RC-9b
Risk Perception and Request for Information About Radiological Risks in the Health Area

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Abstract. Research by cognitive psychologists has demonstrated that when laypersons make estimates of risks do not merely calculate in terms of probabilistic information. People tend to construe the risk in accordance with other schema. Lay people use a broad definition of risk when making their judgements about which ones are of the most concern to them. Another topic of increasing interest within risk-perception research is the trust and credibility of the sources of risk information and communication. This interest is closely related to the increasing social demand for reliable and valid information about the risks to which society is exposed. In fact, several regulations and laws have been developed in an effort to respond to this social demand. This paper presents some of the key findings of a comparative Latin-American study on radiological risk perception in the health area. A questionnaire was distributed to outpatient samples from eleven Latin-American countries. A list of 22 risks was evaluated on two rating scales. The questionnaire also address the role of information as a means of feeling safe, who should inform the public about radiological risks, and what kind of information the public would like to receive.

1.Introduction

Understanding public perceptions of risk is increasingly considered to be important in order to make sound policy decisions. Psychologists and other social scientists have shown how individuals judge and evaluate hazards related to working conditions, private activities, technological developments, global ecological changes, and so on. The main issues are the subjective concepts underlying risk judgements, the determinants of perceived risk magnitude, and differences among societal groups or cultures. The "psychometric paradigm" developed by Slovic, Fischhoff, and Lichtenstein [1,2,3,4,5] was a landmark in research about public attitudes toward risks. Lay people use a broad definition of risk when making their judgements about which ones are of the most concern to them. This incorporates a number of qualitative characteristics . Slovic *et al.* [2] identified and analysed several characteristics of this kind using factor analysis and found that they could be resolved into three factors: 1) the dreadfulness of risks, 2) the degree of knowledge of and familiarity with the hazard, 3) the number of exposed people. Several studies repeated the approach by Slovic *et al.,* [6,7,8,9,10,11,12,13]. Some studies produced a roughly equivalent structure, at least for factors 1 and 2 [6,7,8,9,10,12].

The original proponents of the "psychometric paradigm" have developed more sophisticated approaches that include the influence of factors such as gender, ethnicity, nationality, worldviews, and so on. Although the results were inconsistent, there are frequently some differences related to gender, age, socio-economic, and educational level. Since then some studies were also carried out related to specific hazards, especially on those derived from nuclear energy, and from radiation sources in general [14,15,16].

An interesting line of research, derived from "psychometric paradigm" was the replication of the original study by Slovic *et al.* in other countries. One aim was to obtain comparable results among countries. What guided these comparative attempts was a mixture of goals, first, to test general theory and second, to generate a body of exploratory new knowledge of

public opinion in distinct countries. In general, the results confirm the generality of the main factors. Although some technologies frequently used in the health context (i.e., X-rays) have been studied "as examples of radiological hazards with low risk," no study has used this type of hazards as target. This type of hazards could be considered as voluntary, beneficial to the individuals, and characterised by individual exposure.

In this study, one of our main goal was rating these risks, within a more general set of hazards, similar to those generally used in Risk Perception research. In accordance with recent investigations, we are also interested in the stability of the risk perception structure throughout different nations, that exhibit different cultural characteristics.

Several authors argue that trust in information sources is a crucial issue for risk perception and tolerability [17, 18, 19, 20,21,22]. Simultaneously, data from recent studies [23,24] underlined an interesting fact: trust in and credibility of the ecologists and the mass media have been growing for the last ten years. Several theories of trust have been proposed in order to determine its components. Kaspersson [25] notes that trust is composed of the perceptions of competence, absence of bias, and involvement in the processes. More recently, Kaspersson *et al.* [26] developed a new set of trust components, including involvement in goal achievement (i.e., public health protection); the assumption of responsibilities; competence; involvement in and concern about the issue; and predictability.

Sjöberg [27] analysed the relationship between trust and credibility, and risk perception. A survey was applied to representative samples of the general Swedish population. Four "a priori" dimensions were designed to measure trust and credibility: perception of honesty, perception of social armony, trust in politicians, and confidence towards industries. Demand for risk reduction, predicted by a lineal regression model, depending basically on the perceived seriousness of the consequences, and very little (significant weights only occasionally) on the trust dimensions. Another survey, applied in the United Kingdom [28], was designed to establish confidence in several sources of information with regard to some radiological risks. Bias of the sources, as well as levels of knowledge attributed to them by the public, were studied. The authors found that the most valued attributes of the information sources were: independence from the government and industry, high levels of technical experience, and the fact of being specifically devoted to the public interests.

From the limited research already carried out, it can be concluded that a crucial issue for risk communication is trust in and credibility of the information sources [29,30,31]. If populations at risk do not trust those responsible in charge of risk management, both from government and industries, information may be rejected and self-protection instructions ignored. Many studies carried out in other contexts have shown the strong effect of trust and credibility on attitudes and behaviours. Any institution in charge of risk communication should be aware of this fact.

This paper will present some of the key findings of a comparative Latin-American study on radiological risk perception in the health area. The project used a survey method to examine the social demands for information about radiological risks with regard to diagnostic and therapeutic applications. The main cross-cultural differences with regard to social demand for information about radiological risks will be presented.

2. Participants

Although eleven countries were involved in the project, data of three of them cannot be presented in this paper. Due to some problems in the codification process, data from Brazil, Colombia, and Salvador were not available when writing this paper.

A total of 5225 subjects from eight countries (Argentina, Cuba, Spain, Mexico, Panama, Peru, Uruguay, and Ecuador) were interviewed. The national distribution of the sample is shown in table 1.

Table 1. Participants by country.

COUNTRY	Argentina	Cuba	Spain	Mexico	Panama	Peru	Uruguay	Ecuador	Total
Frequency	513	360	1556	1705	88	372	280	351	5225
Percentage	9.8	6.9	29.8	32.6	1.7	7.1	5.4	6.7	100.0

Some demographic variables of the sample were studied in order to analyse individual differences. Gender, educational level, age, and group of patient data are summarised in Tables 2 to 4.

Table 2. Participants by gender.

