Cantone Ticino
Centro Programma Screening Ticino

Radon fattore di rischio

Fonti di radiazioni ionizzanti di tipo naturale e prodotte dall'uomo
Differenti denominatori di esposizione:

- *Occupazionali*
- *Accidentali*
- *Generali*

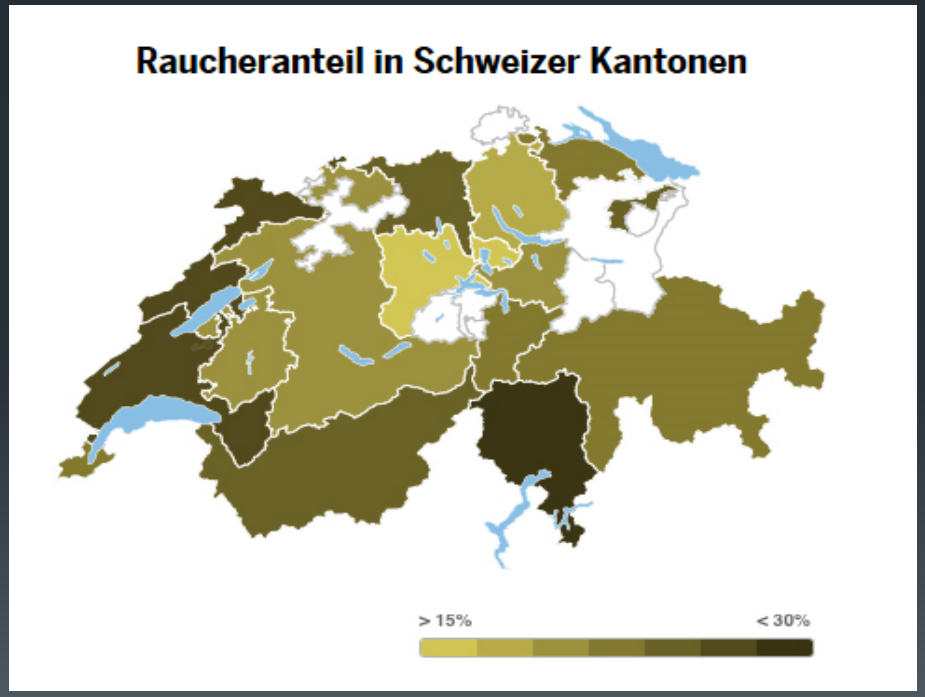


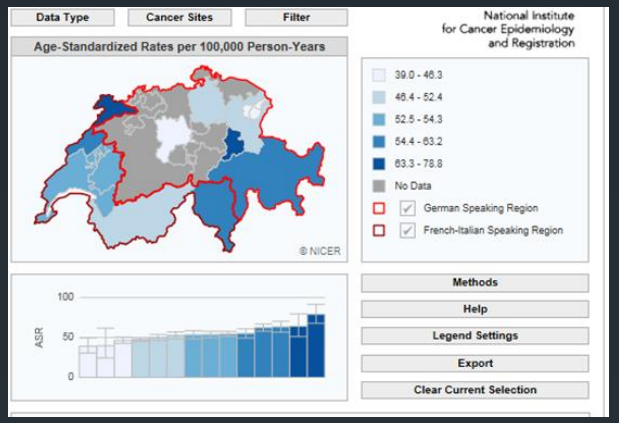
Radon fattore di rischio

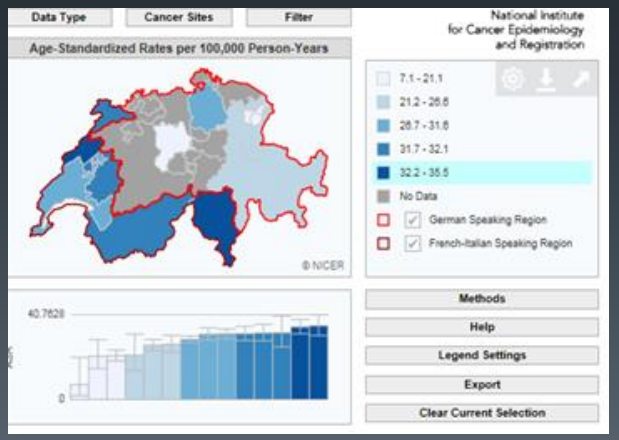
Fattori di rischio dei tumori polmonari

Radon fattore di rischio

Mappa della distribuzione tumori polmonari e tabagismo in Svizzera

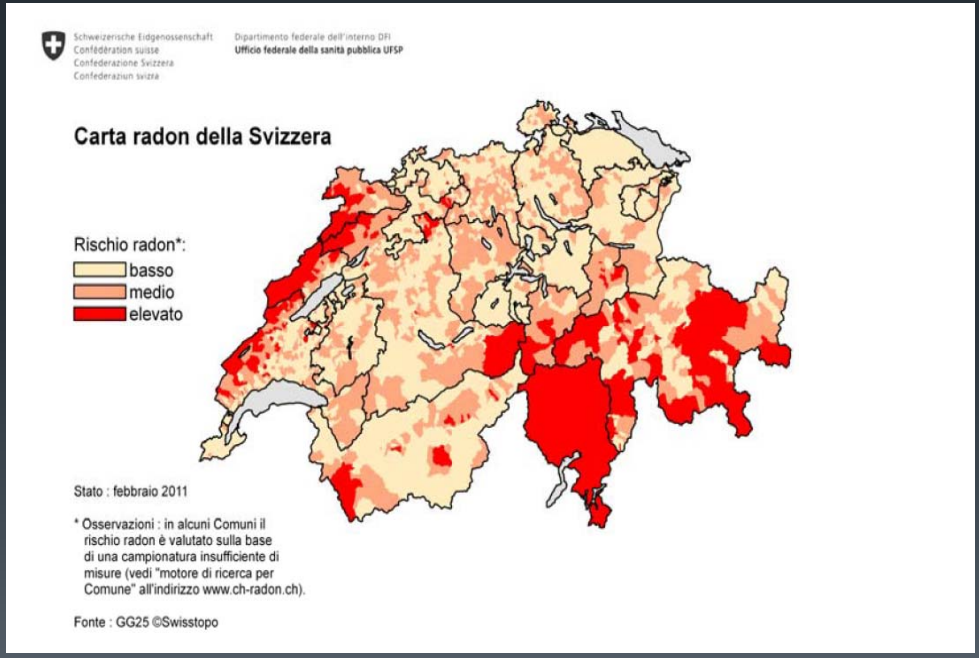


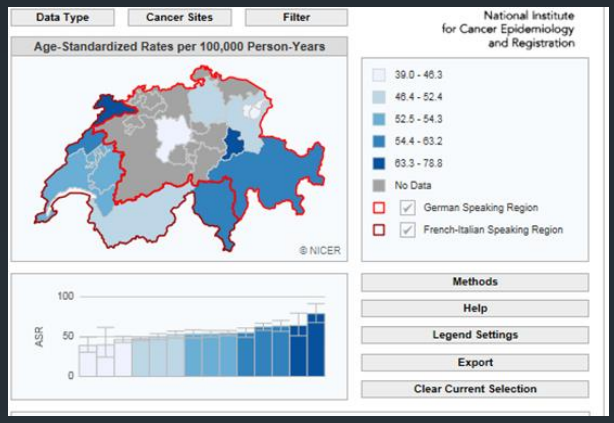


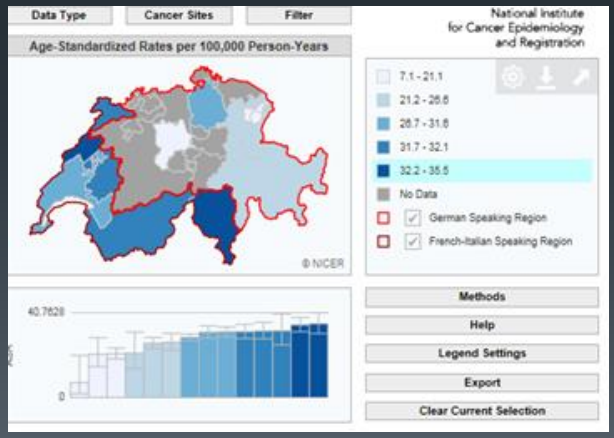


Radon fattore di rischio

Mappa distribuzione radon e tumori polmonari svizzera

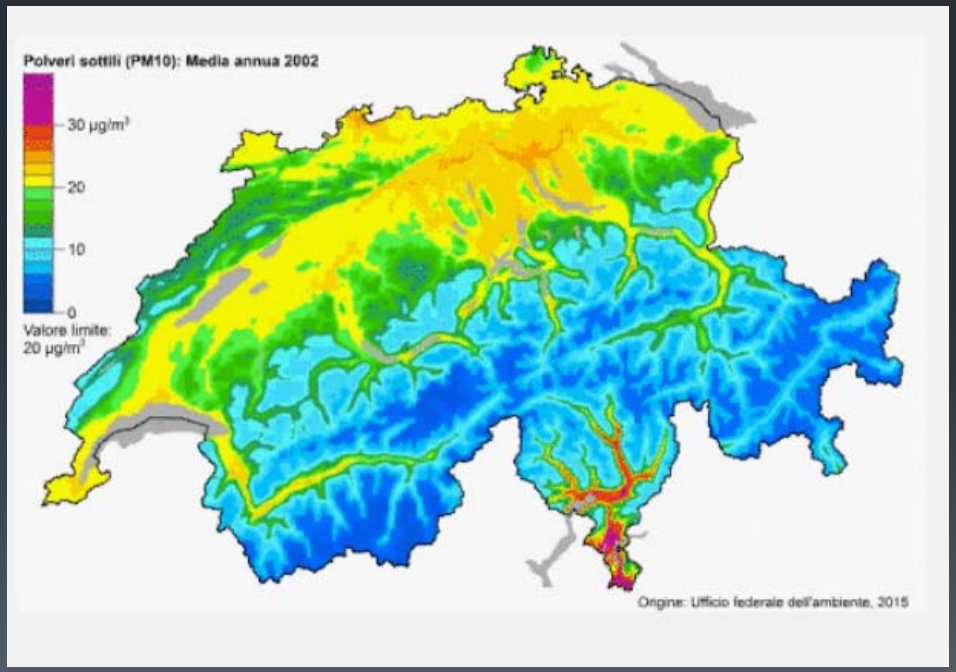


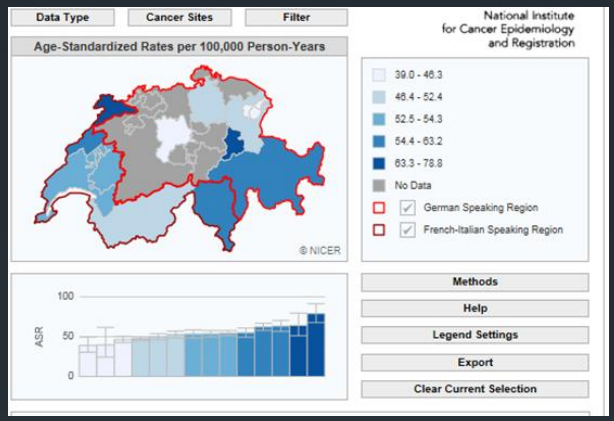


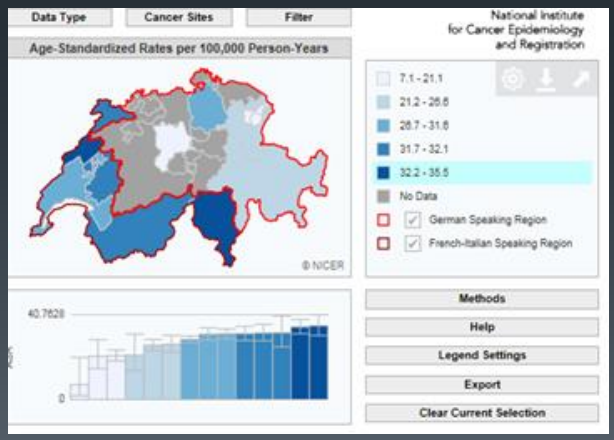


