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Impact of congenital malformations risk measures in areas of Campania (Italy) characterized by hazardous waste dumping.

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□ Introduction

- ζ **Waste management is an increasingly complex problem everywhere, with different characteristics and impacts in industrialized, developing or poor countries.**
- ζ **Effects on health of human exposure to waste and waste management's products are cause of public concern.**

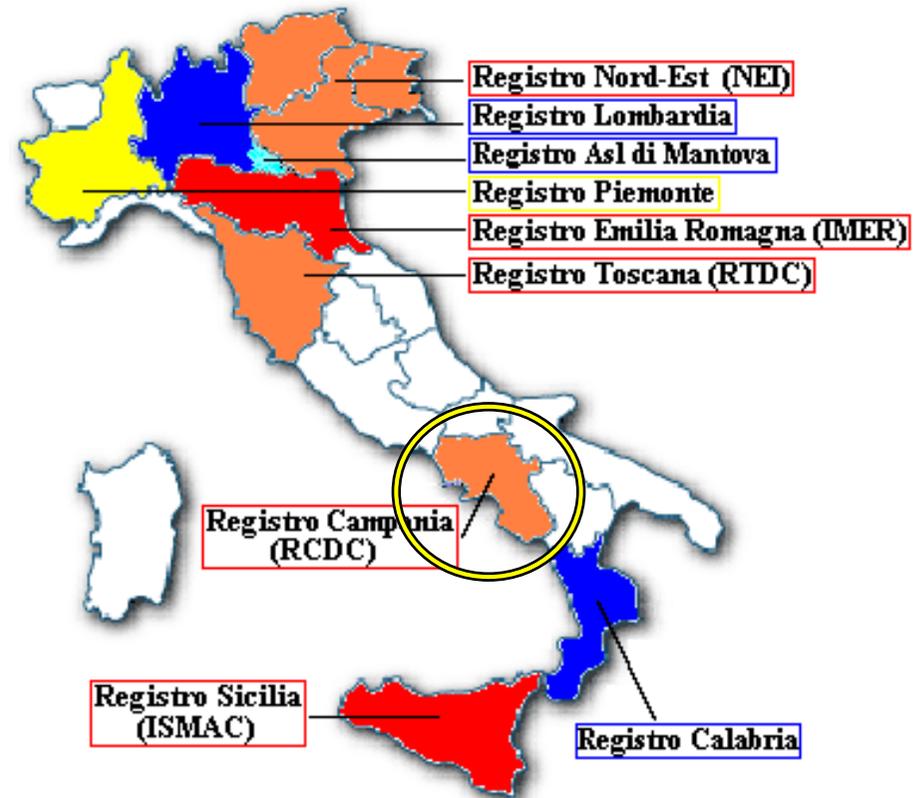


□ Introduction

Since 2004 an intensive epidemiological investigation on health impact of residing near waste disposal sites in two provinces of Campania region was conducted.

Institutions involved:

- ζ WHO Environment & Health Centre,
- ζ National Institute of Health,
- ζ National Research Council,
- ζ Environment Protection Agency and
- ζ Epi - Observatory of Campania Region



□ Introduction

A cycle of epidemiological studies was carried out.

- ζ Descriptive pilot study
- ζ Cluster detection study
- ζ Environ-health correlation study

Poisson regression methods and hierarchical Bayesian models were used to calculate the correlation between a waste hazard score and causes of mortality or congenital malformations, in 196 municipalities on 1996-2002.

Some causes of cancer mortality and congenital malformations were significantly increased in areas where most illegal toxic waste sites are located.

Management of the complex study results was difficult due to emergency phase.



The context: waste treatment in Campania (Italy)



- ζ Decades of “emergency”
- ζ Poor facilities, no planning
- ζ Large scale illegal activities (urban, industrial, toxic...)
- ζ High contamination repeatedly measured in soil, water, foodchain
- ζ Serious threat for many citizens

The context: waste treatment in Campania (Italy)



- ζ **Since 1994: Special power to a government-appointed position**
- ζ **High social and economic costs**
- ζ **One incinerator being built**
- ζ **Little separate waste collection and recycling**



localized and diffused pollution due to illegal landfilling and burning of non-hazardous and hazardous waste

Localized and diffused pollution and contamination



Localized and diffused pollution and contamination



Localized and diffused pollution and contamination



Health in the picture

- ζ April 04: Italy's Civil Defence gets involved
- ζ Health working group created (WHO, ISS, CNR, OER, ARPAC)
- ζ Reportage "*Triangle of death*" published (*Senior et al, Lancet Oncology 2004*) and responded to (*Bianchi et al, Lancet Oncology 2005*)
- ζ Pilot epi-study: Aug-Dec. '04 (*Comba et al, Annals NYAS 2006*)
- ζ Cluster detection study (Fazzo et al, Ann. Ist. Sup. San 2008)
- ζ Correlation study July '07 (Martuzzi et al., sent for publication)



HEALTH OUTCOMES

ATSDR's priority health condition
(Lybarger et al. 1993, Johnson 1999)

- 1. Births defects and reproductive disorders**
- 2. Cancer (selected anatomic sites)**
- 3. Immunologic disorders**
- 4. Kidney dysfunction**
- 5. Liver dysfunction**
- 6. Lung & respiratory diseases**
- 7. Neurotoxic disorders**



**The WHO Regional
Office for Europe**

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**POPULATION HEALTH AND WASTE MANAGEMENT:
SCIENTIFIC DATA AND POLICY OPTIONS**

Available evidence on the health effects of environmental exposures from waste incinerators and landfills was reviewed and discussed in a WHO workshop, attended by a group of international experts in epidemiology, environmental science, public health and economics, together with representatives of interest groups. The implications of such evidence were discussed in terms of policy action on waste management in the European context, with special emphasis on the need of limiting and removing harmful exposures and ensuring healthy environmental conditions.

Limitations and uncertainties in available science, deriving mainly from study design and exposure characterization, were described, with the aim of identifying knowledge gaps and priority needs in research.

Sessions were also dedicated to European case studies on health effects of landfills and incinerators, to economic evaluations of waste management options, and to methods and applications of participatory approaches for developing health-friendly policy response to the growing challenge of waste management in Europe.