GENDER	Male	Female	Total
Frequency	1984	3206	5190
Percentage	38.2	61.8	100.0

More than 60% of the interviewed subjects were females. There is no clear scientific or medical explanation for this overrepresentation of females. A possible reason could be found in their willingness to participate in the research. Fieldwork shown that males were more reluctant to collaborate than females.

Table 3. Participants by educational level.

EDUCATIONAL LEVEL	No studies	Primary	Secondary	University	Total
Frequency	139	796	1536	2505	4976
Percentage	2.8	16.0	30.9	50.3	100.0

The educational level of the sample can be described as quite high (at least considering the average Spanish levels), with 50% with university studies, and 30% with secondary studies. It could be argued that the lower educational levels refused more often or were not capable of filling in the questionnaire.

Table 4. Participants by group of patient.

GROUP OF PATIENT	X - Rays	Nuclear Medicine	Radiotherapy	Others	Total
Frequency	2295	415	312	1464	4486
Percentage	51.2	9.3	7.0	32.6	100.0

Half of the sample defined themselves as X-ray patients, followed by “other” patients. Patients of Nuclear Medicine and Radiotherapy Services account for 16% of the total.

3. The survey

A preliminary version of the questionnaire was designed by the Spanish team and circulated in all the countries for comments. A pre-test was carried out in Spain and Uruguay to check whether it was clearly understood, considered to be meaningful, etc. In both countries, incidental samples were used.

The test showed it was necessary to shorten the extension of the questionnaire (it was too long), to adapt the language (both in terms of common words and of national peculiarities), and to delete some questions (those that generated anxiety, were not understood, etc.). The final version was then designed and circulated for final comments until all the countries agreed on it. Contents of the questionnaire are summarised below:

→ General risk perception: 22 risks, both technological and no technological, and within them, radiological and no radiological ones, to be rated on two scales: possibility and seriousness. All kinds of risks were properly balanced in the list

→ Risk perception of diagnostic and therapeutic radiological applications as a patient

→ Conditions for feeling safe (research, legislation, information, etc.): to choose the three most important ones

→ Information issues: who should inform, what kind of information should be provided, etc.
→ Mood
→ Evaluation of the questionnaire
→ Demographic profile

This paper will focus on the questions related to risk perception, optimistic bias, conditions for feeling safe, and the information issues. The role of information as a means of feeling safe, who should inform the public about radiological risks, and what kind of information the public would like to receive, will be analysed.

4. The procedure

A network of national co-ordinators was established for the final design and distribution of the questionnaire. Within each country, a representative of the National Radiation Protection Society was chosen to co-ordinate the research project. When the final version of the research tool was agreed on, a set of copies of the questionnaire was sent from Spain to all involved countries. Each national co-ordinator was in charge of the distribution of the questionnaire in his/her country.

The Spanish team prepared a set of instructions to be followed in each country. Guidelines for the sample design, the data-gathering processes, and possible incidences during the data gathering were provided. In all countries, the co-ordinator distributed questionnaires in the main hospitals with radiological services according with the above-mentioned guidelines. In general terms, a common procedure for the data gathering was adopted, although several differences were unavoidable due to national peculiarities.

Taking into account the national singularities (educational levels, suitability of the waiting rooms, etc.), each national co-ordinator decided the best procedure in his/her country. In most of the countries the questionnaire was distributed in the waiting rooms, handed out to the patients, and was self-administered. To achieve an acceptable response rate it was necessary to use a face-to-face procedure in the following countries: Cuba, Mexico, Brazil, Colombia, and Uruguay.

5. Results

5.1.Risk Perception issues.

First we analysed the 22 risks from two rating scales: possibility and seriousness, and we examined the differences between them by *Student's t-contrast* for related samples. Table 5 presents the summary of this analysis.

Table 5. Ratings of risks by Possibility and Seriousness.

Source of risk	N	Possibility		Seriousness		Differences.	Corr.
		Mean	S.D.	Mean	S.D.		
Aids	5203	2.63	1.17	3.90	1.55	-1.27**	.384
Nuclear Med. Diagnostic	5197	2.29	1.19	2.70	1.42	-.40**	.468
X-Rays	5199	2.61	1.37	2.32	1.22	.29**	.391
Infection from animal	5197	2.19	1.16	2.67	1.38	-.48**	.458
Mammography	5174	2.10	1.33	2.03	1.30	.07ns	.453
Nuclear arms	5194	2.72	1.55	3.24	1.69	-.52**	.495
Food contaminated rad.	5175	2.81	1.52	3.47	1.67	-.66**	.455
Computerised Tomog.	5189	2.25	1.23	2.27	1.33	-.02ns	.485
Road accident	5192	3.31	1.44	3.51	1.59	-.20**	.560
Nuclear power plant	5193	2.66	1.59	3.29	1.71	-.63**	.470
Magnetic resonance	5199	2.13	1.24	2.18	1.36	-.04ns	.507
Surgical intervention	5203	2.83	1.26	2.85	1.39	-.02ns	.512
Wrong diagnostic	5198	2.92	1.40	3.50	1.62	-.57**	.499
Nuclear wastes	5206	2.84	1.57	3.44	1.70	-.59**	.496
Terrorism	5198	2.75	1.50	3.37	1.70	-.62**	.483
Ecography	5188	2.03	1.31	1.89	1.27	.15**	.432
Chemical wastes	5201	2.75	1.43	3.15	1.59	-.40**	.521
Floods	5204	2.79	1.41	3.17	1.58	-.38**	.520
Chemiotherapy	5206	2.70	1.40	3.03	1.59	-.33**	.549
Radioactive escape	5193	2.91	1.65	3.64	1.74	-.73**	.482
Natural radiation	5209	2.63	1.38	2.69	1.45	-.02ns	.554
Radiotherapy	5214	2.61	1.32	2.89	1.52	-.28**	.607

Note: ** : p < .001; Ns: non significant difference.

A graphical representation of the results can be seen in Figure 1.