Radon fattore di rischio

Mappa distribuzione polveri fini e tumori polmonari svizzera

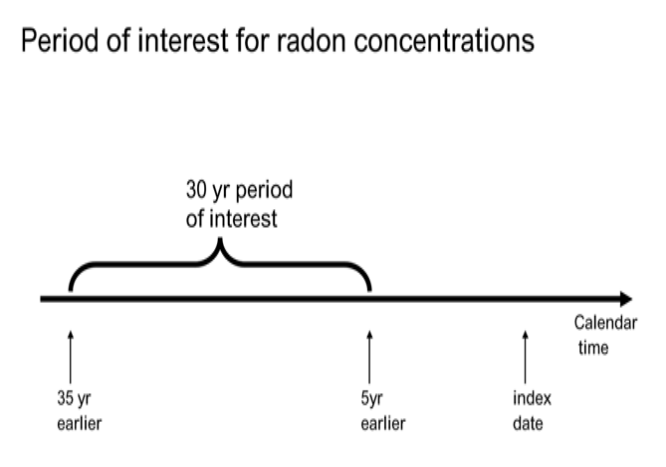


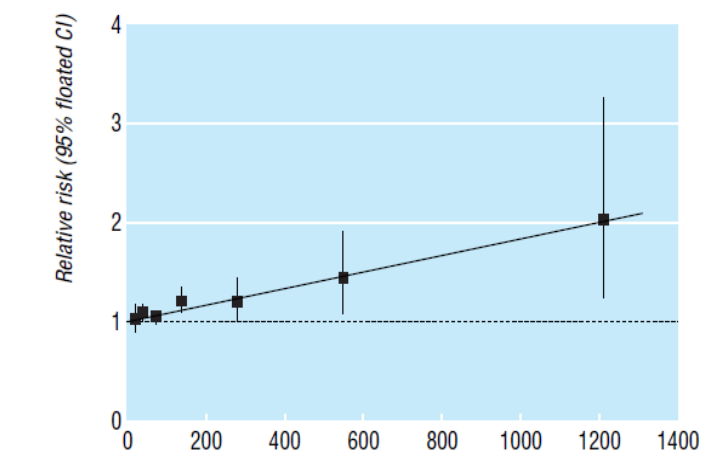




Radon fattore di rischio

Tempo tra esposizione ed evento?
Rapporto tra dose ed effetto?
Dose minima necessaria?





Studi caso/controllo a livello individuale

Radon fattore di rischio

Cite this article as: BMJ, doi:10.1136/bmj.38308.477650.63 (published 21 December 2004)

Papers

Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies

S Darby, D Hill, A Auvinen, J M Barros-Dios, H Bayssson, F Bochicchio, H Deo, R Falk, F Forastiere, M Hakama, I Heid, L Kreienbrock, M Kreuzer, F Lagarde, I Mäkeläinen, C Muirhead, W Oberaigner, G Pershagen, A Ruano-Ravina, E Ruosteenoja, A Schaffrath Rosario, M Tirmarche, L Tomášek, E Whitley, H E Wichmann, R Doll

Abstract

Objective To determine the risk of lung cancer associated with exposure at home to the radioactive disintegration products of naturally occurring radon gas
Design Collaborative analysis of individual data from 13 case-control studies of residential radon and lung cancer.
Setting Nine European countries.

into a series of short lived radioactive progeny. Two of these, polonium-218 and polonium-214, also decay by emitting α particles. If inhaled, radon itself is mostly exhaled immediately. Its short lived progeny, however, which are solid, tend to be deposited on the bronchial epithelium, thus exposing cells to α irradiation.

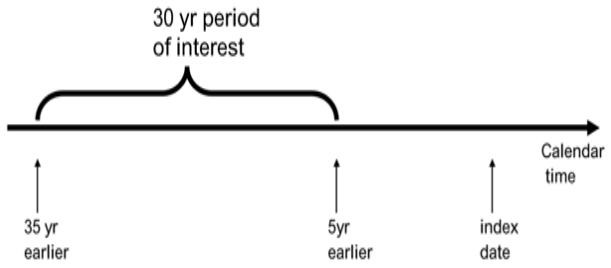
Air pollution by radon is ubiquitous. Concentrations are low

Abstract

Objective To determine the risk of lung cancer associated with exposure at home to the radioactive disintegration products of naturally occurring radon gas

