



Inquinamento e tumori

Alcune considerazioni

L'esempio del Carcinoma polmonare

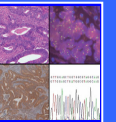
Dati ticinesi

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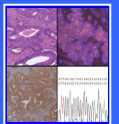
Introduzione

- 835 nuovi pazienti uomini/anno con tumori in Ticino (esclusa cute)
- 775 nuove pazienti donne/anno con tumori in Ticino (esclusa cute)
- 127 nuovi tumori polmonari uomini/anno
- 51 nuovi tumori polmonari donne/anno
- La sopravvivenza è inferiore al 20% a 5 anni.



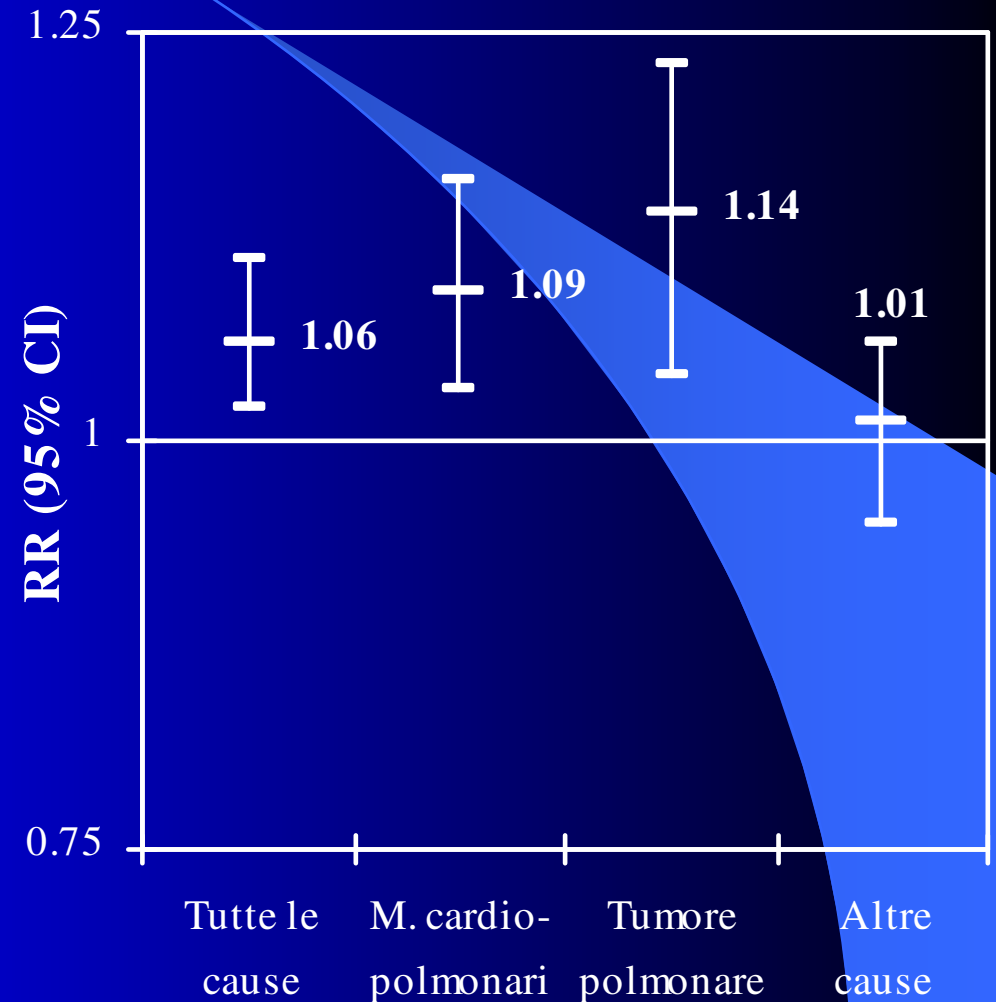
I risultati di alcune ricerche epidemiologiche sul rapporto tumori polmonari e PM

- Ca. 1000 gli studi effettuati sulla tematica sino ad oggi
- **Pope et al. 2002**, iniziato nel 1982 (!) con la selezione di un campione di 1,2 mio di persone, esposte a PM : si osserva un rischio di decesso per tumori polmonari 1.14 volte maggiore rispetto alla norma.
- **WHO working group** in un rapporto del 2005 conclude che l'esposizione a PM aumenta la mortalità per tumore polmonare, ma non quantifica la soglia minima di PM per ovviare questo rischio
- **EPIC study 2007**, è uno studio prospettico iniziato nel 1991, arruolati 520'000 volontari non fumatori in 10 paesi EU (CH?), seguiti tramite Registri Tumori per quantificare l'insorgenza di tumori polmonari: secondo gli autori il 5-7% tumori polmonari è associato a esposizione di NO₂, non si osserva associazione per il PM 10.
- **Merletti et al. 2006**, campione di 545 soggetti ad alto rischio / 845 a basso rischio dal 1991, seguiti per esposizione a PM. Non associazione tra tumori polmonari e PM.
- **Boffetta P (IARC) 2006**. La proporzione di tumori polmonari attribuibili all'inquinamento atmosferico puo' raggiungere una percentuale pari a 10.7%, sulla base dei risultati dello studio piu' ampio esaminato



Pope CA III et al. – Lung cancer, cardiopulmonary mortality and long-term exposure to fine particulate air pollution. JAMA 2002;287:1132-1141

- Studio di mortalità prospettico (coorte) su 1.2 milioni di adulti americani
- Informazioni su fumo, dieta, esposizioni lavorative ecc. raccolte tramite questionario
- Indice riportato: **Rischio relativo (RR) di mortalità per le principali cause di morte, aggiustato per numerose covariate*, associato con un aumento del PM2.5 di 10 $\mu\text{g}/\text{m}^3$**



* Età, sesso, razza, fumo, educazione, stato civile, BMI, alcool, esposizione occupazionale e dieta

Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide

Report on a WHO Working Group – Bonn, 2003

- **Domanda:** Quali effetti, clinici e preclinici, dell'esposizione a lungo termine ai livelli di **PM attualmente osservati in Europa** ci possiamo aspettare?
 - Risposta: L'esposizione a lungo termine alle attuali concentrazioni ambientali di PM può portare ad una **marcata riduzione dell'attesa di vita**, soprattutto a causa di un aumento della mortalità per malattie cardio-polmonari e per **tumore polmonare**. Un aumento dei sintomi respiratori minori e una ridotta funzionalità polmonare nei bambini ed un aumento delle malattie polmonari cronico ostruttive e una ridotta funzionalità respiratoria negli adulti sono verosimili.
- **Domanda:** Esiste una **soglia** sotto la quale nessun effetto del PM sulla salute delle persone è atteso?
 - Risposta: **Studi epidemiologici** su grandi popolazioni non sono stati in grado di identificare una concentrazione-soglia sotto la quale la concentrazione ambientale di PM non produce effetti sulla salute. E' verosimile che in ogni grande popolazione umana vi sia una tale varietà di suscettibilità individuale **che alcuni soggetti siano a rischio anche alle concentrazioni più basse**.

Lung cancers attributable to environmental tobacco smoke and air pollution in non-smokers in different European countries: a prospective study.

[Vineis P](#), [Hoek G](#), [Krzyzanowski M](#), [Vigna-Taglianti F](#), [Veglia F](#), [Airoldi L](#), [Overvad K](#), [Raaschou-Nielsen O](#), [Clavel-Chapelon F](#), [Linseisen J](#), [Boeing H](#), [Trichopoulou A](#), [Palli D](#), [Krogh V](#), [Tumino R](#), [Panico S](#), [Bueno-De-Mesquita HB](#), [Peeters PH](#), [Lund E E](#), [Agudo A](#), [Martinez C](#), [Dorransoro M](#), [Barricarte A](#), [Cirera L](#), [Quiros JR](#), [Beglund G](#), [Manjer J](#), [Forsberg B](#), [Day NE](#), [Key TJ](#), [Kaaks R](#), [Saracci R](#), [Riboli E](#).