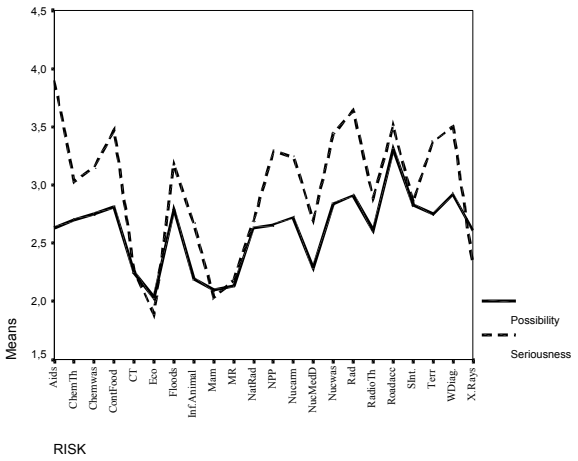


Figure 1. Possibility versus Seriousness

Most of risks showed significant differences between “possibility” and “seriousness,” being the seriousness always higher than the possibility. This result agrees with the main findings from “optimistic bias” from the “psychometric paradigm.” However, all risks related to health diagnosis present a different profile: no significant differences or differences in the opposite direction were found. The two sets showed a similar ranking for health related hazards which stayed at the bottom in both, possibility and seriousness. Other radiological risks were at top (nuclear power plants, nuclear wastes, etc.), near road accidents and terrorism. Natural radiation is near health hazards on the two rating scales.

We also examined the differences among countries in the risk ratings. Regarding “Possibility”, significant differences among countries (p < .001) were found. However, the effect size was low as revealed by eta coefficient. Eta coefficient values greater than 0.130 were obtained only for the following risks: AIDS (.209), X-rays (.150), nuclear arms (.160),

nuclear power plant (.161), nuclear wastes (.178), terrorism (.169), ecography (.151), and radioactive escape (.175). We computed the pair wise differences on the above risks, using the Games-Howell contrast. The main differences among countries were the following: In general, Peru, Ecuador, Uruguay, and Spain show higher than average means, in most of the analysed risks. On the other hand, we found that Cuba presents the lower means on all the medical applications. It could be argued that the Cuban people place special trust in the Health institutions.

The rank order or risk ratings was quite similar in all countries. The correlations between the ratings from the seven countries were in the range [.697 (Peru-Mexico) - .955 (Ecuador-Uruguay)]

There were also significant differences among the countries in all risks in the ratings of "seriousness"($p < .001$). However, the effect size was low as revealed by eta coefficient. Eta coefficient values greater than 0.130 were obtained only for the following hazards: AIDS (.143), infection from animal (.137), contaminated foods (.147), road accident (.135), nuclear power plant (.134), nuclear wastes (.145), terrorism (.148), chemotherapy (.166), radioactive escape (.175), and radiotherapy (.146). We also examined the pairwise differences on the above risks, using the Games-Howell contrast. The main differences among countries were the following: In general, Peru, Ecuador, Uruguay and Spain show higher than average means in most of the analysed risks, except for infection from animal, nuclear arms, and natural radiation. On the other hand, we found that Mexico presents, in general, the lowest means on all the risks rated.

The rank order or risk ratings was very similar in all countries. The correlations among the ratings from the seven countries were in the range [.913 (Cuba-Ecuador) - .985 (Uruguay-Mexico; Spain-Argentine)]

5.2.Information Preferences.

We will also summarise the most important results and then focus on some particularly interesting findings concerning information preferences. First, we will present data dealing with the role of information as a means of increasing the feeling of security. Then, main findings of both the preferred contents and sources of information will be discussed.

In Table 6, preferences of all the countries related to several means of increasing the feeling of security are summarised. The proposed means were: research on the health effects of radiation (RADHE), laws to regulate radiation uses (LAW), information and communication (INFOR), to have the right demand liability (RIGHT), and to be able to use means for radiation protection (MEANS)

Table 6. Feeling of security by country

COUNTRY		RADHE	LAW	INFOR	RIGHT	MEANS	TOTAL
Argentina	Frequency	3	2	46	72	344	467
	Percentage	.6%	.4%	9.9%	15.4%	73.7%	100.0%
Cuba	Frequency	3	3	40	69	236	351
	Percentage	.9%	.9%	11.4%	19.7%	67.2%	100.0%
Spain	Frequency	2	1	158	199	1118	1478
	Percentage	.1%	.1%	10.7%	13.5%	75.6%	100.0%
Mexico	Frequency	6	6	149	291	1084	1536
	Percentage	.4%	.4%	9.7%	18.9%	70.6%	100.0%
Panama	Frequency	0	1	9	22	55	87
	Percentage	.0%	1.1%	10.3%	25.3%	63.2%	100.0%
Peru	Frequency	0	0	33	37	295	365
	Percentage	.0%	.0%	9.0%	10.1%	80.8%	100.0%
Uruguay	Frequency	0	5	37	78	154	274
	Percentage	.0%	1.8%	13.5%	28.5%	56.2%	100.0%

Ecuador	Frequency	0	1	59	69	218	347
	Percentage	.0%	.3%	17.0%	19.9%	62.8%	100.0%
TOTAL	Percentage	.3%	.4%	10.8%	17.1%	71.4%	100.0%

The chi-square value was 127.27 (df=28) with $p < .001$. The contingency coefficient value was 0.160, indicating a low correlation between country and the conditions for feeling safe.

Figure 2 shows the preferences of all the countries, as far as the various considered means of increasing the feeling of security are concerned.

As can be seen, there is a clear preference for the MEANS (being able to use means for radiological protection). On the other hand, we find that neither RADHE (research on the health effects of radiation) nor LAWS were considered at all useful by the sample. The right to demand liability and the information about radiation are in an intermediate position. It is not easy to find an explanation for these data, because of the big differences and the peculiarities of the countries involved in the research.