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Population health and waste management: scientific data and policy options

POPULATION HEALTH AND WASTE MANAGEMENT: SCIENTIFIC DATA AND POLICY OPTIONS

Report of a WHO workshop
Rome, Italy, 29-30 March 2007

Objectives of the present communication

To evaluate the impact of congenital malformations risk measures when released and presented

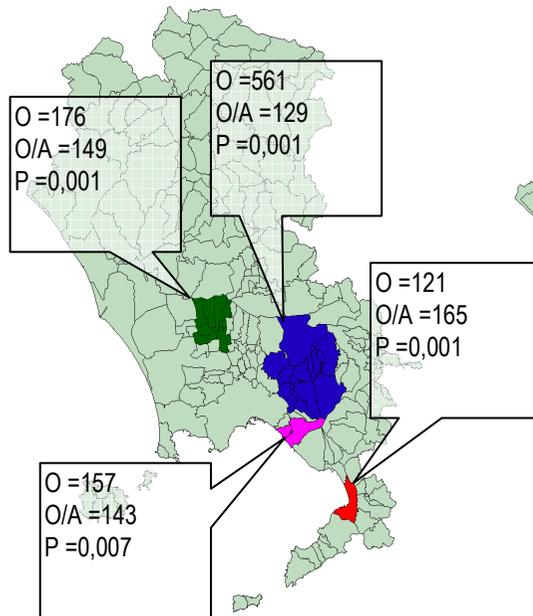
- ζ **Their impact to different stakeholders and circumstances is crucial for communication and management strategies.**
- ζ **The impact of two type of epi-measures is discussed:**
 - ψ **relative risk estimation (O/E)**
 - ψ **absolute number of observed compared to expected**