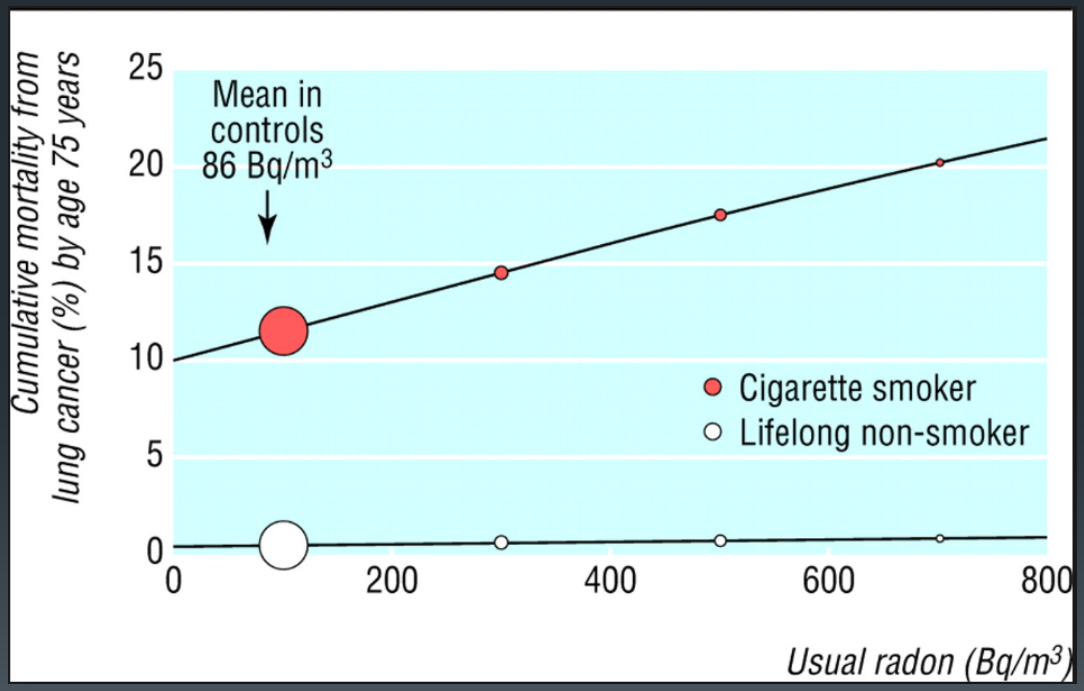
Main outcome measures Relative risks of lung cancer and radon gas concentrations in homes inhabited during the previous 5-34 years measured in becquerels (radon disintegrations per second) per cubic metre (Bq/m^3) of household air.

Period of interest for radon concentrations



Radon fattore di rischio

Concetto di dose/effetto e fattori potenzianti/amplificanti



Darby et al., 2005. *Radon in houses and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies.* British Medical Journal 330: 218-223.

Radon fattore di rischio

Radon rischio su esposizione in età pediatrica

Table 1. Risk equivalent radon concentration for lifetime exposure (RERCLE) when Canadian boys are exposed to radon concentrations of 1,000, 2,000, 4,000, 8,000, and 10,000 Bq/m^3 for short periods of 1, 2 and 5 years.

Bq/m^3	1-year exposure	RERCLE	2-year exposure	RERCLE	5-year exposure	RERCLE
	LRR	Bq/m^3	LRR	Bq/m^3	LRR	Bq/m^3
1,000	1.03	13	1.07	26	1.17	66
2,000	1.07	26	1.14	53	1.34	132
4,000	1.14	53	1.28	105	1.67	263
8,000	1.28	105	1.54	211	2.30	527
10,000	1.34	132	1.67	263	2.60	660

Int. J. Environ. Res. Public Health **2013**, *10*, 1916-1926;

Canadian Lung Cancer Relative Risk from Radon Exposure for Short Periods in Childhood Compared to a Lifetime
Jing Chen

Radon fattore di rischio

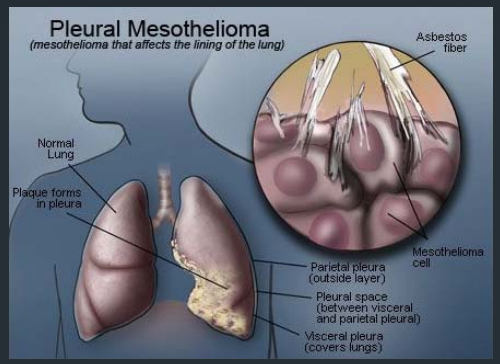
limiti degli studi:

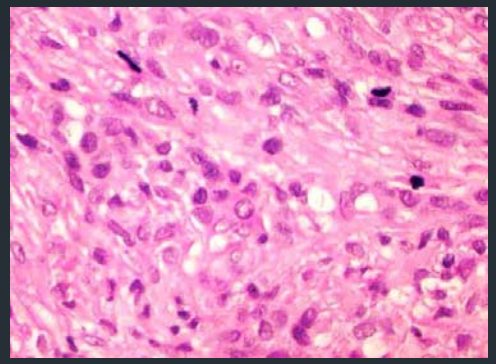
– assenza di dati sulle donne e sui bambini nelle coorti di minatori;
– assenza di dati sul tabagismo nella maggior parte degli studi;
– incertezze sugli effetti delle intensità di dose (breve esposizione a forti concentrazioni ed esposizione prolungata a basse concentrazioni);
– controllo insufficiente dei fattori di confusione (radiazioni gamma, polveri di uranio, altri inquinanti come l'arsenico e i gas di scarico di motori diesel).

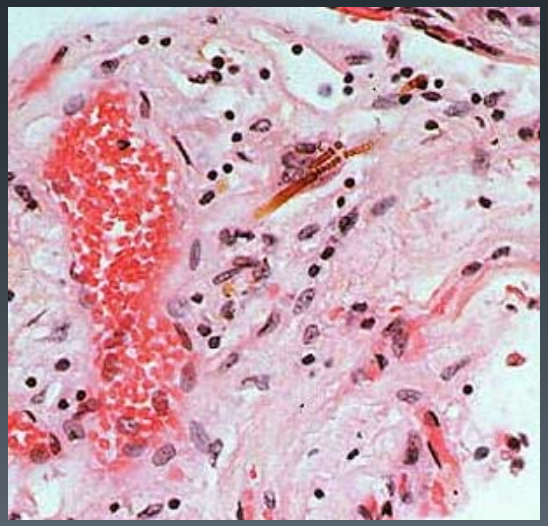
Ancora tanto lavoro da fare!