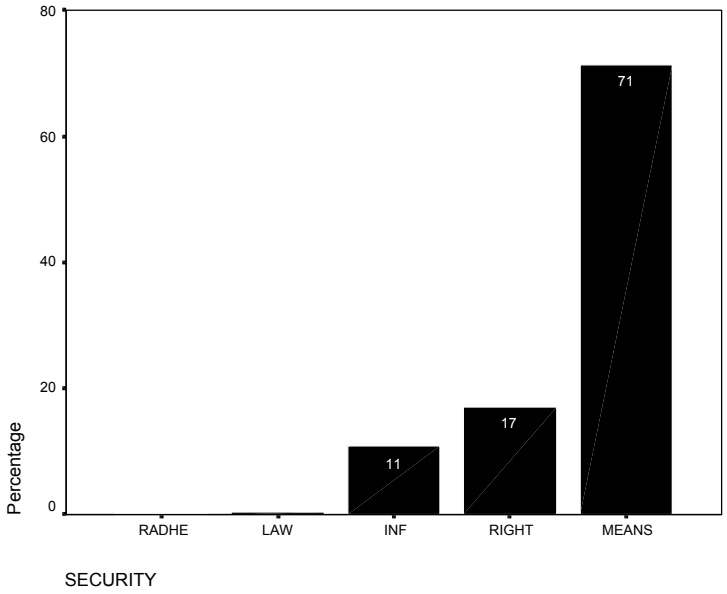


Figure 2. Feeling of security. Total.

The corrected typified residuals were analysed in order to find relevant differences among countries. Results showed that Cuba presents a pattern clearly different from the other countries. Cuban people focus their preferences on research. Spain and Peru are quite similar, emphasising availability of the means and paying less attention than other countries to the law and right aspects. On the other hand, we find Mexico, Panama, Uruguay, and Ecuador, with the opposite profile: special preference for the right to demand liability and less interest in the means than the other countries.

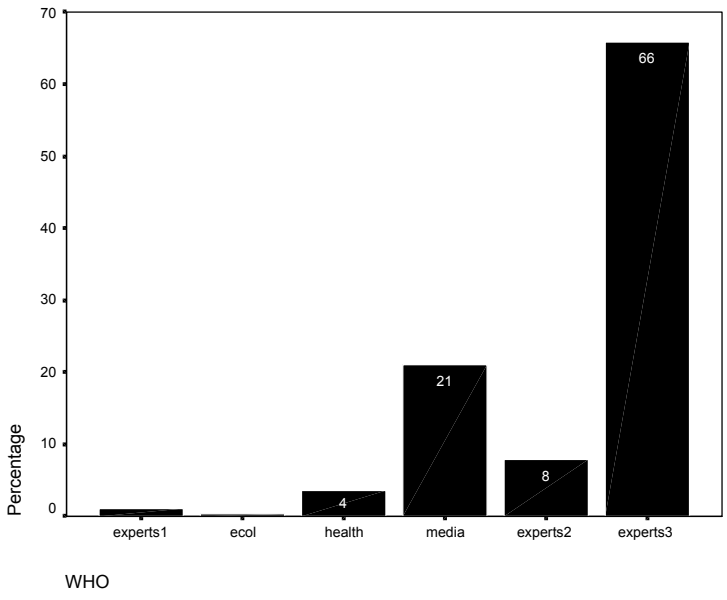
The same analysis was carried out for the question: “Who should inform the public about radiation risks?” The following potential sources were included: EXPERTS 1: experts on radiation protection from hospitals; ECOL: ecologists; HEALTH: health personnel in general; MEDIA: mass media (TV, radio, newspapers, etc.); EXPERTS 2: experts from the government; and EXPERTS 3: experts from the nuclear regulatory bodies. In Table 7 and Figure 3, the preferred sources of information in all the countries are presented.

Table 7. Preferred sources of information by country.

COUNTRY		EXPERTS1	ECOL	HEALTH	MEDIA	EXPERTS2	EXPERTS3	TOTAL
Argentina	Frequency	6	0	16	108	38	306	474
	Percentage	1.3%	.0%	3.4%	22.8%	8.0%	64.6%	100.0%
Cuba	Frequency	0	0	11	116	50	177	354
	Percentage	.0%	.0%	3.1%	32.8%	14.1%	50.0%	100.0%
Spain	Frequency	15	4	64	270	102	1025	1480
	Percentage	1.0%	.3%	4.3%	18.2%	6.9%	69.3%	100.0%
Mexico	Frequency	23	8	56	362	104	1012	1565
	Percentage	1.5%	.5%	3.6%	23.1%	6.6%	64.7%	100.0%
Panama	Frequency	1	0	2	17	5	63	88
	Percentage	1.1%	.0%	2.3%	19.3%	5.7%	71.6%	100.0%
Peru	Frequency	4	1	4	64	19	273	365
	Percentage	1.1%	.3%	1.1%	17.5%	5.2%	74.8%	100.0%
Uruguay	Frequency	2	1	21	54	42	155	275
	Percentage	.7%	.4%	7.6%	19.6%	15.3%	56.4%	100.0%
Ecuador	Frequency	1	0	8	54	32	253	348
TOTAL	Percentage	1.1%	.3%	3.7%	21.1%	7.9%	66.0%	100.0%

The chi-square value was 151.52 (df=35) with $p < .001$. The contingency coefficient value was .172, indicating a low correlation between country and preferred sources of information

Figure 3. Preferred sources of information. Total.



There is a clearly most-preferred source of information: the EXPERTS 3, experts from the nuclear regulatory bodies. Almost 70% of the sample considered that they should be the ones informing the public about radiation risks. Even though the study was carried out in the health area, experts on radiation protection from hospitals (EXPERTS 1) are not considered a suitable source of information by most of the sample. Only 1% of the interviewed subjects chose that option. Another kind of experts were also included among the potential sources: EXPERTS2, those from the government. This last kind of experts were selected by 8% of the sample, being the third preferred option.