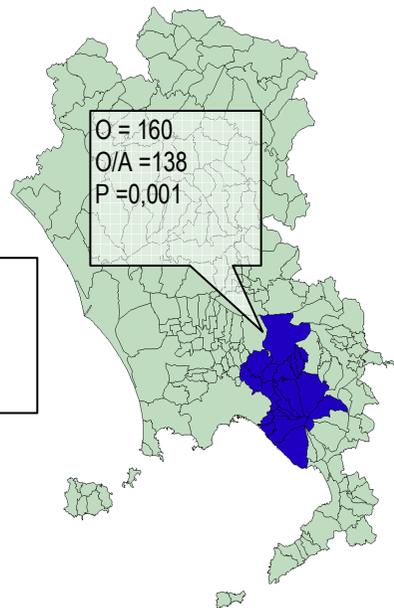
Results of the pilot study

REGISTRY OF CONGENITAL DEFETS OF CAMPANIA REGION, 1996-2002

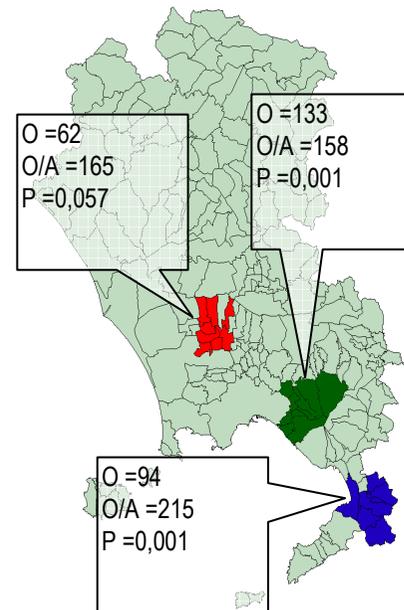
Total CM



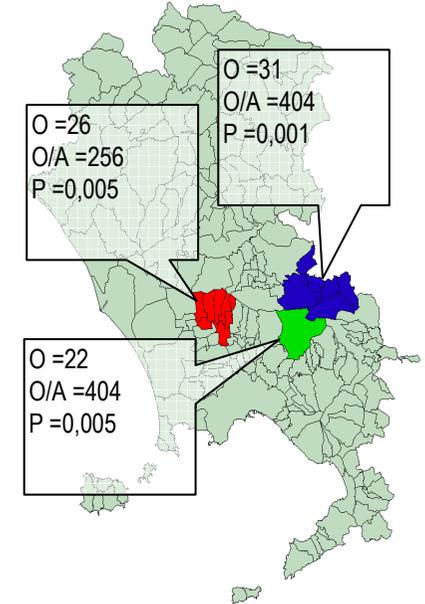
Limb defects



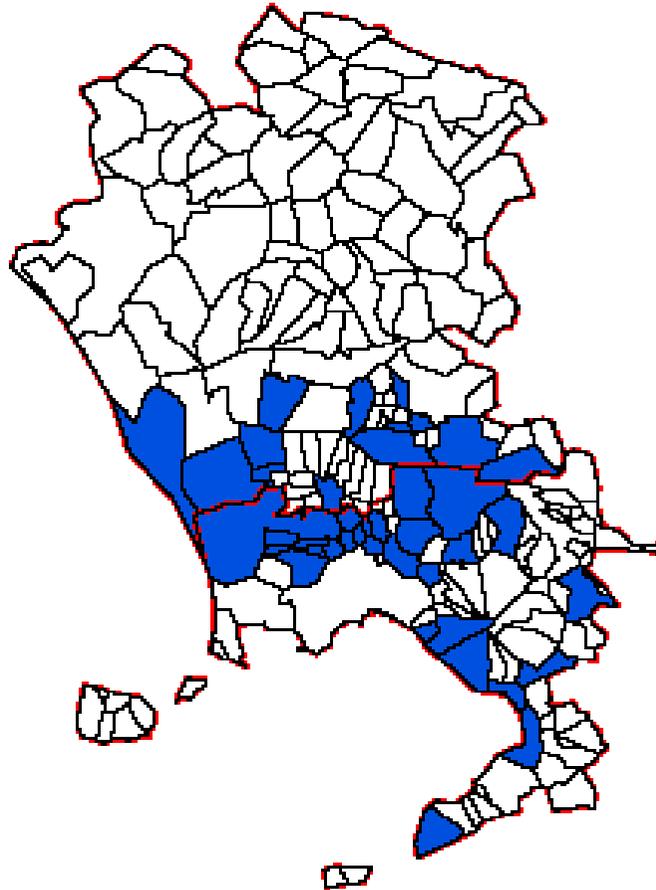
CHD



Uro-genital



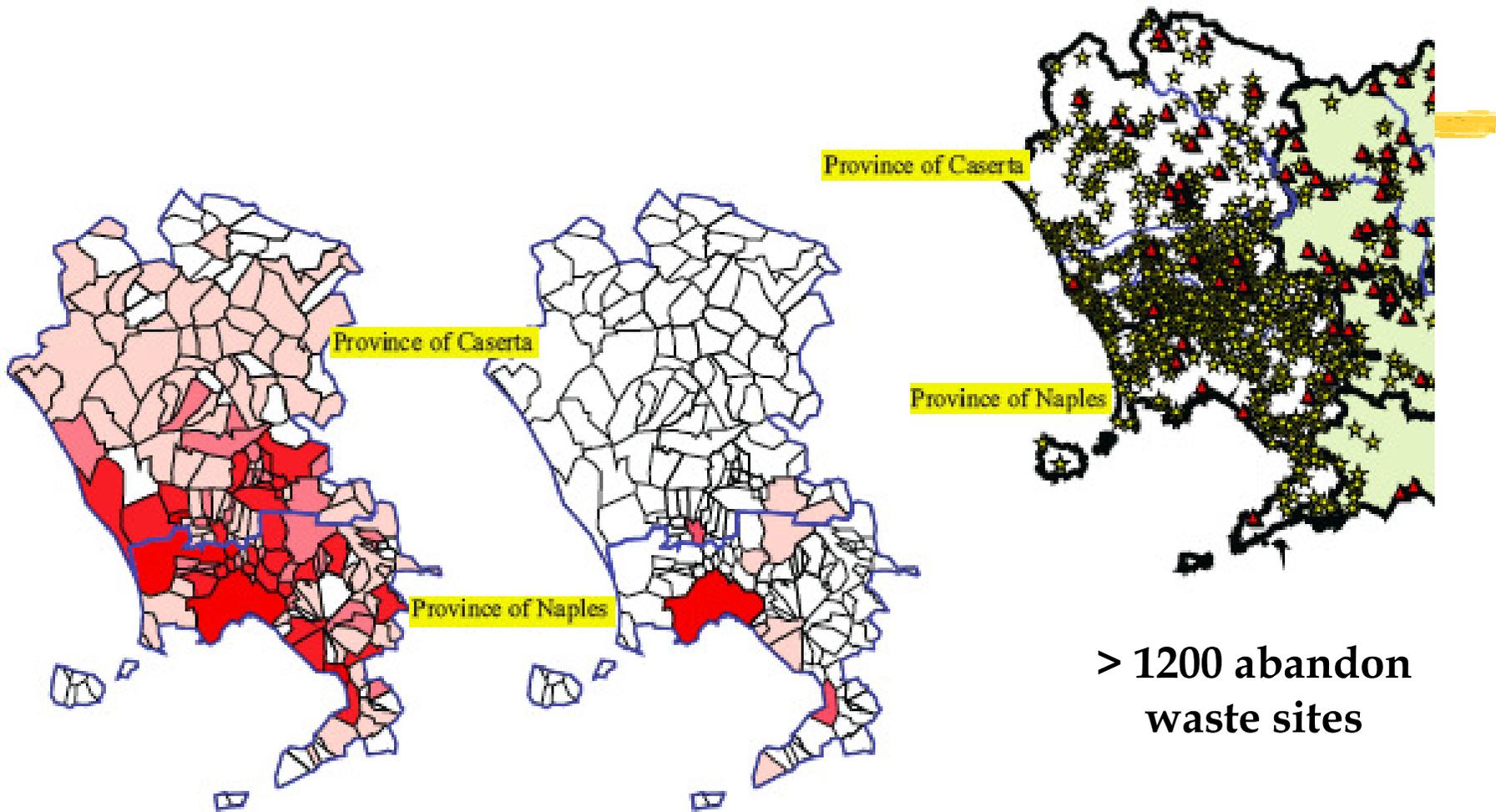
Results of the pilot study: areas with risk excesses of CMs



By Spatial Scan Statistics (Kulldorff, 1997)

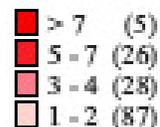


Municipalities with significant excesses of mortality and congenital malformations and distribution of landfill sites



> 1200 abandon waste sites

Significant excesses: mortality
Men and Women



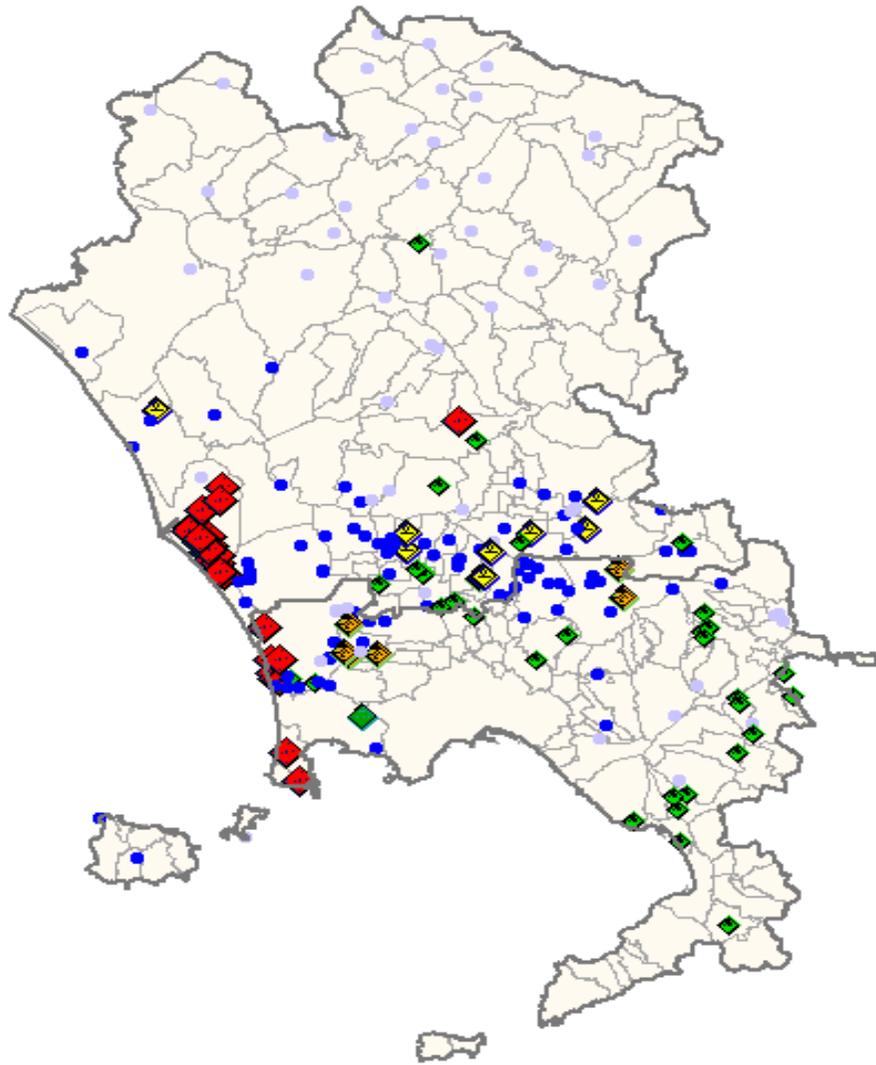
Significant excesses: malformations
Men and Women