Radon fattore di rischio

Concetto di bio-marcatori applicato a studi epidemiologici







Occup Environ Med. 2012 Sep;69(9):619-27. doi: 10.1136/oemed-2011-100566. Epub 2012 Jul 7.

Biomarkers of ambient air pollution and lung cancer: a systematic review.

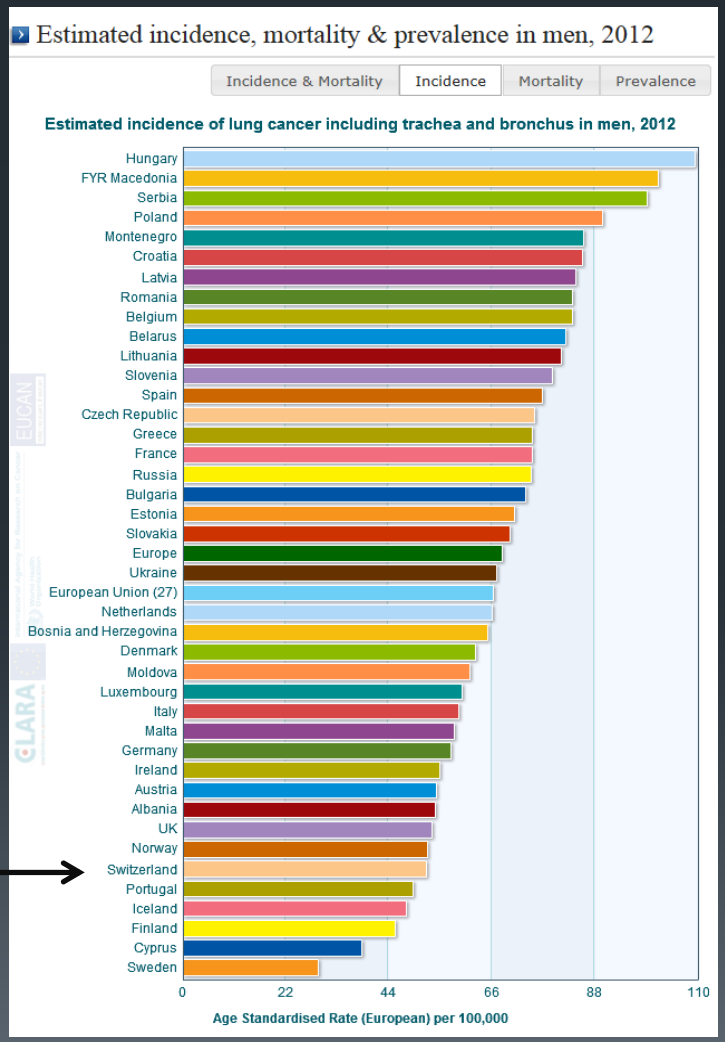
Demetriou CA[1], Raaschou-Nielsen O, Loft S, Møller P, Vermeulen R, Palli D, Chadeau-Hyam M, Xun WW, Vineis P.