Mass media and ecologist groups were also included in the list of possible sources of information, in order to check if the last findings of the literature applied in this specific context, i.e., the increasing levels of credibility of both potential sources of information. Results showed that the media do follow the pattern identified in other risks contexts. The

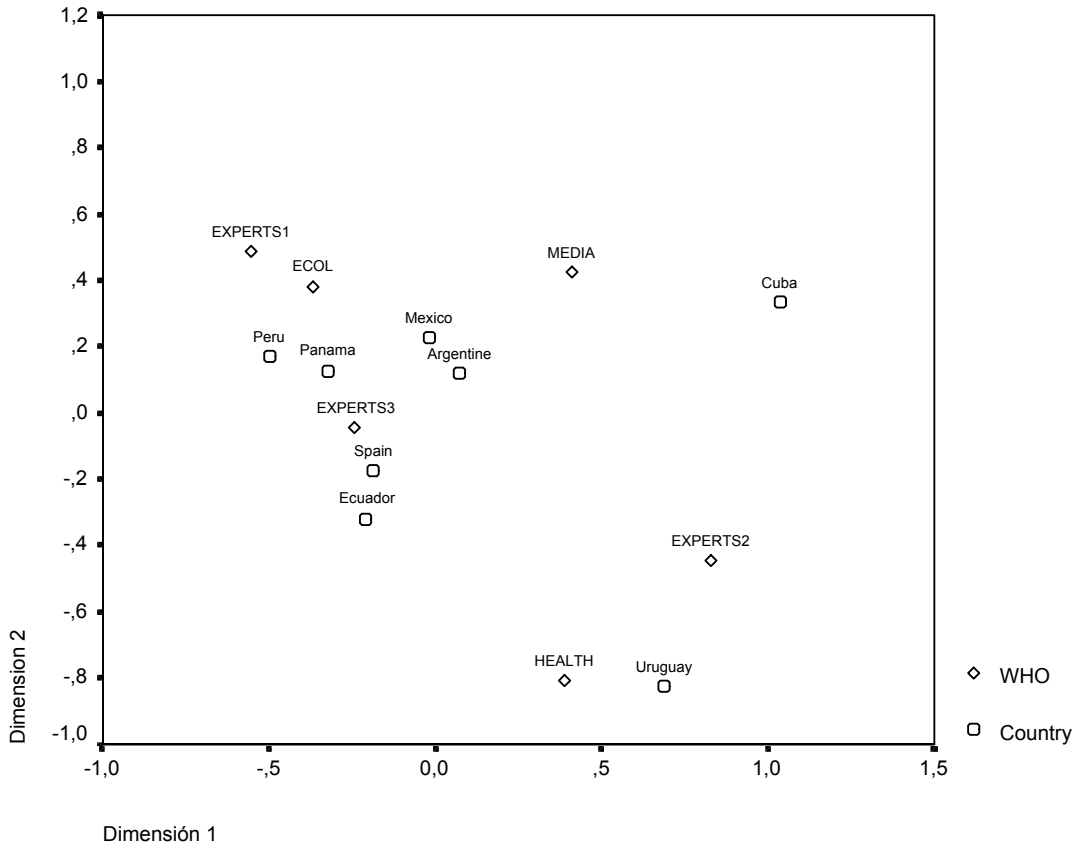
media were selected by 21% of the sample, holding the second place of all considered sources. However, the ecologists were not considered within the health context. In fact, they were the least mentioned source.

Relevant differences among countries were identified with regard to "who should inform." As in the previous question (role of information), Cuba presents an unusual profile, very different from the other countries. On this island, experts from the government and the mass media are more preferred than in other countries. Uruguay also presents quite a singular profile, focusing on the mass media and the health professionals and paying less attention to the experts from the nuclear regulatory bodies. Again, Spain and Peru shared a very similar pattern, with high percentages of people choosing the experts from the nuclear regulatory bodies and few deciding in favour of the mass media. Ecuador follows this same pattern.

We carried out a correspondence analysis, with symmetrical normalisation, in order to explain the relationship between country and "Who Should inform." We retained two dimensions (eigenvalues 0.137 and 0.082, respectively) accounting for 83.8% of the total inertia.

In Figure 4, a graphic representation of the relationship between country and the potential sources of information is shown.

Figure 4. Preferred sources of information by country.



The figure confirms the aforementioned pattern. Most of the countries are grouped around "Experts 3," Uruguay is located near Health Personnel, and Cuba stands alone.

Lastly, we will present the results obtained for the question: "What kind of information on radiation risks would you like to receive?." The following potential types of information were included: INF1: general information; INF2: detailed scientific information; WHERE: to know

where to obtain answers to specific questions; MEANS2: available radiation protection means; RISKS: level of risks in different areas, and HEEF: effects on health

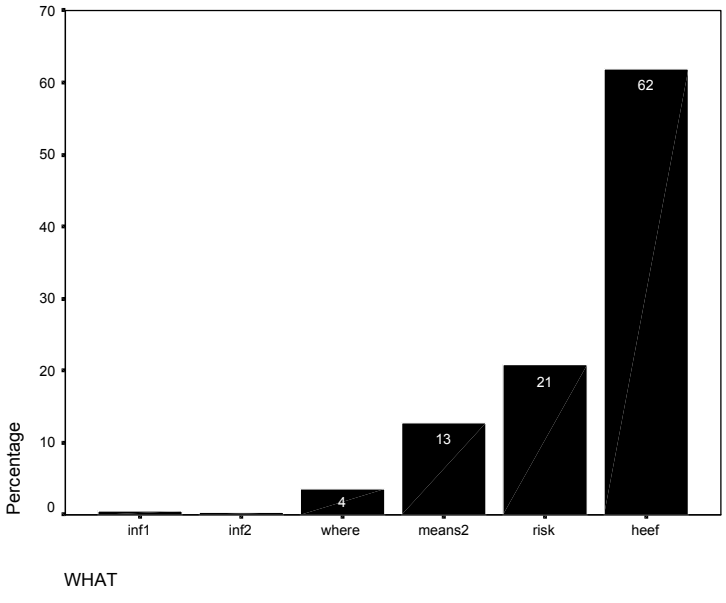
Table 8. Kind of information by country.