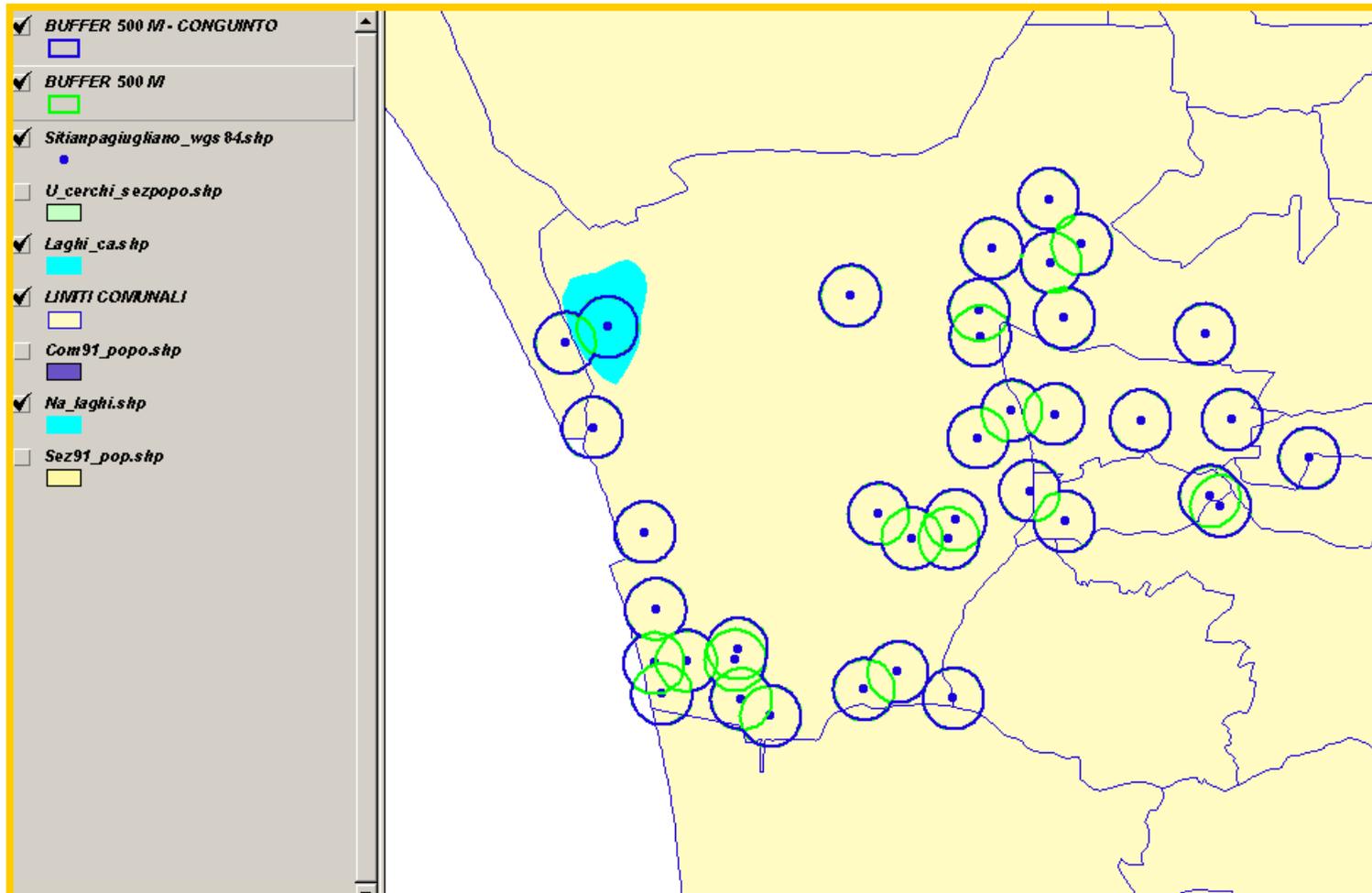
Authorized landfills ▲
Sites of uncontrolled abandon
in Campania Region ★