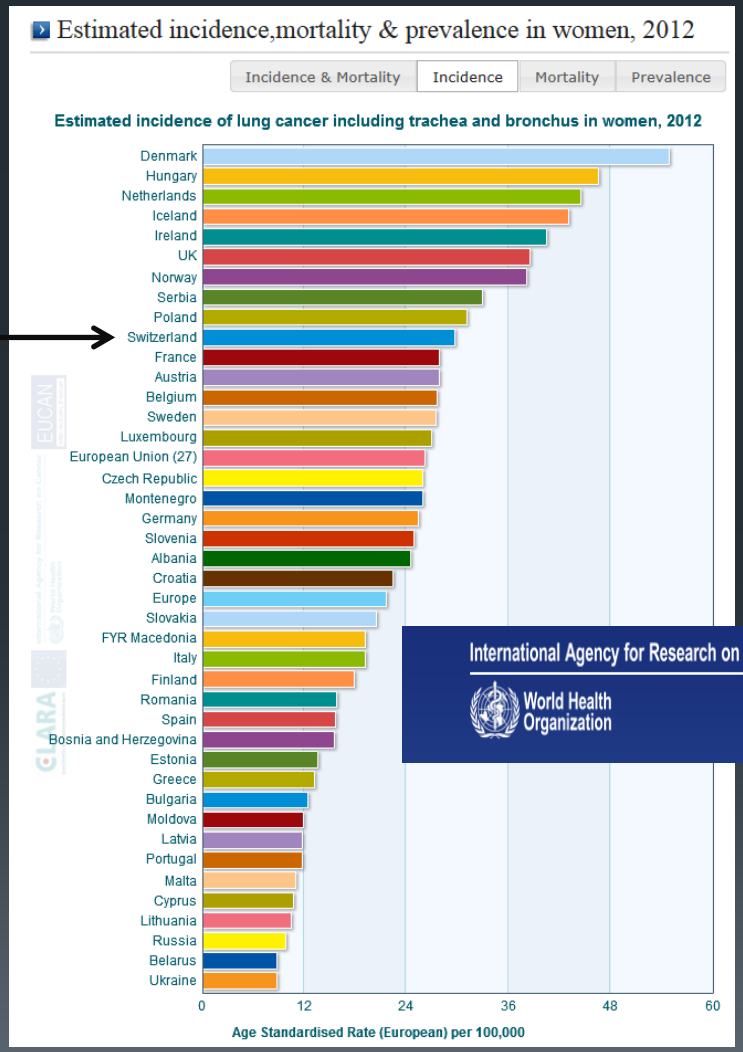
Author information

Abstract

The association between ambient air pollution exposure and lung cancer risk has been investigated in prospective studies and the results are generally consistent, indicating that long-term exposure to air pollution may cause lung cancer. Despite the prospective nature and consistent findings of these studies, causality assessment can benefit from biomarker research. In the present systematic review, we assess the contribution of intermediate biomarkers in epidemiological studies, to ascertain whether their measurement reinforces causal reasoning. We have reviewed 524 papers which described the relationships between ambient air pollution and biological markers of dose and early response. The evidence for each marker was evaluated using assessment criteria which rate a group of studies from A (strong) to C (weak) on amount of evidence, replication of findings, and protection from bias. Biomarkers that scored A or B for all three criteria are included here. The markers that fulfilled the inclusion criteria are: 1-hydroxypyrene, DNA adducts, chromosomal aberrations, micronuclei, oxidative damage to nucleobases, and methylation changes. These biomarkers cover the whole spectrum of disease onset and progression from external exposure to tumour formation and some have also been suggested as risk predictors of future cancer, reinforcing causal reasoning. However, methodological issues such as confounding, publication bias and use of surrogate tissues instead of target tissues in studies on these markers are of concern. The identified biological markers have potential to shed light on the pathways of carcinogenesis, thus defining the association more clearly for public health interventions.

Epidemiologia tumore polmonare





International Agency for Research on Cancer
World Health Organization
EUCAN
http://eco.iarc.fr/eucan

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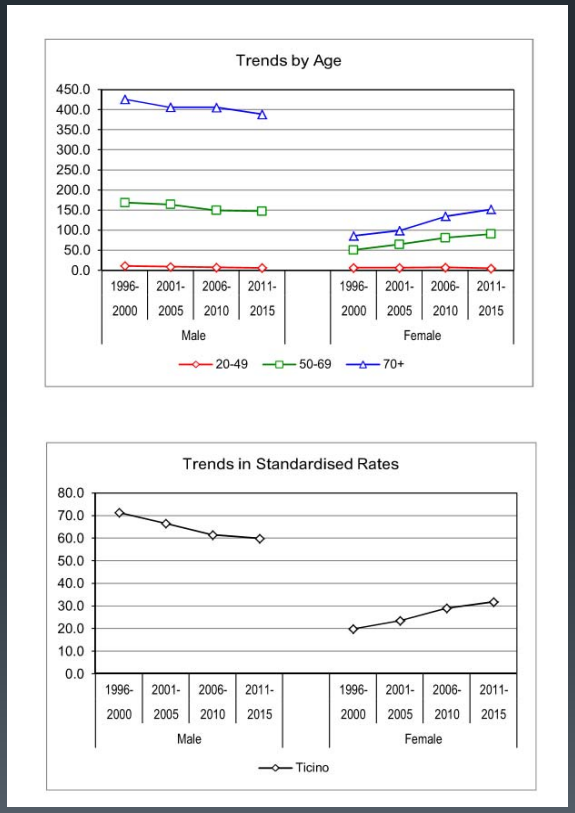
Centro Programma Screening Ticino

Epidemiologia tumore polmonare



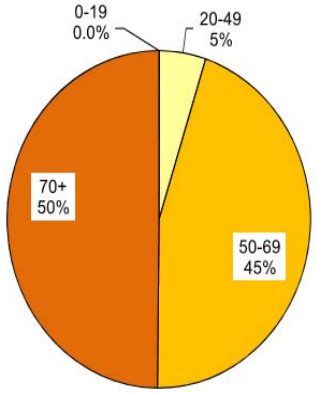
Repubblica e Cantone Ticino

Incidence

Ticino

Number of new cases

Sex	Period	Total	Yearly average
Male	1996 - 2000	623	125
	2001- 2005	653	131
	2006- 2010	704	141
	2011- 2015	774	155
Female	1996 - 2000	225	45
	2001- 2005	285	57
	2006- 2010	393	79
	2011- 2015	464	93
Total	Total	4'121	206



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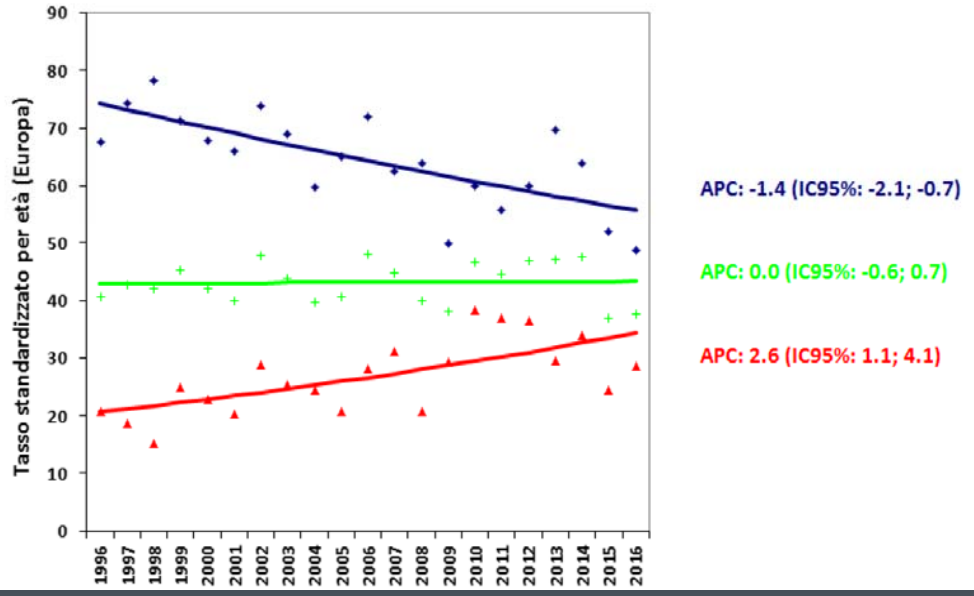
Epidemiologia tumore polmonare