COUNTRY		INF1	INF2	WHERE	MEANS2	RISK	HEEF	TOTAL
Argentina	Frequency	2	1	12	74	86	302	477
	Percentage	.4%	.2%	2.5%	15.5%	18.0%	63.3%	100.0%
Cuba	Frequency	6	0	18	52	92	184	352
	Percentage	1.7%	.0%	5.1%	14.8%	26.1%	52.3%	100.0%
Spain	Frequency	7	2	39	128	280	1020	1476
	Percentage	.5%	.1%	2.6%	8.7%	19.0%	69.1%	100.0%
Mexico	Frequency	5	12	75	264	355	845	1556
	Percentage	.3%	.8%	4.8%	17.0%	22.8%	54.3%	100.0%
Panama	Frequency	0	0	0	14	20	53	87
	Percentage	.0%	.0%	.0%	16.1%	23.0%	60.9%	100.0%
Peru	Frequency	1	3	5	28	85	241	363
	Percentage	.3%	.8%	1.4%	7.7%	23.4%	66.4%	100.0%
Uruguay	Frequency	2	0	15	30	59	168	274
	Percentage	.7%	.0%	5.5%	10.9%	21.5%	61.3%	100.0%
Ecuador	Frequency	3	0	8	44	48	244	347
	Percentage	,9%	,0%	2,3%	12,7%	13,8%	70,3%	100,0%
TOTAL	Percentage	,5%	,4%	3,5%	12,9%	20,8%	62,0%	100,0%

The chi-square value was 167.22 (df=35) with $p < .001$. The contingency coefficient value was 0.182, indicating a low correlation between country and the preferred types of information.

As can be seen in Figure 5, the most appreciated knowledge is that related to the effects of the radiation on health, more than 60% of the sample chose this option. In second place, we find the one related to the levels of risk, followed by the available means for radiation protection. A very interesting result is the one related to "information," both general and detailed. There is very little interest, almost none at all, in receiving this type of information. It seems that the population prefers more practical knowledge: how they may be affected and how to protect themselves.

Figure 5. Kind of information. Total.



As in the previous questions, relevant differences among countries were identified with regard to the type of information the public would like to receive. Once again, Cuba presents an unusual profile, very different from the other countries. Cuban people are more interested in receiving general information and in knowing where to find answers to specific questions. In contrast with most of the countries, they are not so interested in health effects. In this case, Mexico shows a quite similar profile: less interest in health effects and especial attention to WHERE (to find answers), MEANS (for radiation protection), and INF2 (scientific detailed information). Spain presents almost the opposite pattern, focussing on health effects and paying less attention to the available means for radiation protection and where to find answers to specific questions. This last profile is shared by Ecuador.

We carried out a correspondence analysis, with symmetrical normalisation, in order to account for the relationship between country and "What kind of information would the public like to receive?" We retained two dimensions (eigenvalues 0.152 and 0.069, respectively) accounting for the 81.6 of the total inertia.

A graphical representation of all the countries with regard to the types of information preferences can be seen in Figure 6.

Figure 6. Kind of information by country.

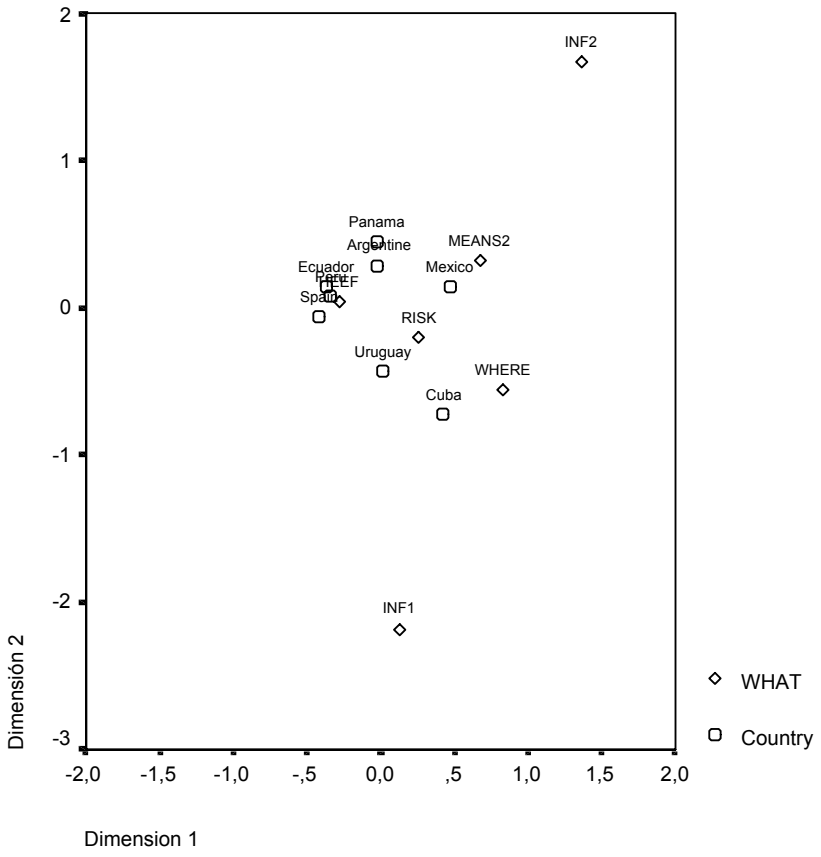


Figure 6 confirms the aforementioned pattern in two dimensions. Both types of information, INF1 (General information) and INF2 (detailed information), are located very far from all the countries. Ecuador, Argentina, Panama, and Spain, are very close to "Health Effects", Mexico to "Available means for radiation protection," and Cuba to "Where to find answers to specific questions."

6. Conclusions:

6.1. Possibility versus Seriousness.
The "optimistic bias" identified by the "Psychometric Paradigm" is confirmed by our data: seriousness is rated higher than possibility in most risks. There were few exceptions, most of them related to medical applications.

6.2. Risk ranking.
Risk ranking was very similar in all the countries, with the known, voluntary, and beneficial risks remaining at the bottom positions. As in other studies, radiological risks related to industrial activities were at the top positions. The correlations of the risk ratings from the seven countries are quite high, both in possibility and seriousness, reaching values greater than 0.90 in seriousness.

6.3. Conditions for feeling safe and Role of information.
Among the possible options considered for increasing the feeling of security, there is a clear preference for the MEANS (being able to use means for radiological protection). On the other hand, we find that neither RADHE (research on health effects of radiation) nor LAWS were considered at all useful by the sample. The right to demand liability and information about radiation are in an intermediate position.