NEW STUDY BASED ON AN INDEX OF ENVIRONMENTAL WASTE RISK

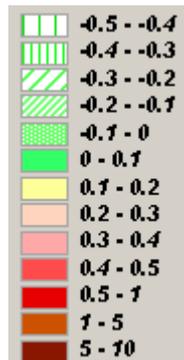
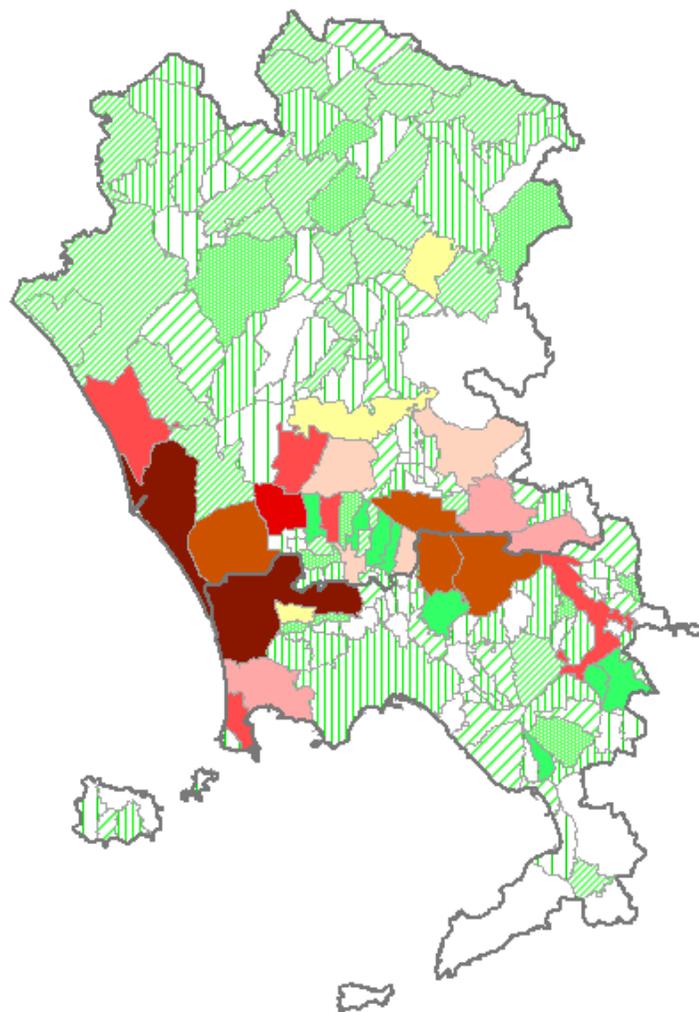
300 landfill sites characterized



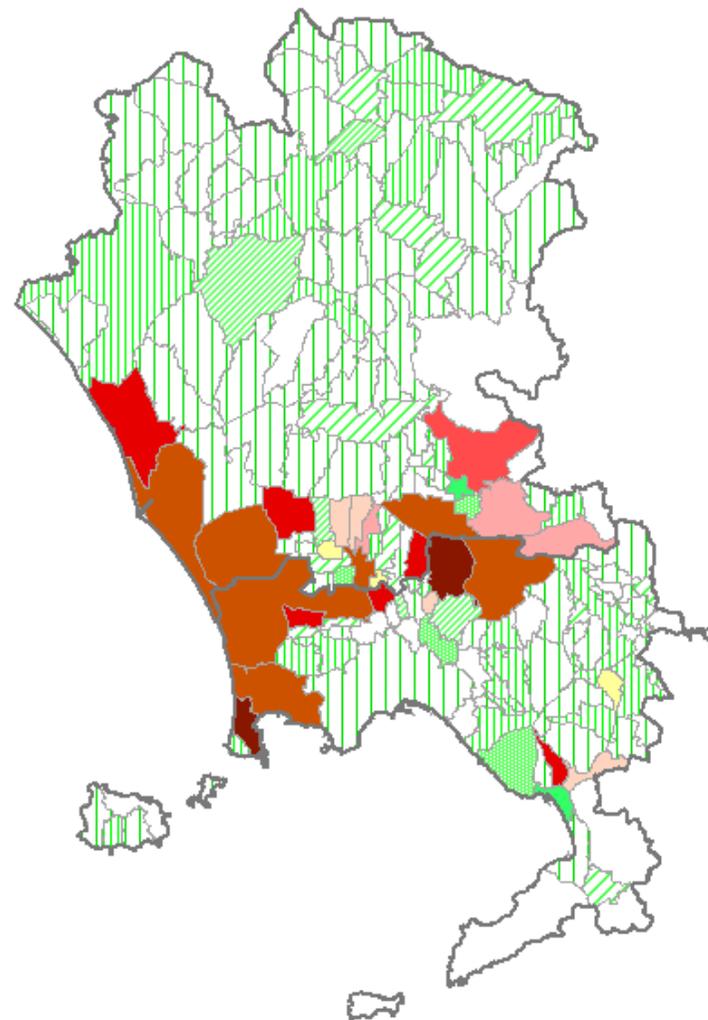
300 landfill sites according to HAZARD INDEX



Municipality Hazard index

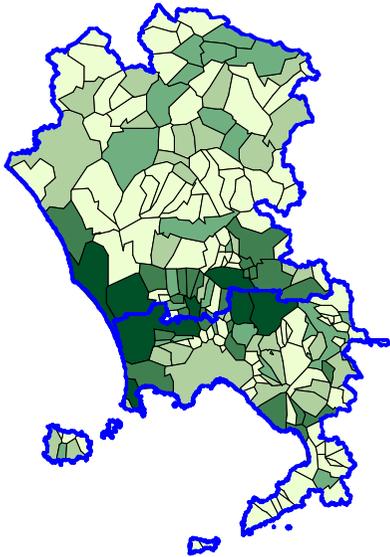


Municipality Risk Index



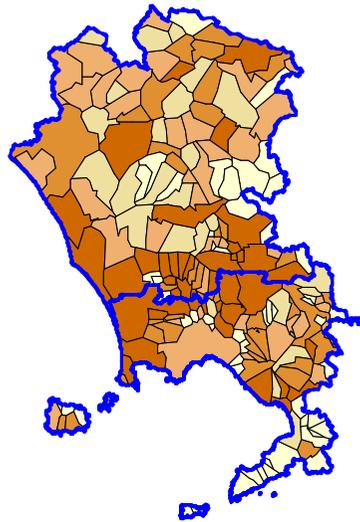
Environmental score index and deprivation index

Risk index (natural breaks)



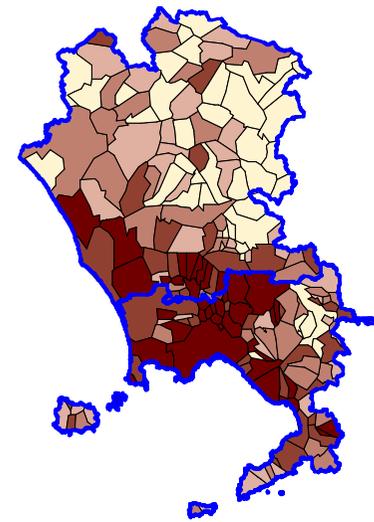
IR (5 natural breaks)

Risk index (quintile)



IR (Quintili aggiustati)

Deprivation index (quintile)



ID (Quintili)

Correlation coefficient, $R = 0,29$ n.s.