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BACKGROUND: Several countries are discussing new legislation on the ban of smoking in public places, and on the acceptable levels of traffic-related air pollutants. It is therefore useful to estimate the burden of disease associated with indoor and outdoor air pollution. **METHODS:** We have estimated exposure to Environmental Tobacco Smoke (ETS) and to air pollution in never smokers and ex-smokers in a large prospective study in 10 European countries (European Prospective Investigation into Cancer and Nutrition)(N = 520,000). We report estimates of the proportion of lung cancers attributable to ETS and air pollution in this population. **RESULTS:**

The proportion of lung cancers in never- and ex-smokers attributable to ETS was estimated as between 16 and 24%, mainly due to the contribution of work-related exposure. We have also estimated that 5-7% of lung cancers in European never smokers and ex-smokers are attributable to high levels of air pollution, as expressed by NO₂ or proximity to heavy traffic roads. NO₂ is the expression of a mixture of combustion (traffic-related) particles and gases, and is also related to power plants and waste incinerator emissions.

DISCUSSION: We have estimated risks of lung cancer attributable to ETS and traffic-related air pollution in a large prospective study in Europe. Information bias can be ruled out due to the prospective design, and we have thoroughly controlled for potential confounders, including restriction to never smokers and long-term ex-smokers. Concerning traffic-related air pollution, the thresholds for indicators of exposure we have used are rather strict, i.e. they correspond to the high levels of exposure that characterize mainly Southern European countries (levels of NO₂ in Denmark and Sweden are closer to 10-20 ug/m³, whereas levels in Italy are around 30 or 40, or higher). Therefore, further reduction in exposure levels below 30 ug/m³ would correspond to additional lung cancer cases prevented, and our estimate of 5-7% is likely to be an underestimate. Overall, our prospective study draws attention to the need for strict legislation concerning the quality of air in Europe.

PMID: 17302981 [PubMed - in process]

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Annals of Oncology 2006 17(12):1842-1847; doi:10.1093/annonc/mdl307

epidemiology

Occupational exposure to diesel exhausts and risk for lung cancer in a population-based case-control study in Italy

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A Ferrando¹, P Boffetta³ and F Merletti¹**

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³ Unit of Environmental Cancer Epidemiology, International Agency for Research on Cancer, Lyon, France

Background: We studied the effect of exposure to diesel exhausts on lung cancer risk in a population-based case-control study in the city of Turin, Italy.

Patients and methods: Information on occupational histories of 595 incident lung cancer cases diagnosed in 1991–1992 and 845 population controls was obtained. During the interviews, diesel job-specific modules (D-JSMs) were administered whenever subjects had worked in occupations included in the following nine categories: railroad workers, miners, professional drivers and transport conductors, heavy-machine operators, mechanics and testers, filling station attendants, motor-vehicle park attendants, transport equipment operators, and occupations carried out in/near urban roads. All D-JSMs were evaluated for probability, intensity and frequency of exposure.

Results: The odds ratio for ever exposure to diesel exhausts was 1.04 (95% confidence interval 0.79–1.37), after adjusting for age, sex, smoking and having worked in occupations entailing exposure to known lung carcinogens. No association was found with intensity, probability and duration of exposure.

Conclusions: Although misclassification of the exposure may have contributed to the negative results, we did not find an association between occupational exposure to diesel exhausts and lung cancer risk.

1: [Muta](#) 2006 S 8;608(2):157-62. Epub 2006 Jul 13.

Human cancer from environmental pollutants: the epidemiological evidence

[Boffetta P.](#)

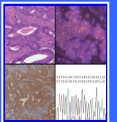
International Agency for Research on Cancer, 150 Cours Albert-Thomas, 69008 Lyon, France. boffetta@iarc.fr

An increased risk of mesothelioma has been reported among individuals experiencing residential exposure to asbestos, while results for lung cancer are less consistent. Several studies have reported an increased risk of lung cancer risk from outdoor air pollution: on the basis of the results of the largest study, the proportion of lung cancers attributable to urban air pollution in Europe can be as high as 10.7%. A causal association has been established between second-hand tobacco smoking and lung cancer, which may be responsible for 1.6% of lung cancers. Radon is another carcinogen present in indoor air, which may be responsible for 4.5% of lung cancers. An increased risk of bladder might be due to water chlorination by-products. The available evidence on cancer risk following exposure to other environmental pollutants, including, pesticides, dioxins and electro-magnetic fields, is inconclusive.

PMID: 16843042 [PubMed - indexed for MEDLINE]

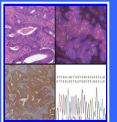
Principali difficoltà nello studio dell'associazione tra inquinamento atmosferico e tumori polmonari

- Tempo tra esposizione ed evento
- Assenza di marcatori biologici (biomarker)
- Fattori di confusione (vedi fattori di rischio)
- Costi
- Esposizione globale, di tutti i soggetti indistintamente



Fattori di rischio dei tumori polmonari

- Tabagismo attivo 70-80% (Gruppo 1 OMS)
- Tabagismo passivo 9-20% (Gruppo 1 OMS)
- Radon 5-15 % (Gruppo 1)
- Fattori occupazionali 5-10% (Gruppo 1)
- Inquinamento dell'aria 1-10% (Gruppo 1, Gruppo 2 A e B)
- Altro?



Overall Evaluations of Carcinogenicity to Humans as evaluated in *IARC Monographs Volumes 1-88*

- A total of **900** agents and groups of agents, mixtures, exposure circumstances:
 - Group 1: Carcinogenic to humans (**95**)
 - Amianto, Benzene, Cadmio
 - Group 2A: Probably carcinogenic to humans (**66**)
 - Benzo[*a*]pirene, Gas di scarico di motori diesel
 - Group 2B: Possibly carcinogenic to humans (**241**)
 - Piombo, Gas di scarico, Benzina
 - Group 3: Not classifiable as to carcinogenicity to humans (**497**)
 - Mercurio, Biossido di zolfo
 - Group 4: Probably not carcinogenic to humans (**1**)
 - Caprolattame

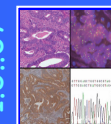
Fattori di rischio

Consumo di tabacco in Ticino per distretto

Consumo di tabacco in % - Entrambi i sessi - Ticino - 1997 e 2002

| | Bellinzona e Tre Valli | | Locarno | | Lugano | | Mendrisio | | Totale | |
|------------------|---------------------------|------|---------|------|--------|------|-----------|------|--------|------|
| | 1997 | 2002 | 1997 | 2002 | 1997 | 2002 | 1997 | 2002 | 1997 | 2002 |
| Fumatori | 27.2 | 31.0 | 40.1 | 30.4 | 34.1 | 35.0 | 42.5 | 26.7 | 35.5 | 31.9 |
| Fumatrici | 28.9 | 25.6 | 34.2 | 30.3 | 30.7 | 24.8 | 24.5 | 25.0 | 29.9 | 26.1 |

Fonti: Ufficio federale di statistica e Ufficio cantonale di Prevenzione e valutazione sanitaria



Evoluzione tabagismo in Svizzera

Fonti: Ufficio federale di statistica e Ufficio cantonale di prevenzione e valutazione sanitaria