6.4.Sources of information.
Experts from the nuclear regulatory bodies are the most preferred source of information: almost 70% of the sample considered that they should be the ones informing the public about radiation risks. Even though the study was carried out in the health area, experts on radiation protection from hospitals are not considered as a suitable source of information by most of the sample. Only 1% of the interviewed subjects chose that option. Another kind of experts was also included among the potential sources: those coming from the government. This last kind of experts was selected by 8% of the sample, being the third preferred option.

Mass media and ecologist groups were also included as possible sources of information in order to check whether the most recent findings of the literature applied in this specific context, i.e., the increasing levels of credibility of both sources of information. Results showed that the media do follow the pattern identified in other risks contexts. The media were selected by 21% of the sample, holding the second place of all considered sources. However, the ecologists are not considered within the health context. In fact they were the least mentioned sources.

6.5. Type of information
The most appreciated information is that related to the effects of the radiation on health, more than 60% of the sample chose this option. In second place, we find that related to the levels of risk, followed by the available means for radiation protection. A very interesting result is the one related to "information," both general and detailed. It can be said that there is very little interest, almost none at all, in receiving this type of information. It seems that the population prefer more practical knowledge: how they may be affected and how to protect themselves.

6.6. Cross-cultural differences.
Cuba presents an unusual profile, very different from the other countries in all analysed areas. Spain and Peru tend to show quite similar profiles. In most of the issues, Ecuador shares the profile of these countries. Uruguay and Mexico vary, depending on the specific area under consideration.

Regarding possible implications for risk communication programs, we would like to underline the need to adapt both the contents and the sources of information to the national peculiarities.

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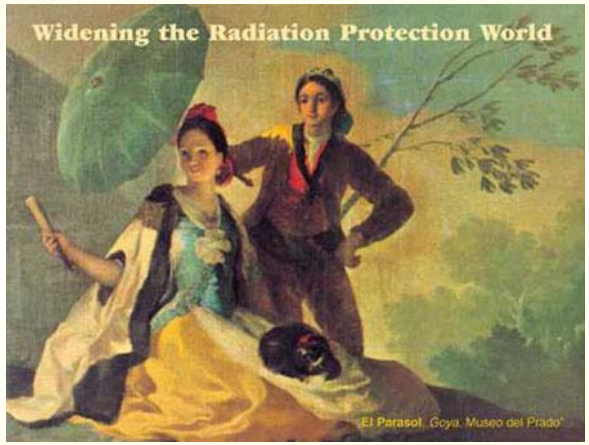


Risk perception and request for information about radiological risks in the health area

Rosario Martinez Arias - Ana Prades

- **Overview of Risk Perception Research**

- **A study on Risk Perception & Request for Information in the Health Area**

Overview of
Risk Perception Research

Origin of the Research line

- USA/1960: Commercial application of nuclear energy: Public Opinion concern
  (proximity with nuclear power plants)

- "Public Education" Campaign based on the "objective risk"

- Public opposition increases more and more ..:
  "Objective" / "Subjective" debate → Deaf dialogue

DECISION MAKERS APPEALED TO SOCIAL SCIENTISTS :
Why is this "lack of understanding" taking place?
How could it be overcome?

Theoretical / Methodological Approaches

PSYCHOLOGY
Pyschometric Paradigm

SOCIO - CULTURAL
Cultural Theory
Social Amplification of Risk

Why do some risks generate high anxiety and fear while others do not?

Relevance of social context

Relevance of risk "transmitters"