NEW STUDY BASED ON AN INDEX OF ENVIRONMENTAL WASTE RISK

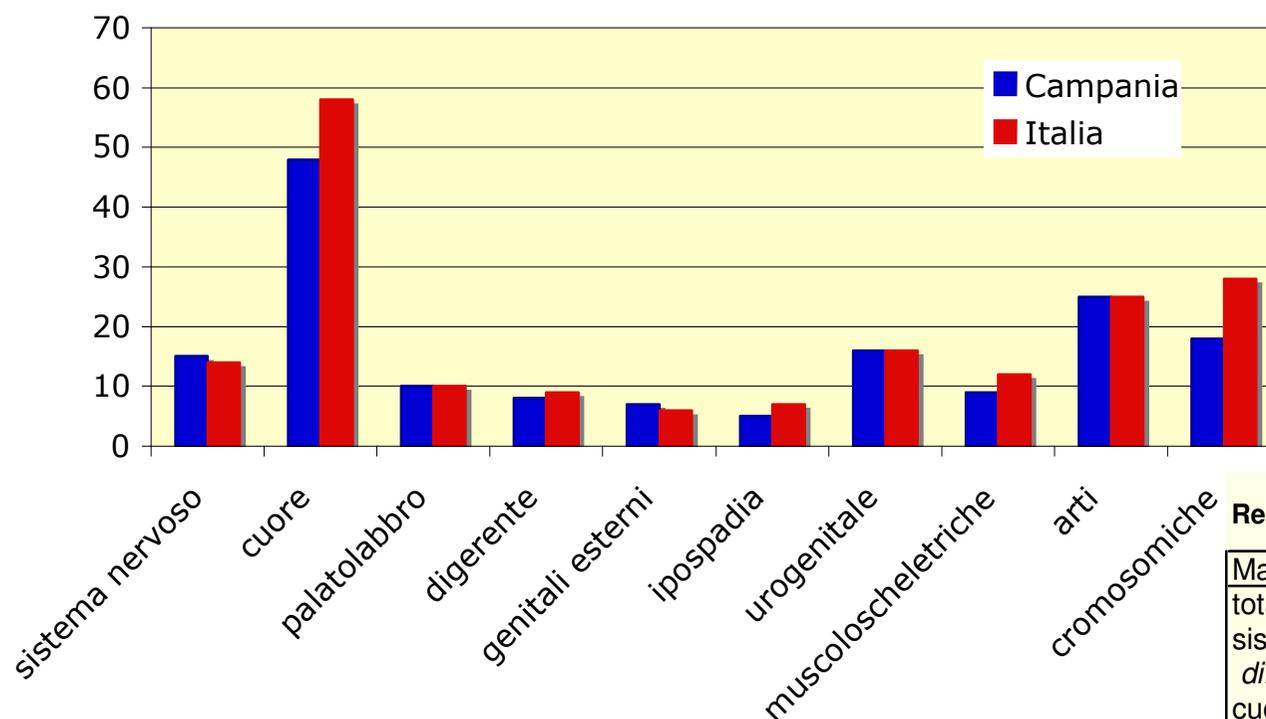
- ζ The index was categorized in 5 classes by cluster analysis method: from class I, including unexposed municipalities (reference category) to class V, including more exposed municipalities.

<u>Category</u>	<u>N° Municipalities</u>
1 (ref.)	104
2	35
3	25
4	24
5	8



Analysis: the context

Malformazioni congenite in Campania e Italia, 1996-20



Registro Campano Difetti Congeniti, 1996-2002

Malformazioni congenite	Num.	Tasso (*)
totali	5.412	151
sistema nervoso	539	15
<i>difetti tubo neurale</i>	236	7
cuore	1.712	48
palatolabbro	359	10
digerente	281	8
genitali esterni	262	7
ipospadia	194	5
urogenitale	591	16
muscoloscheletriche	336	9
arti	901	25
cromosomiche	655	18

(*) tasso di prevalenza per 10.000 nati

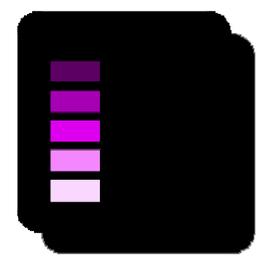
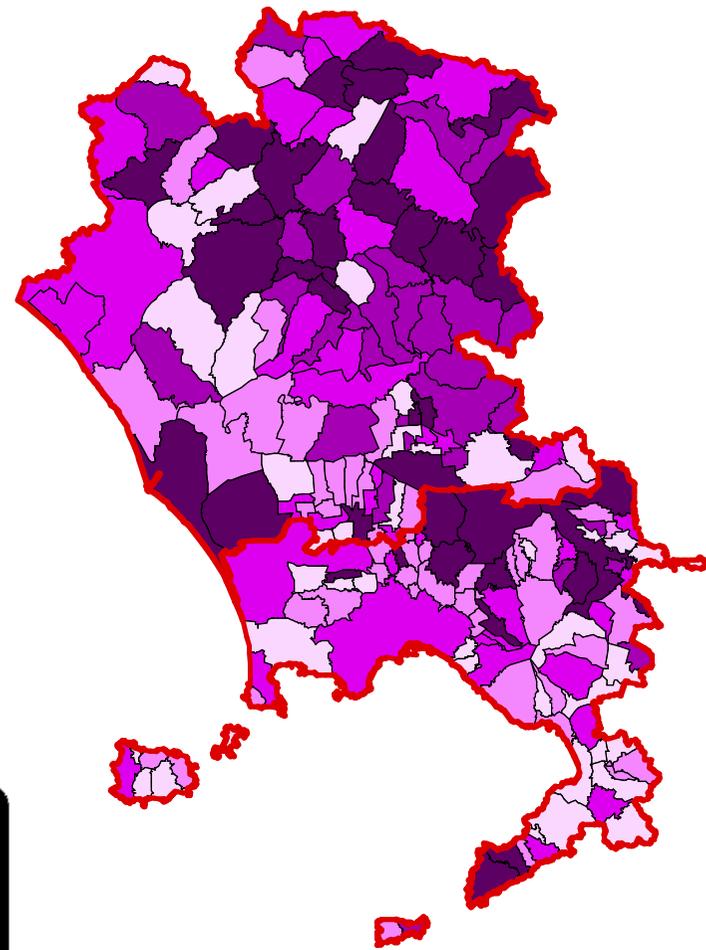
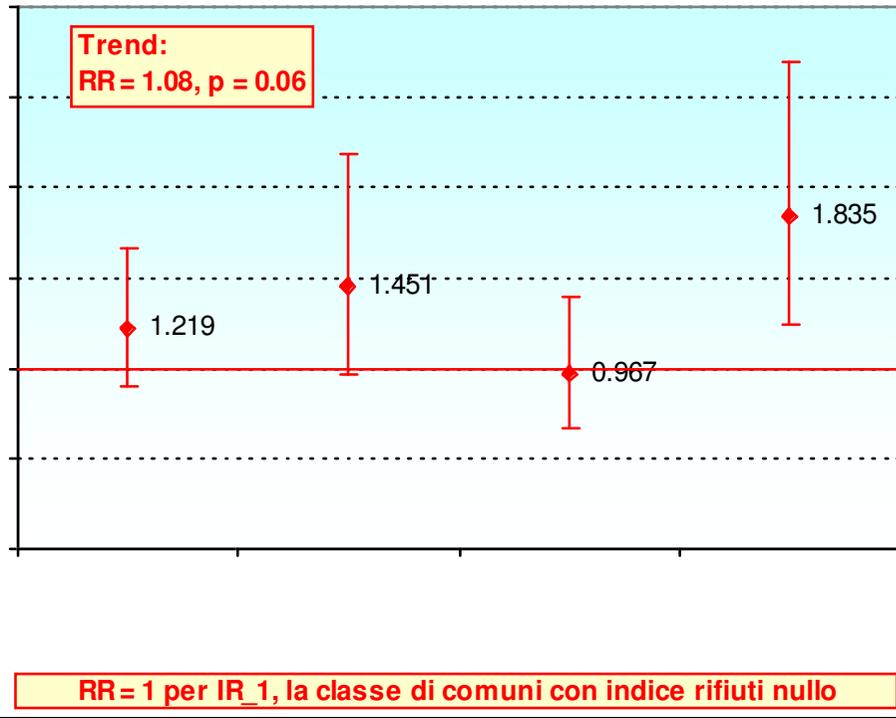
4 type of analysis