TABELLA 1

| 20 sigarette o più al giorno, per sesso, per regione linguistica, 1992, 1997, 2002 | | | | | | |
|--|--------|------|------|-------|------|------|
| Regione di lingua | Uomini | | | Donne | | |
| | 1992 | 1997 | 2002 | 1992 | 1997 | 2002 |
| | % | % | % | % | % | % |
| italiana | 17.5 | 14.0 | 10.8 | 7.4 | 8.6 | 7.0 |
| francese | 17.2 | 16.9 | 14.0 | 9.3 | 10.5 | 8.5 |
| tedesca | 15.6 | 15.4 | 12.4 | 7.0 | 8.2 | 6.5 |
| Svizzera | 16.0 | 15.7 | 12.7 | 7.5 | 8.8 | 7.0 |

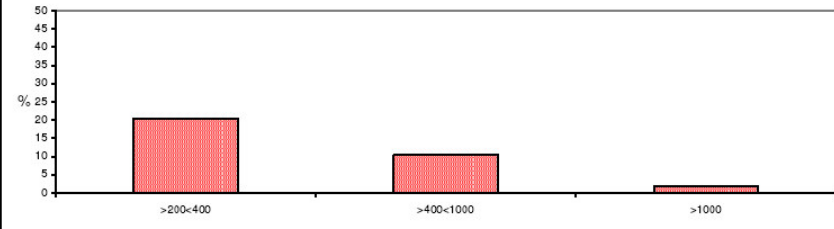
Svizzera n=14722 (1992) n=12555 (1997) n=18778 (2002) Sviz. italiana n=813 (1992) n=1114 (1997) n=1488 (2002)
 Fonte: ISS 92, 97, 02, elaborazione UST

Consommation de substances psychoactives chez les jeunes de 15 à 24 ans, en 1992 et 2002 (en %)

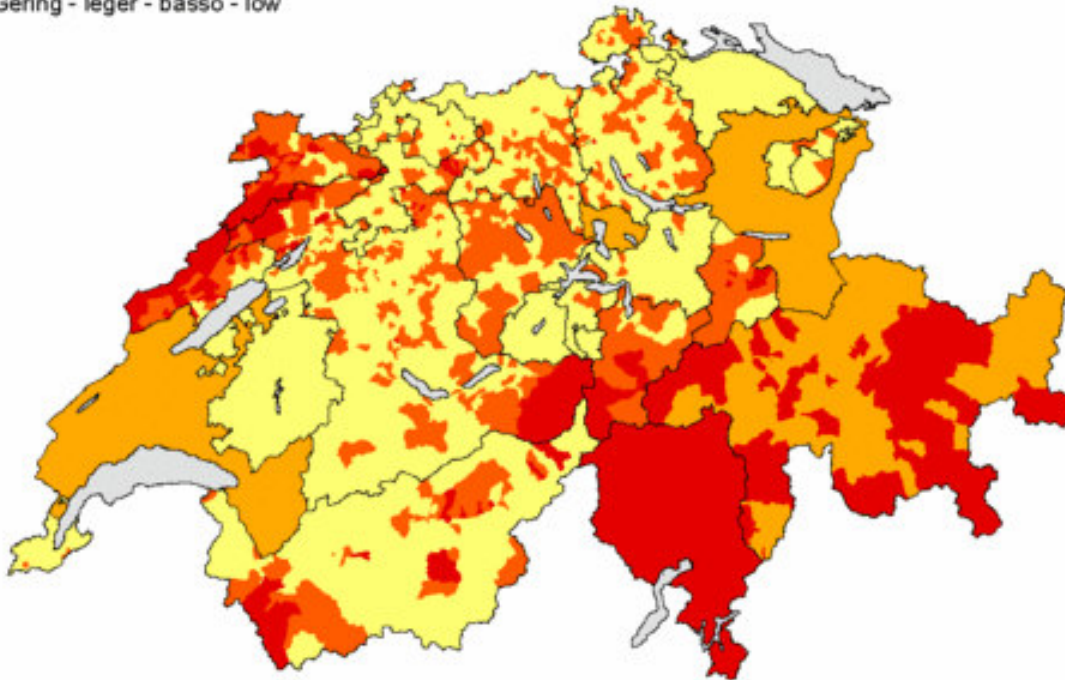
| | hommes | | femmes | |
|----------------------|--------|------|--------|------|
| | 1992 | 2002 | 1992 | 2002 |
| Tabac | | | | |
| fumeurs | 35,9 | 39,9 | 25,7 | 34,8 |
| anciens fumeurs | 5,9 | 4,3 | 5,5 | 5,4 |
| non-fumeurs (jamais) | 58,2 | 55,8 | 68,8 | 59,9 |

Distribuzione Radon in CH

Radon (^{222}Rn): Abitazioni controllate (in%) con concentrazioni di radon $> 200 \text{ Bq/M}^3$, Cantone Ticino
Fonte: Radonprogramm Schweiz "RAPROS" 1995-2004; UFSP, Berna

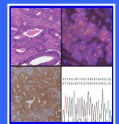


- Hoch - élevé - elevato - high
- Mittel - moyen - medio - medium
- Gering bis mittel - léger à moyen - basso a medio - low to medium
- Gering - léger - basso - low

