Ranking cancer sites for monitoring and studying possible associations with environmental exposures

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Introduction

Links between cancer and the environment are of scientific and social concern. This is due to the increasing incidence of cancers in developed countries and the rapid changes observed in the human environment. For several cancer sites, this increase is not or incompletely explained by known risk factors.

In order to improve knowledge in this field, it is necessary to obtain valid incidence data and analyze time and space trends. A general surveillance of incidence of cancer sites associated with environmental exposure and some specific studies should be implemented.

Cancer registries cover only 14% of the French population and contribute to the monitoring of time trends but are unable to inform us about space trends. A new surveillance system is proposed for this purpose, relying on several data sources covering the whole territory. It is being tested on thyroid cancer and will be possibly extended progressively to others sites.

In order to contribute to the decisions about these future sites, our purpose was to identify which cancer sites are of high priority for monitoring and for studies focusing on possible links with the environment.

Methods

Elaboration of the scoring method (see methodological diagram opposite below)

- A list of 24 cancer sites to classify was drawn up starting from the data available on epidemiology of cancers in France (1).
- Three series of criteria were defined: suspected or proved link with environment, public health importance and social perception.
- All the criteria were discussed within a group of expert epidemiologists of InVS. A weight (very important, important, not very important) was assigned to each criterion by scientific consensus.
- For each criterion an indicator variable suitable for semi-quantitative scoring was defined.
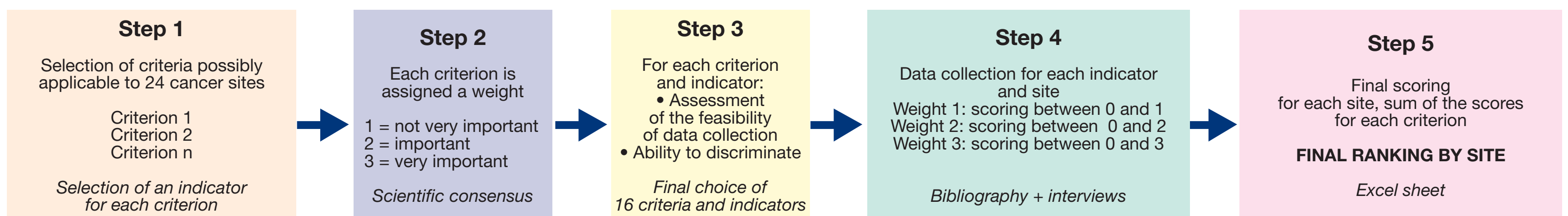
Data collection

- Bibliographic research
- 27 face-to-face semi-structured interviews were carried out, according to the same grid of interrogations with hospital clinicians qualified for each localization. Two complementary interviews with a toxicologist researcher and a university veterinary surgeon were carried out.

Data processing

- Excel sheet

A- Elaboration of the scoring method

Step 1

Selection of criteria possibly applicable to 24 cancer sites

Criterion 1
Criterion 2
Criterion n

Selection of an indicator for each criterion

Step 2

Each criterion is assigned a weight

1 = not very important
2 = important
3 = very important

Scientific consensus

Step 3

For each criterion and indicator:
• Assessment of the feasibility of data collection
• Ability to discriminate

Final choice of 16 criteria and indicators

B- Implementation and scoring

Step 4

Data collection for each indicator and site
Weight 1: scoring between 0 and 1
Weight 2: scoring between 0 and 2
Weight 3: scoring between 0 and 3

Bibliography + interviews

Step 5

Final scoring for each site, sum of the scores for each criterion

FINAL RANKING BY SITE

Excel sheet

Methodological diagram

Results

Table 1: List of selected criteria, explanation, indicators and weight

CRITERION	EXPLANATION	INDICATOR	WEIGHT
Suspected or proved link with environment			
1- Non explained time variations for this site	Principle of precaution	Increase in the annual incidence rate standardized 78-2000 [1] of more than average for at least one sex, not explained by the known factors	2
2- Results of twins or family studies	Almost experimental situation	Quantitative results of Lichtenstein [5] et Czene [6] by cancer site	3
3- Occupational cancers	Criterion of Hill [2] [analogy]	Quoted or not in the tables of french occupational diseases	3
4- Risk factors unknown in population	Criterion by default	Data collected from interviews	2
5- Significantly increased risk for for environmental exposure in pooled or meta analysis	Criterion of Hill [2] (consistency of the link)	At least one positive study published in last 5 years	3
6- Emergent factor in population being the subject of causal assumptions for this site	Principle of precaution	Data collected from interviews	1
7- Same cancer sites observed among pets sharing human environment	Criterion of Hill [2] [analogy]	Data collected from interview of the veterinary referent concerning cats and dogs	1
8- Persistence in environment of the agents proved or suspected causing this cancer site	Increase in the level and the probability of exposure + link between persistence in the environment and carcinogenic risk [3]	Among IARC classified agents in groups 1 and 2A concerning this site, at least one is persistent in environment (POP or metal)	3
Public health importance			
9- Frequency of this cancer site	Criterion of public health importance [4]	Estimated incidence in 2000 [1]	3
10- Risk of cancer increased for new generations for this site	Worry to protect future generations	Design of the curb RR by birth cohort [1]	3
11- Exposure prevalence in population (acknowledged or potential) for classified agents concerning this site	Principle of precaution/ potential frequency	Evaluated with the help of IARC monographs and knowledge about the agent	3
12- Seriousness	Criterion of public health importance [4]	Average rate of survival at 5 years for this site	3
13- Quality of life for treated patients	Seriousness+ social and economic impact [4]	Data collected from interviews	2
14- Unfavorable french situation for this site incidence compared with other european countries	Principle of attention	Data collected from reference [1]	1
Social perception of a link with environment			
15- Patients' worry for a link between this cancer site and environment	Social perception of the patients	Data collected from interviews: frequency of queries to clinicians	2
16- Clinicians' worry concerning a link with environment and whish for surveillance and studies	Social perception of the clinicians	Data collected from interviews	1

Table 2: Scoring and ranking by site when all criteria are considered

Sites	Score	Rank
Brain and other central nervous system	30	1
Lung	29	2
Non hodgkin lymphoma	27.5	3
Mesothelioma	25.8	4
Leukaemia	24.5	5
Skin (all types)	24	6
Liver	23.3	7
Multiple myeloma and immunoproliferative diseases	23.3	7
Pancreas	21.8	9
Kidney	21	10
Bladder	21	10
Lip, oral cavity, pharynx	20.3	12
Breast	19.5	13
Esophagus	19.3	14
Stomach	19	15
Prostate	17.5	16
Larynx	16.8	17
Large bowel	14.5	18
Testis	12.5	19
Ovary	10.3	20
Thyroid	10	21
Cervix uteri	8	22
Corpus uteri	7.3	23
Hodgkin's disease	6.3	24

Discussion and conclusion

The method proved feasible and discriminant. We obtained a clear ranking of 24 selected cancer sites with scores varying from 6.3 to 30. The site "brain and other central nervous system" ended up first place followed by "lung", "non Hodgkin lymphoma", "mesothelioma", "leukaemia" and "skin". These 6 sites are constantly ranked among the seven first ones, overall and within the three groups of criteria.

Methological limitations of composite scales are well known : they depend on the validity of expert judgement, the pertinence of chosen indicators. The results may vary with the quality of data collection (i.e interviews) and the progress in scientific knowledge.

However we could identify a group of 6 cancer sites to be monitored and studied with high priority. The results can be interpreted coherently and are compatible with those of other teams (7) using different methods of ranking.

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