- ζ **Poisson regression by 5 RISK and 5 DEPRIVATION INDEX categories**
- ζ **SMR, using rate of 196 municipalities as standard, adjusted for RI and DI**
- ζ **SMR, using rate of 196 municipalities as standard, adjusted for RI and DI**
- ζ **Clustering according to Scan Statistics by Kulldorff, 1997**

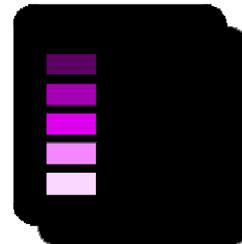
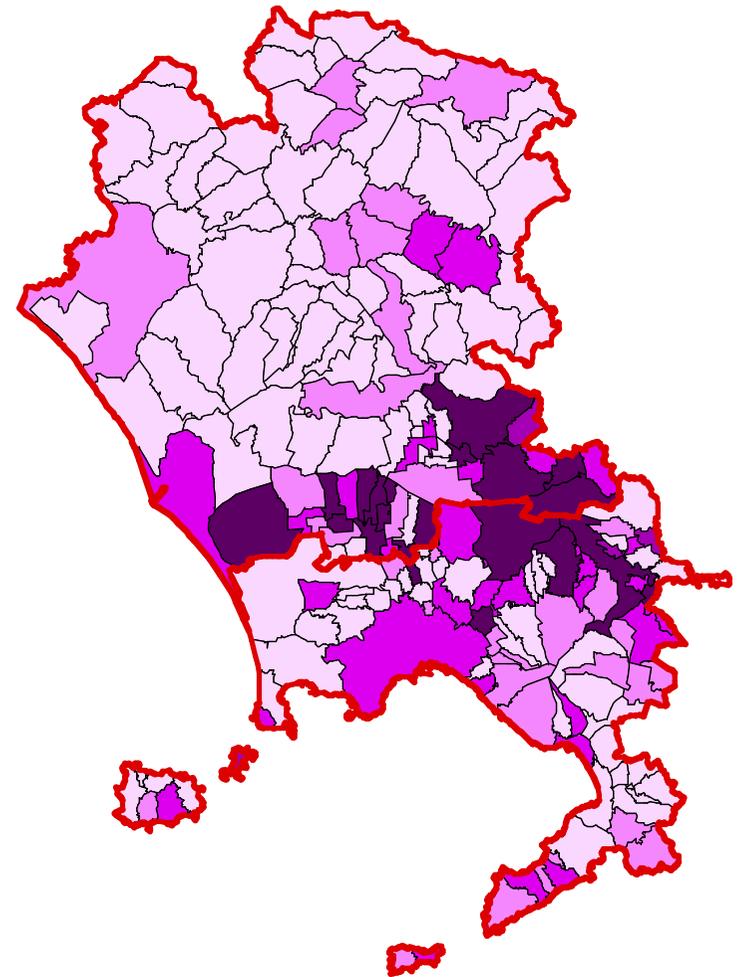
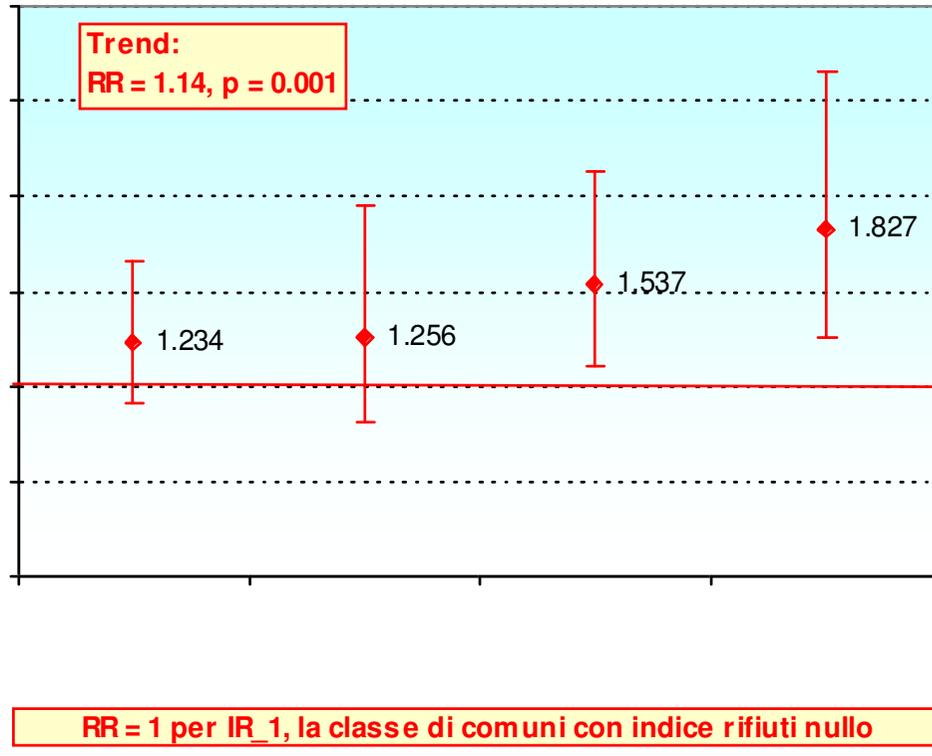
Some results: bayesian analysis

nervous system



Some results: bayesian analysis

genitourinary



Summary results (*by Poisson regression*)