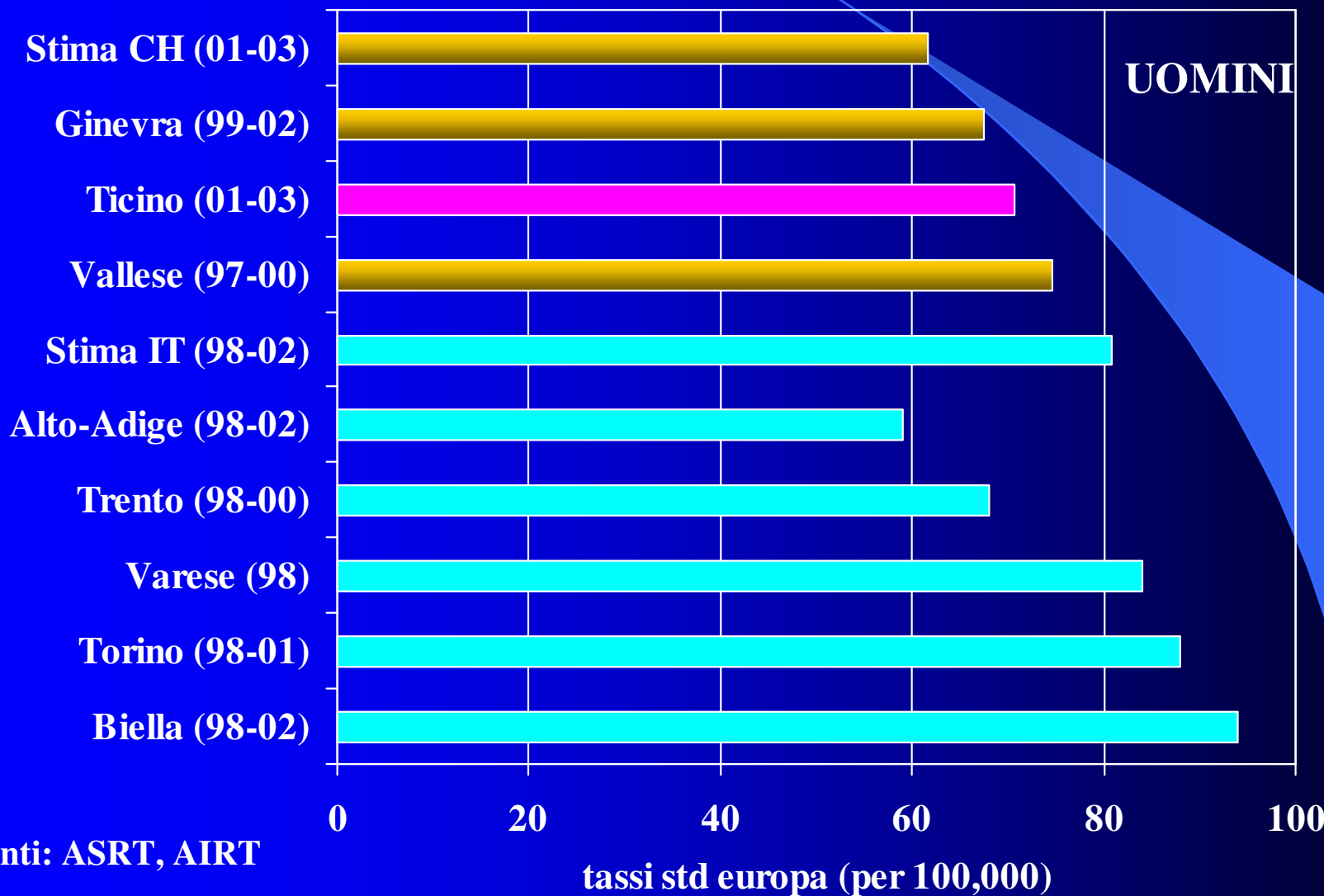


Fonte: UFSP

1.3...07

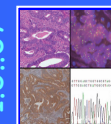


Incidenza tumori polmonari in Ticino a confronto con Registri tumori di zone limitrofe - Uomini, 2001-2003

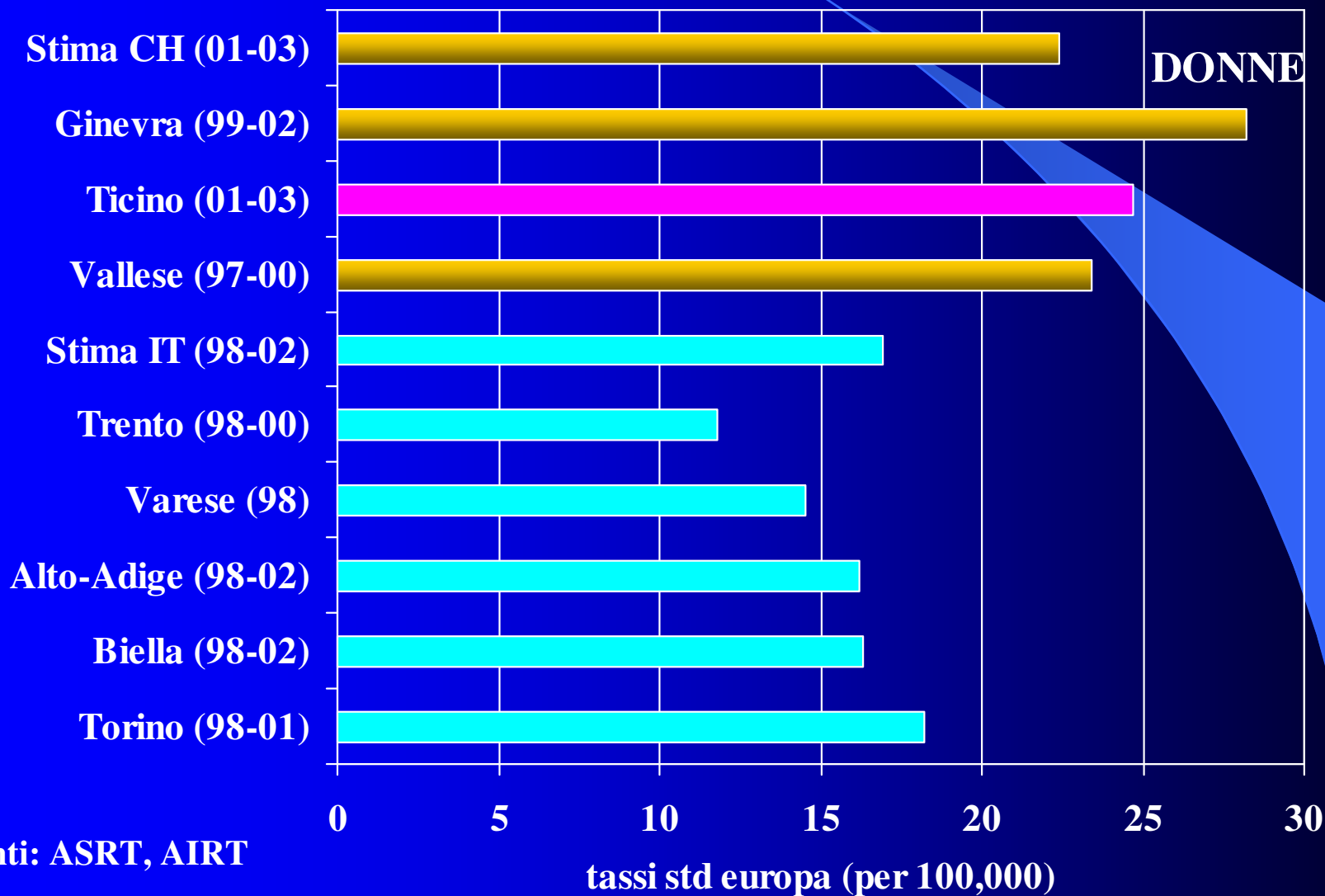


Fonti: ASRT, AIRT

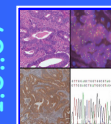
1.3.07



Incidenza tumori polmonari in Ticino a confronto con Registri tumori di zone limitrofe - Donne, 2001-2003



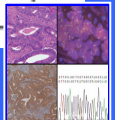
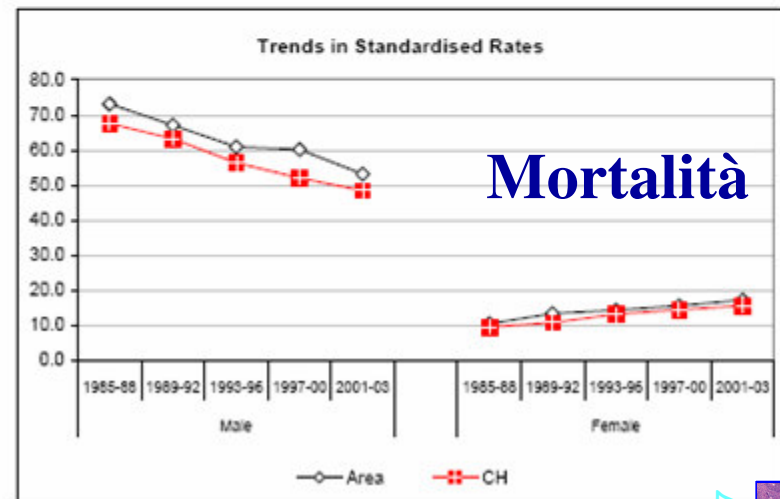
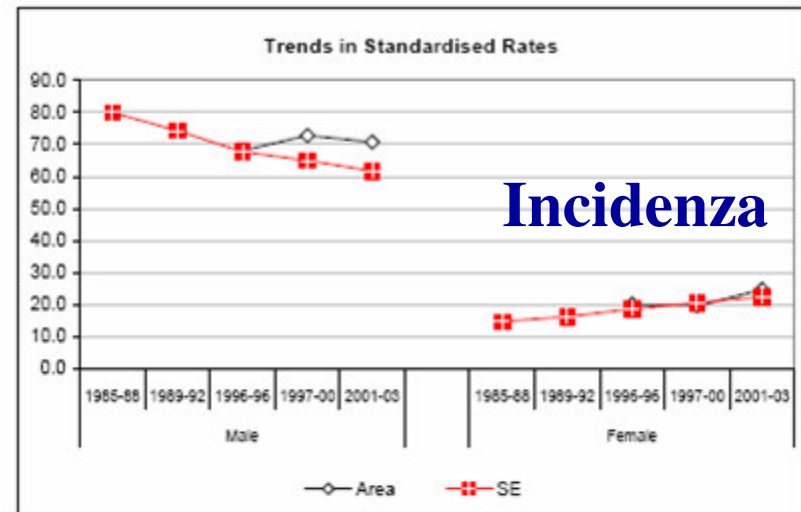
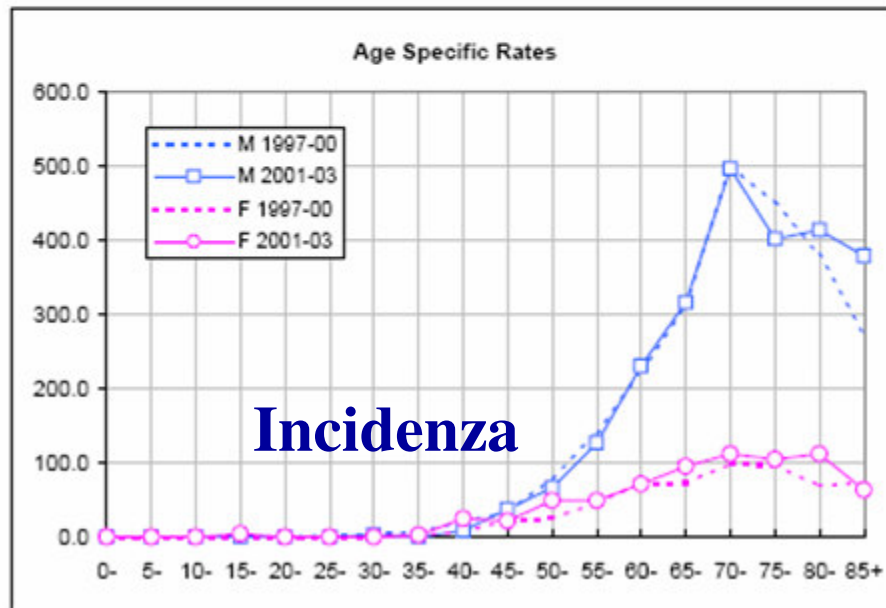
Fonti: ASRT, AIRT