Trend di incidenza ticino

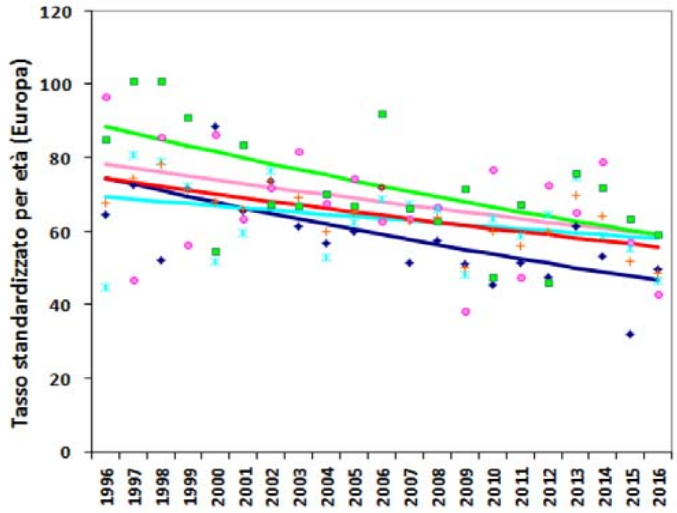
Figura 3. Trend di incidenza dei tumori polmonari in Canton Ticino, per genere. Tassi standardizzati per età sulla popolazione europea (per 100'000 abitanti), 1996-2016.



Epidemiologia tumore polmonare

Trend di incidenza ticino

Figura 5. **Trend di incidenza dei tumori polmonari in Canton Ticino, per distretto. Tassi standardizzati per età sulla popolazione europea (per 100'000 abitanti). Uomini, 1996-2016.**



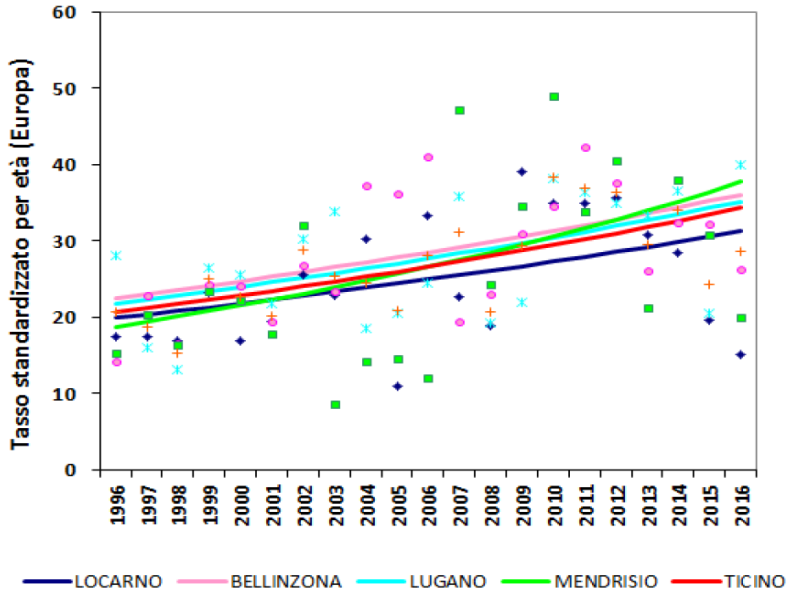
DISTRETTO di DOMICILIO	APC annual percentage change
LOCARNO	-2.3* (IC95%: -3.5; -1.1)
BELLINZONA	-1.4 (IC95%: -3.0; 0.2)
LUGANO	-0.9 (IC95%: -2.1; 0.3)
MENDRISIO	-2.0* (IC95%: -3.2; -0.7)
TICINO	-1.4* (IC95%: -2.1; -0.7)

* statisticamente significativo

Epidemiologia tumore polmonare

Trend di incidenza ticino

Figura 6. **Trend di incidenza dei tumori polmonari in Canton Ticino, per distretto. Tassi standardizzati per età sulla popolazione mondiale (per 100'000 abitanti). Donne, 1996-2016.**