Comparing class V (8 higher risk municipalities) to class I (104 lower risk municipalities), statistically significant results were found for:

Nervous system (46 cases) **O/E=1.66** (1.36-2.12)

Uro-genital (49 cases) **O/E=1.75** (1.44-2.23)

in press releases the risk excesses were reported as:

**66% , 75% “excesses” or “higher” or “more cases”,
usually without reporting the number of cases**



Three considerations

- 1.** The provoked concern was greater than for lower relative risk values of mortality, regarding hundred to thousand cases.
- 2.** The notion of the geographical area where the excess was found (8 municipalities of category V) was often lost, and the percentage of excess was “applied” to the whole territory.
- 3.** The proportion of the exposed population was unknown, therefore Attributable Risk cannot be calculated.



Alternative indicator and mode of presentation

Nervous system malformations

class V (46 cases) versus class I (81 cases)

O – E = 18 cases (12 - 24)

Uro-genital malformations

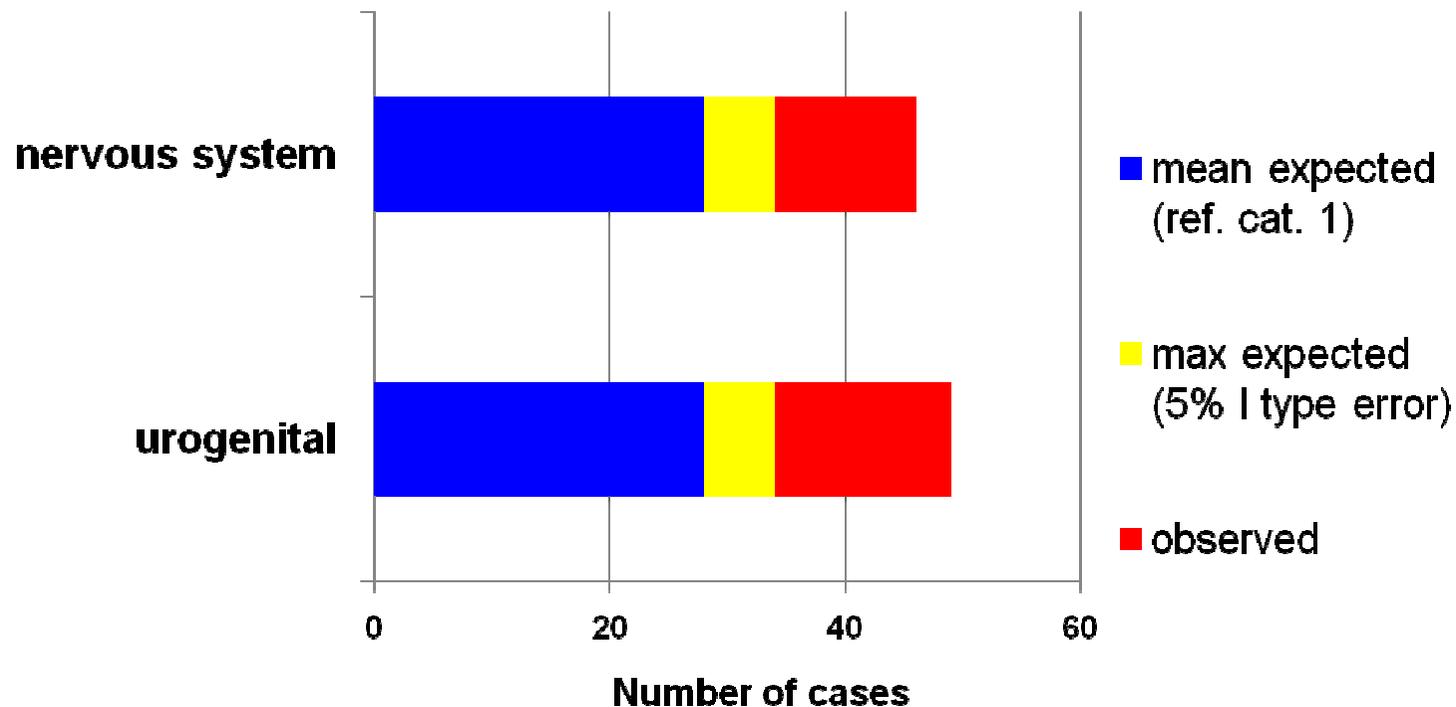
class V (49 cases) versus class I (82 cases)

O – E = 21 cases (15 - 27)



Alternative indicator and mode of presentation

- Campania study on congenital anomalies, 1996-2002 -
Number of observed and expected cases comparing hazard
category 5 versus category 1



DISCUSSION

Relative risk were difficult to explain and to be understood by public:

- When the excess was reported only as a percentage (e.g. + 75%), it was open to misleading, in different direction according to stakeholders, often over-represented as alarming and threatening.
- The number of subjects observed compared with the mean and maximum expected (e.g. 21 and 15 cases), has a high informative contents, was well understood and gave rise to a positive discussion about causing and managing.



Conclusions

- ζ **Highest values of relative risk estimates attracted attention of the media and raised concern in communities.**
- ζ **In the Campania emergency case, the difference between observed and expected cases presented provided useful indications for communication management.**
- ζ **Advanced epi-studies by adopting analytical design with individual exposure assessment appear opportune.**
 - ψ **A human biomonitoring investigation is in progress.**
- ζ **Risk communication and participation are main tasks to be integrated in the epi-studies.**