Incidenza e Mortalità Ti e CH

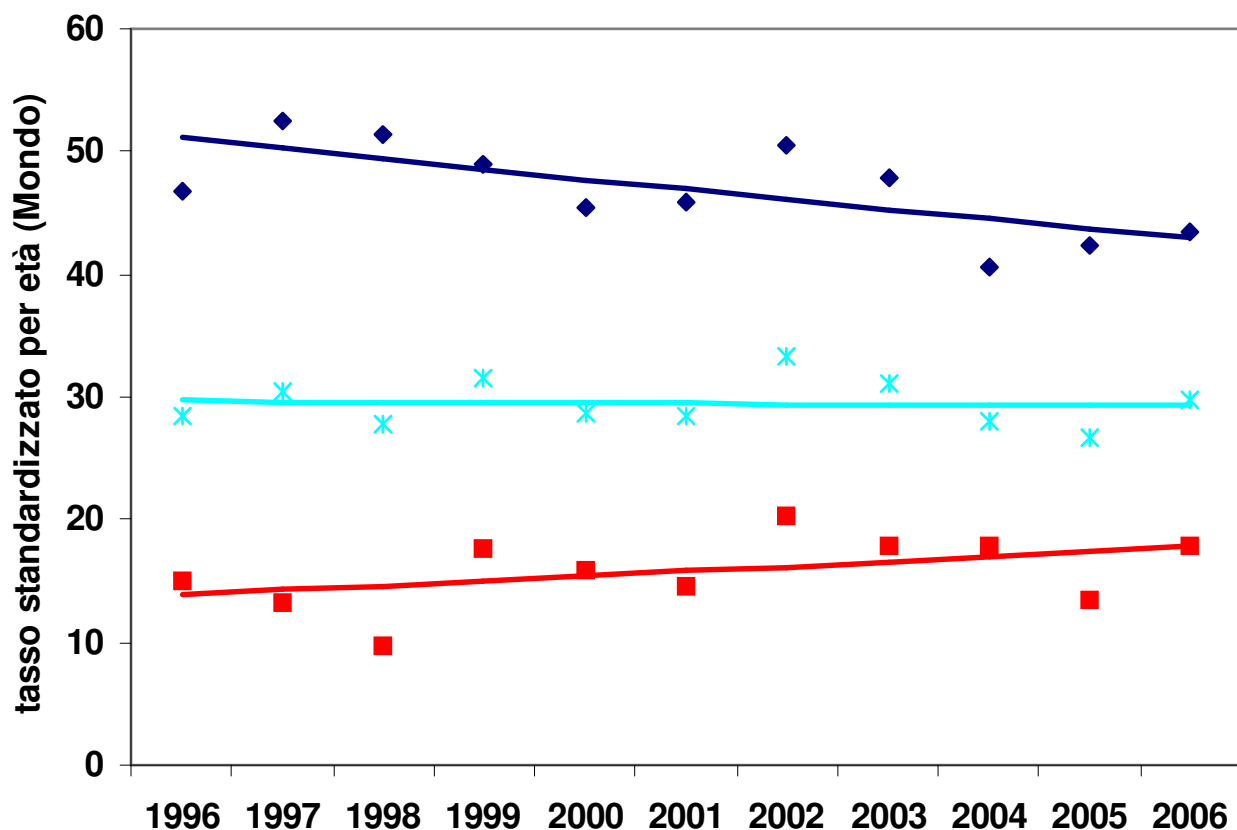
Number of new cases - three last periods

| Sex | Period | Age group | | | Total | Yearly average |
|--------|---------|-----------|-------|-----|-------|----------------|
| | | 0-49 | 50-69 | 70+ | | |
| Male | 1996-98 | 9 | 53 | 52 | 114 | 114 |
| | 1997-00 | 29 | 248 | 231 | 508 | 127 |
| | 2001-03 | 16 | 195 | 190 | 401 | 134 |
| Female | 1996-98 | 8 | 16 | 19 | 43 | 43 |
| | 1997-00 | 14 | 80 | 84 | 178 | 45 |
| | 2001-03 | 18 | 78 | 76 | 172 | 57 |
| Total | Total | 94 | 670 | 652 | 1'416 | 177 |