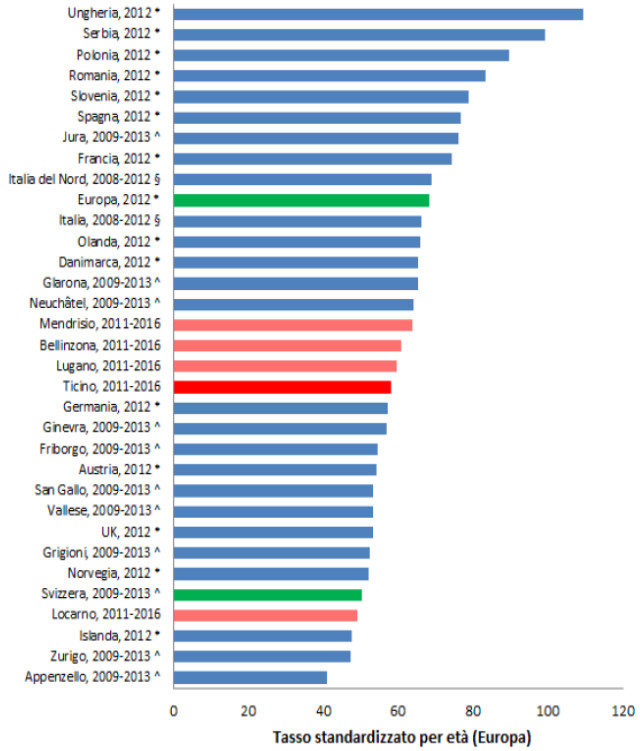


DISTRETTO di DOMICILIO	APC annual percentage change
LOCARNO	2.3 (IC95%: -0.2; 4.9)
BELLINZONA	2.4* (IC95%: 0.4; 4.4)
LUGANO	2.4* (IC95%: 0.4; 4.5)
MENDRISIO	3.6* (IC95%: 0.4; 6.8)
TICINO	2.6* (IC95%: 1.1; 4.1)

* statisticamente significativo

Epidemiologia tumore polmonare

Figura 1. Incidenza dei tumori polmonari in Canton Ticino e nei 4 distretti del Cantone (Locarno, Bellinzona, Lugano, Mendrisio) a confronto con la Svizzera e alcuni paesi europei limitrofi. Tassi standardizzati per età sulla popolazione europea (per 100'000 abitanti). Uomini, 2008-2016.

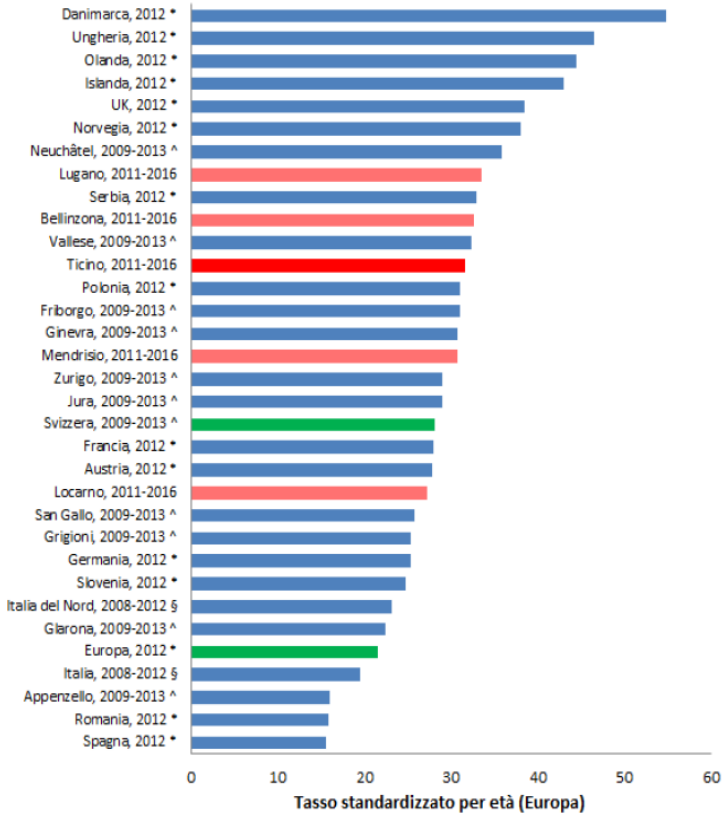


* NICER, http://www.nicer.org

^ EUCAN, http://eco.iarc.fr/EUCAN/CountrySearch.aspx

§ AIRTUM, I numeri del cancro in Italia 2016. Il Pensiero Scientifico Editore: 2016.

Figura 2. Incidenza dei tumori polmonari in Canton Ticino e nei 4 distretti del Cantone (Locarno, Bellinzona, Lugano, Mendrisio) a confronto con la Svizzera e alcuni paesi europei limitrofi. Tassi standardizzati per età sulla popolazione europea (per 100'000 abitanti). Donne, 2008-2016.



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Radon fattore di rischio

Concetto di rischio attribuibile

1. *Tabagismo: 80-90%*
2. *Radon 5-15% (10% secondo UFSP)*
3. *Inquinamento atmosferico 0.5-2% (5%)*

Table 5. Estimates of the proportion of lung cancer attributable to radon in selected countries

Country	Mean indoor radon [Bq/m³]	Risk estimate used in calculation	Percentage of lung cancer attributed to radon [%]	Estimated no. of deaths due to radon-induced lung cancer each year
Canada (Brand et al. 2005)	28	BEIR VI	7.8	1 400
Germany (Menzler et al. 2008)	49	European pooling study[a]	5	1 896
Switzerland (Menzler et al. 2008)	78	European pooling study[a]	8.3	231
United Kingdom (AGIR 2009)	21	European pooling study[a]	3.3	1 089
		BEIR VI	6	2 005
France (Catelinois et al. 2006)	89	European pooling study	5	1 234
		BEIR VI	12	2 913
United States (BEIR VI, 1999)	46	BEIR VI	10-14	15 400 - 21 800

[a] with adjustment for year-to-year variation in indoor radon concentrations.

WHO Handbook on Indoor Radon

Radon fattore di rischio

Rischio attribuibile in Ticino in termini di frequenza media 2011-2015

Nuovi casi anno 206 x 10%

=

20

(5%-15%= 10-31)

Take home message

1. *Tabagismo, radon e asbesto principali fattori di rischio tumori polmonari*
2. *Rischio attribuibile 5-15% tumori polmonari*
3. *In Ticino ca. 20 tumori polmonari attribuibili*
4. *Ogni 100 Bq/m3 aumento del rischio del 16%*
5. *Tumori polmonari hanno generalmente caratteristiche aggressive*
6. *Lo stadio alla diagnosi fondamentale per probabilità di guarigione*