Evoluzione tassi d'incidenza - Ticino 1996-2006 Uomini e Donne

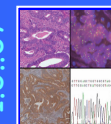
Trend di incidenza - tumori polmonari



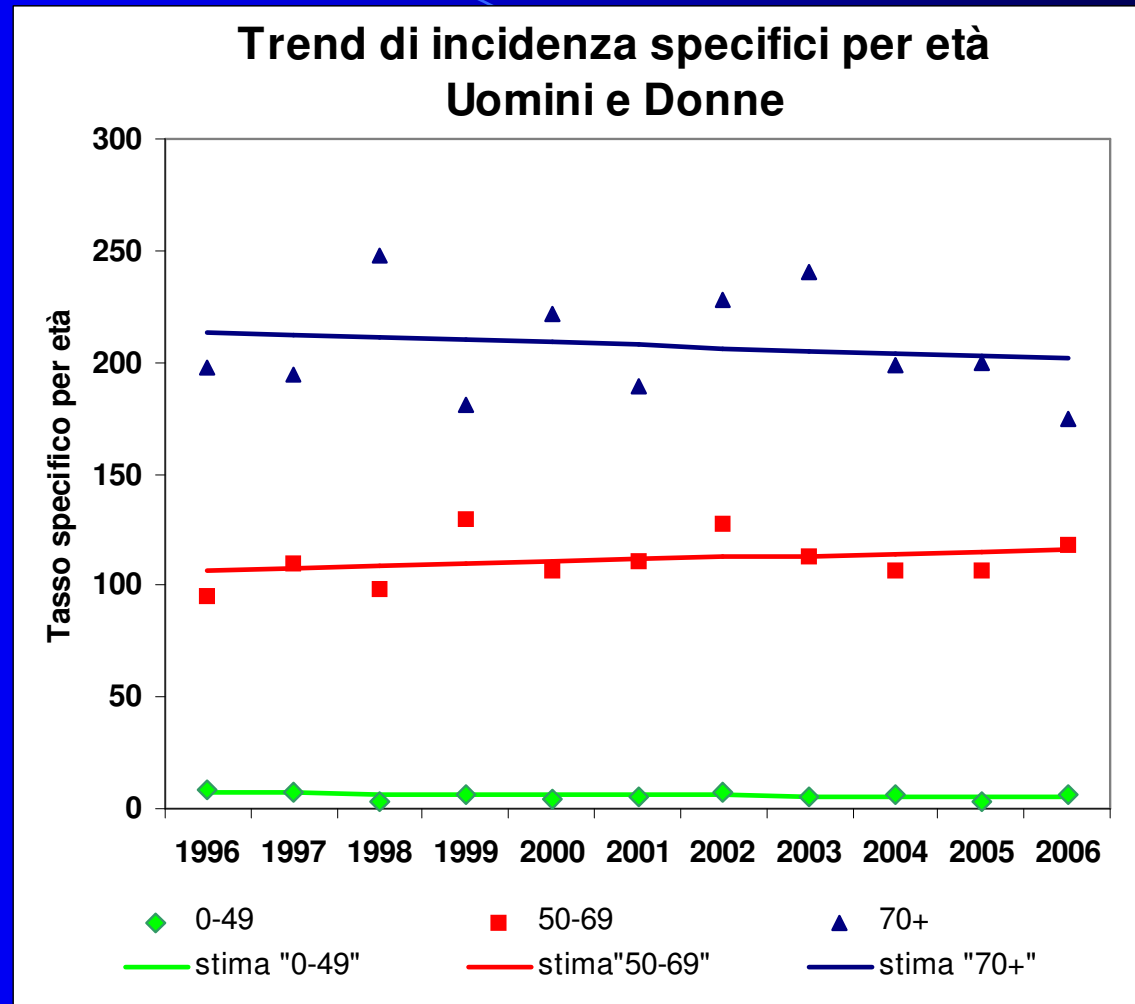
◆ Uomini ■ Donne — Uomini, stime JP
 — Donne, stime JP * Tutti — Tutti, stime JP

Annual Percentage Change

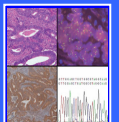
| | |
|--------|----------------------|
| Uomini | -1.70 (-3.04; -0.35) |
| Donne | 2.53 (-1.50; 6.72) |
| Tutti | -0.15 (-1.69; 1.41) |



Trend di Incidenza per classi d'età

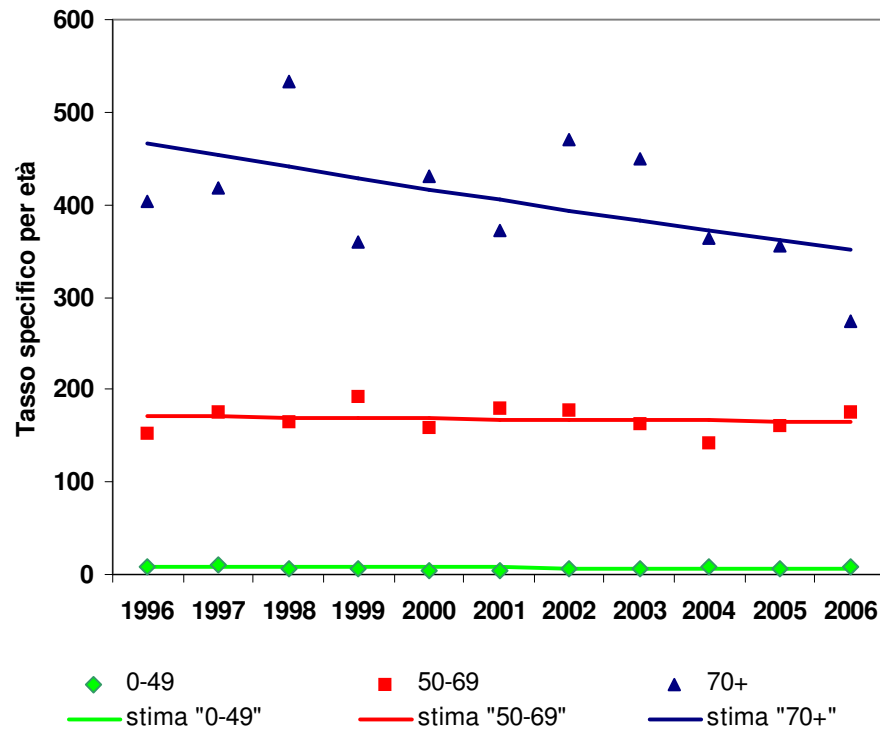


| | | | |
|-----|-------|-------|-------|
| APC | 0-49 | 50-69 | 70+ |
| | -3.03 | 0.85 | -0.58 |



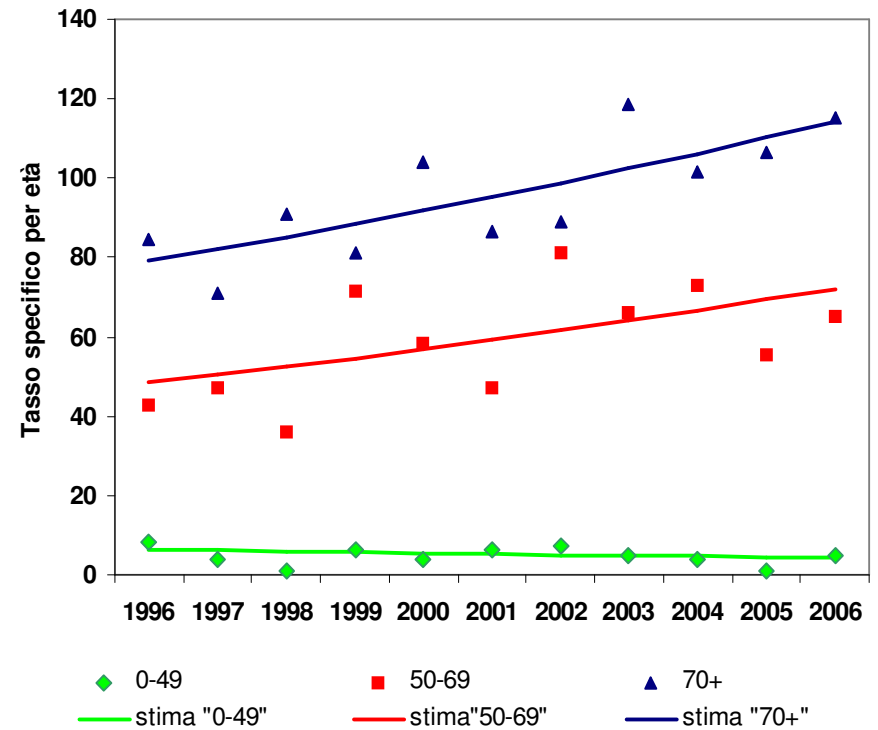
Trend di Incidenza per classi d'età

Trend di incidenza specifici per età - Uomini

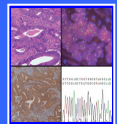


| | | | |
|-----|-------|-------|-------|
| APC | 0-49 | 50-69 | 70+ |
| | -2.67 | -0.39 | -2.78 |

Trend di incidenza specifici per età - Donne



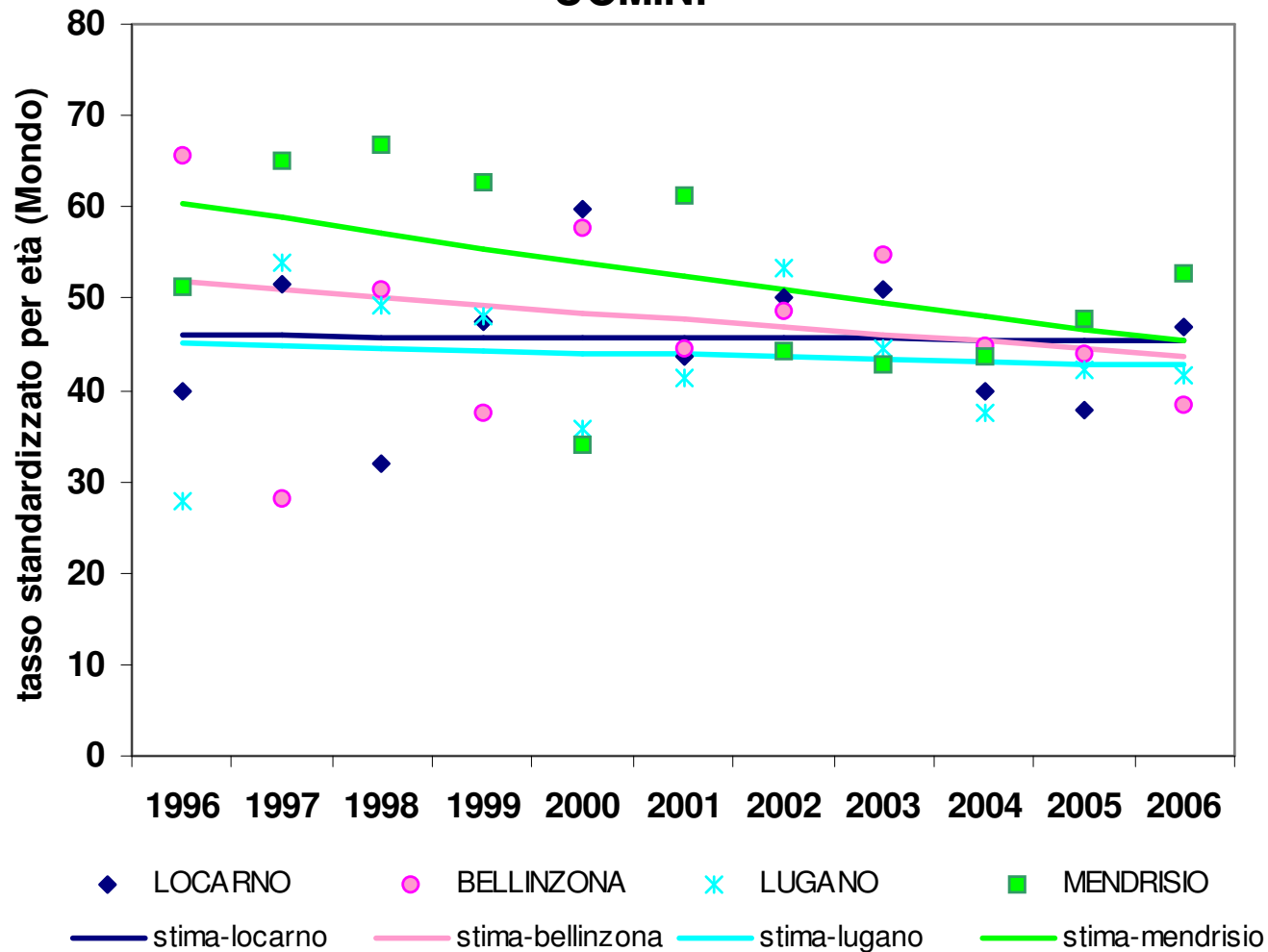
| | | | |
|-----|-------|-------|-------|
| APC | 0-49 | 50-69 | 70+ |
| | -3.64 | 4.03 | 3.71* |



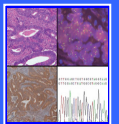
| PERIODO 1996-2006 | | Locarno | Bellinzona | Lugano | Mendrisio | Tutti i Distretti |
|--------------------------|--------------------------------------|----------------|-------------------|---------------|------------------|--------------------------|
| UOMINI | Numero casi | 297 | 336 | 521 | 244 | 1398 |
| | Tasso standardizzato mondiale | 45.4 | 46.7 | 43.2 | 51.8 | 46.7 |
| | Tasso cumulativo 0-74 | 6.0 | 6.0 | 5.5 | 6.5 | 6.0 |
| DONNE | Numero casi | 115 | 146 | 245 | 71 | 577 |
| | Tasso standardizzato mondiale | 14.5 | 18.1 | 16.2 | 11.9 | 15.8 |
| | Tasso cumulativo 0-74 | 1.9 | 2.3 | 1.9 | 1.6 | 2.0 |
| UOMINI e DONNE | Numero casi | 412 | 482 | 766 | 315 | 1975 |
| | Tasso standardizzato mondiale | 28.1 | 31.1 | 28.1 | 29.6 | 29.4 |
| | Tasso cumulativo 0-74 | 3.8 | 4.0 | 3.5 | 3.8 | 3.8 |

Evoluzione tassi d'incidenza – Ticino Uomini, per distretto (1996-2006)

Trend di incidenza - tumori polmonari per Distretto
UOMINI

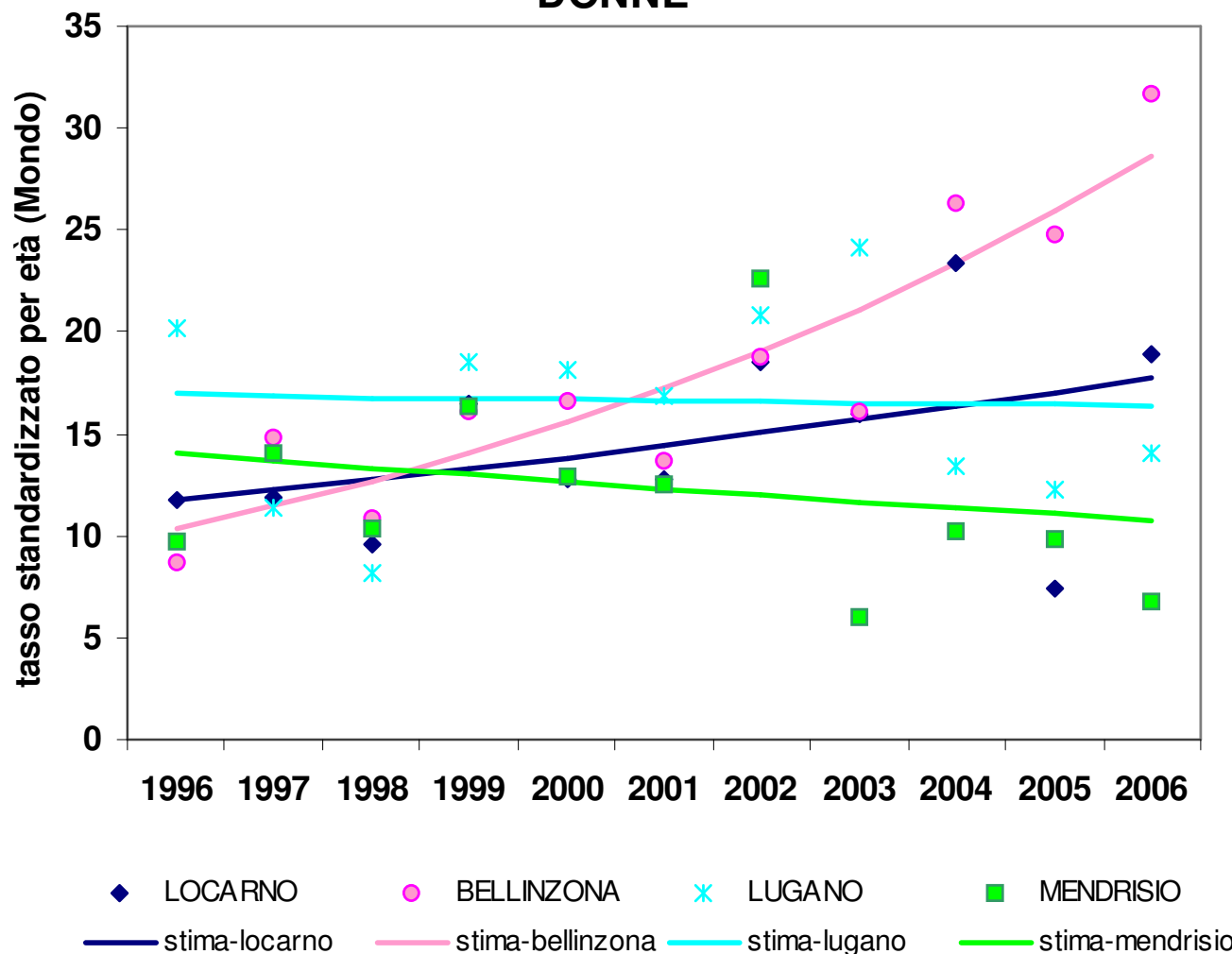


| UOMINI | APC |
|------------|-------|
| Locarno | -0.11 |
| Bellinzona | -1.67 |
| Lugano | -0.54 |
| Mendrisio | -2.84 |

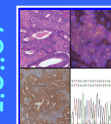


Evoluzione tassi d'incidenza, Ticino Donne, per distretto (1996-2006)

Trend di incidenza - tumori polmonari per Distretto
DONNE

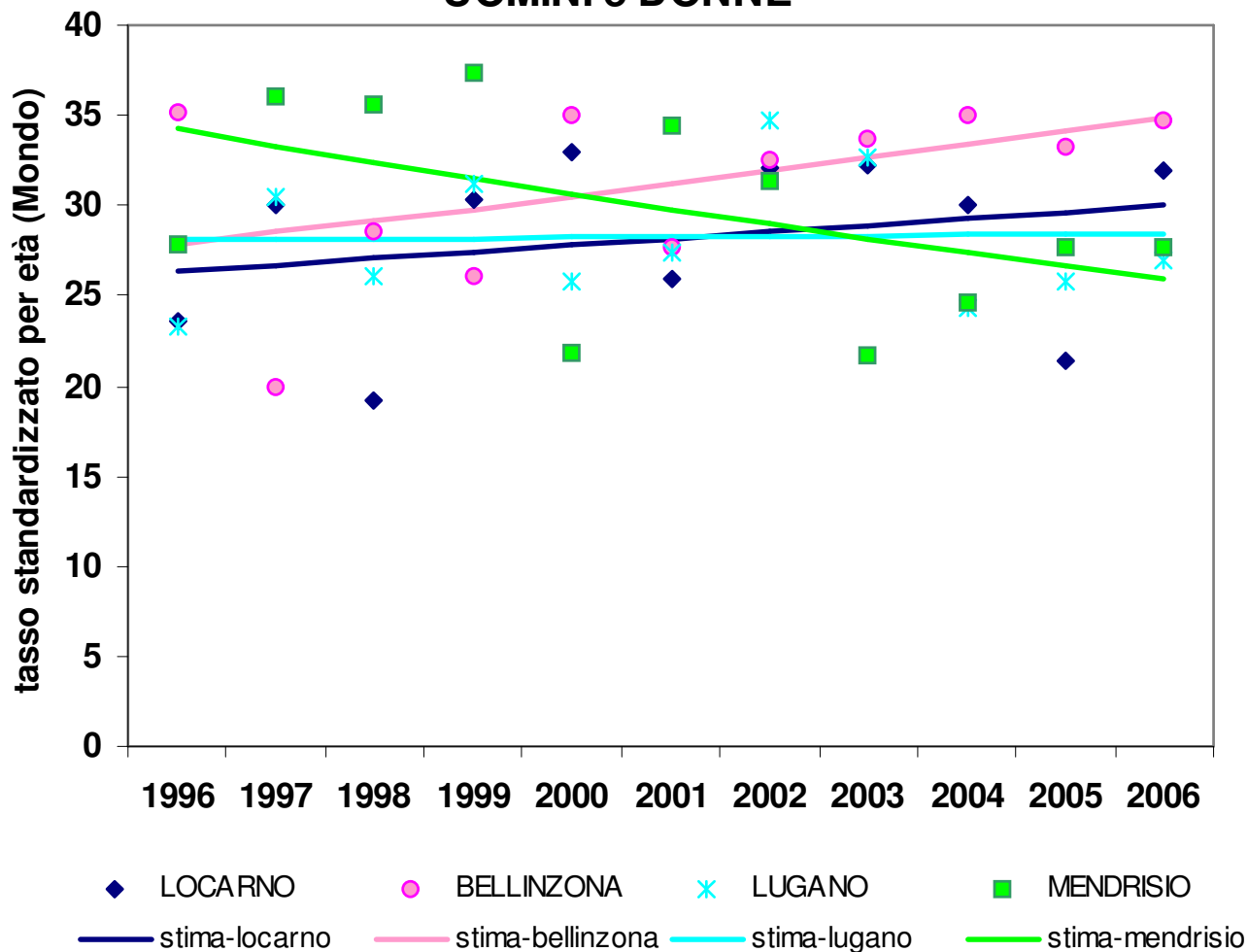


| DONNE | APC |
|------------|-------|
| Locarno | 4.26 |
| Bellinzona | 10.7* |
| Lugano | -0.34 |
| Mendrisio | -2.61 |

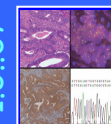


Evoluzione tassi d'incidenza, Ticino Uomini e Donne, per distretto (1996-2006)

Trend di incidenza - tumori polmonari per Distretto
UOMINI e DONNE



| Uomini e Donne | APC |
|----------------|-------|
| Locarno | 1.32 |
| Bellinzona | 2.28 |
| Lugano | 0.12 |
| Mendrisio | -2.77 |



Cosa è stato fatto in Ticino

- Monitoraggio periodico dei tumori polmonari e leucemie infantili (Registro Tumori)
- Gruppo operativo salute e ambiente GOSA.
- Annunciata disponibilità a fornire casistiche tumorali (RT) e dati ambientali (DT) per studi su larga scala (OMS Lione, studio SAPALDIA, International Association CR, Registro Tumori Varese, GRELL (studio Canadese))

Studio Vallese / Ticino e Canada

Determinants of Excessive Rates of Lung Cancer in the Bas-Valais Region and some part of Ticino (to be confirmed), Switzerland

Jean-Christophe Luthi, M.D., M.P.H., Ph.D. ¹

Daniel DeWeck, M.D. ¹

Annick Clerc Berod, Ph.D. ¹

Andrea Bordini, M.D. ⁴

Fred Paccaud, M.D., M.P.H. ²

Others IUMSP Lausanne

Georges Piller ³

ISPM Basle

Canada-US Border Air Quality Strategy

Study to investigate lung cancer incidence rates in relation to air pollution in Windsor

PROPOSAL

Study of relationship between lung cancer incidence and chronic exposure to air pollution by interested participating GRELL tumor registries

Ontario Cancer Registry interested to participate

Drs Eric Holowaty (Cancer Care Ontario) and Pierre Band (Health Canada) willing to develop a protocol with interest GRELL members

Fine

Si ringraziano:

Antonella Borsari

Paola Mazzola

Alessandra Spitale

Luca Mazzucchelli

1.3.07