ATTRIBUTES OF RISKS

CULTURAL BIAS

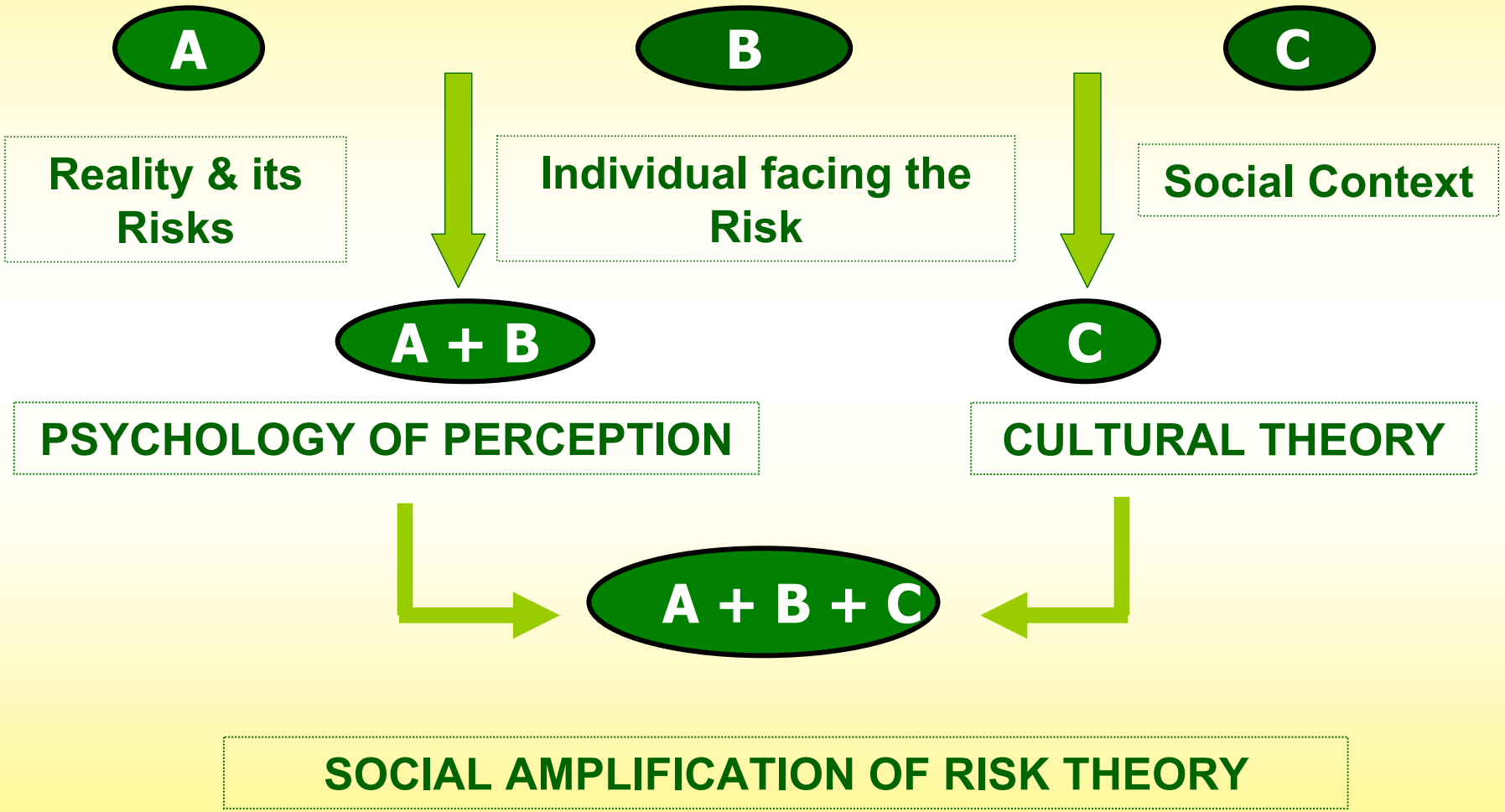
INFORMANTS BEHAVIOUR

QUANTITATIVE

QUALITATIVE

MULTIPLE

Risk perception research



Theoretical Approaches

Psychometric Paradigm

- Risks are not perceived in a random way but according to a perceptive structure defined by two factors: Level of knowledge (familiarity) and Catastrophic potential (Sovic, 1987).

  This structure applies for both experts and the public, and has been empirically verified for radiological risks in several countries, including Spain.

- The core of the discrepancies between experts and the public lies in the third factor of the perceptive structure.

  This third factor – “tampering with nature” (Sjöberg, 2000) or “evaluative factor" (Solá et al , 1999), identified by recent research, includes the set of values and ethical principles underlying risk evaluation.

Theoretical Approaches

Cultural Theory

- The "context" (local, cultural, historic, socio-economic, regulatory and other contextual factors) in which risks are perceived clearly influences the configuration of perceptions (Horlick-Jones, 2000).

Local construction of risks shows clear implications for risk communication, local discourses of risk, proximity, trust, etc...

Social Amplification of Risk

- Social agents - risk transmitters – by attenuating or amplifying risks – play a key role in risk perception and responses towards the issue (Kassperson, 1988)

Behaviour and characteristics of these agents (credibility, social distance, etc.) significantly affect social risk perceptions."

State of the Art

Key Factors in Risk Perception - Acceptability

- Catastrophic Potential
- Understanding: lack of understanding increases worries and concerns
- Benefits / Compensations
- Trust in authorities: key factor
- Control: special sensibility towards risks out of personal control
- Wilfulness: imposed decisions/ out of local control multiply risk aversion

Key Factors in Nuclear Risk Perception

- Potential of accident with serious consequences
- Complexity of the technology – not easily understandable
- Risk source is not perceived by human senses (radioactivity)
- Neither its need (energy) nor its benefits are perceived
- Control of the projects is centralized (not local)

From Risk Perception to Risk Governance:

Communicaction and public participation processes

Psychometric Paradigm Contribution: Need to inform and promote social participation processes.

"Known and voluntary are always perceived as less threatening than unknown and imposed" (Knowledge and feeling of control influence the "feeling" of risk and threat" but no its acceptability).

Cultural Theory Contribution: Need to integrate the information and the participation in the "worldviews" associated to each social group

"The public is not an homogeneous entity. There are different social groups (Cultural bias) and each of them may present clearly different perceptions and concerns."

Social Amplification of Risk Theory Contribution: Need to analyse and take into account the "informants" behaviour.

"Social agents, by attenuating or amplifying risks, play a key role in social perception and public responses towards risks. Behaviour and characteristics of these agents significantly affect social risk perceptions."

A study on Risk Perception and Request for Information in the Health Area

- Goal:

A comparative Latin-American study on radiological risk perception in the health area

✓**Replication of the original study by Slovic *et al.*** to test general theory and generate a body of exploratory new knowledge of public opinion in distinct countries.

✓Some **technologies frequently used in the health context (i.e., X-rays)** have been studied "as examples of radiological hazards with low risk," but no study has used this type of hazards as target.

✓To examine the **social demands for information about radiological risks with regard to diagnostic and therapeutic applications**.

- The Participants:

Country	Frequency	Percentage
Argentina	513	9.8
Cuba	360	6.9
España	1.556	29.8
Mexico	1.705	32.6
Panama	88	1.7
Peru	372	7.1
Uruguay	280	5.4
Ecuador	351	6.7
TOTAL	5.225	100.0

Gender	Frequency	Percentage
Male	1.984	38.2
Female	3.206	61.8
TOTAL	5.190	100.0

There is no medical or scientific explanation for this overrepresentation of females. A possible reason could be their willingness to participate in the research

Educational Level	Frequency	Percentage
No studies	139	2.8
Primary Studies	796	16.0
Secondary Studies	1.536	30.9
University	2.505	50.3
TOTAL	4.796	100.0

According to Spanish levels, educational level is quite high. It could be argued that lower educational levels refused more often or were not capable to fill the questionnaire.

• The Survey:

✓ **General risk perception:** 22 Risks to be rated on possibility and seriousness

✓ **Risk perception of diagnostic & therapeutic radiological applications** as a patient

✓ **Conditions for feeling safe:** Research, legislation, information, etc.

✓ **Information issues:** Who should inform, what kind of information should be provided, etc.

Evaluation of the questionnaire / Demographic profile

• The Procedure:

✓Taking into account the national singularities (educational levels, suitability of the waiting rooms, etc.), each national coordinator decided the best procedure in his/her country.

✓In most of the countries the questionnaire was distributed in the waiting rooms, **handed out to the patients,** and was **self-administered.**

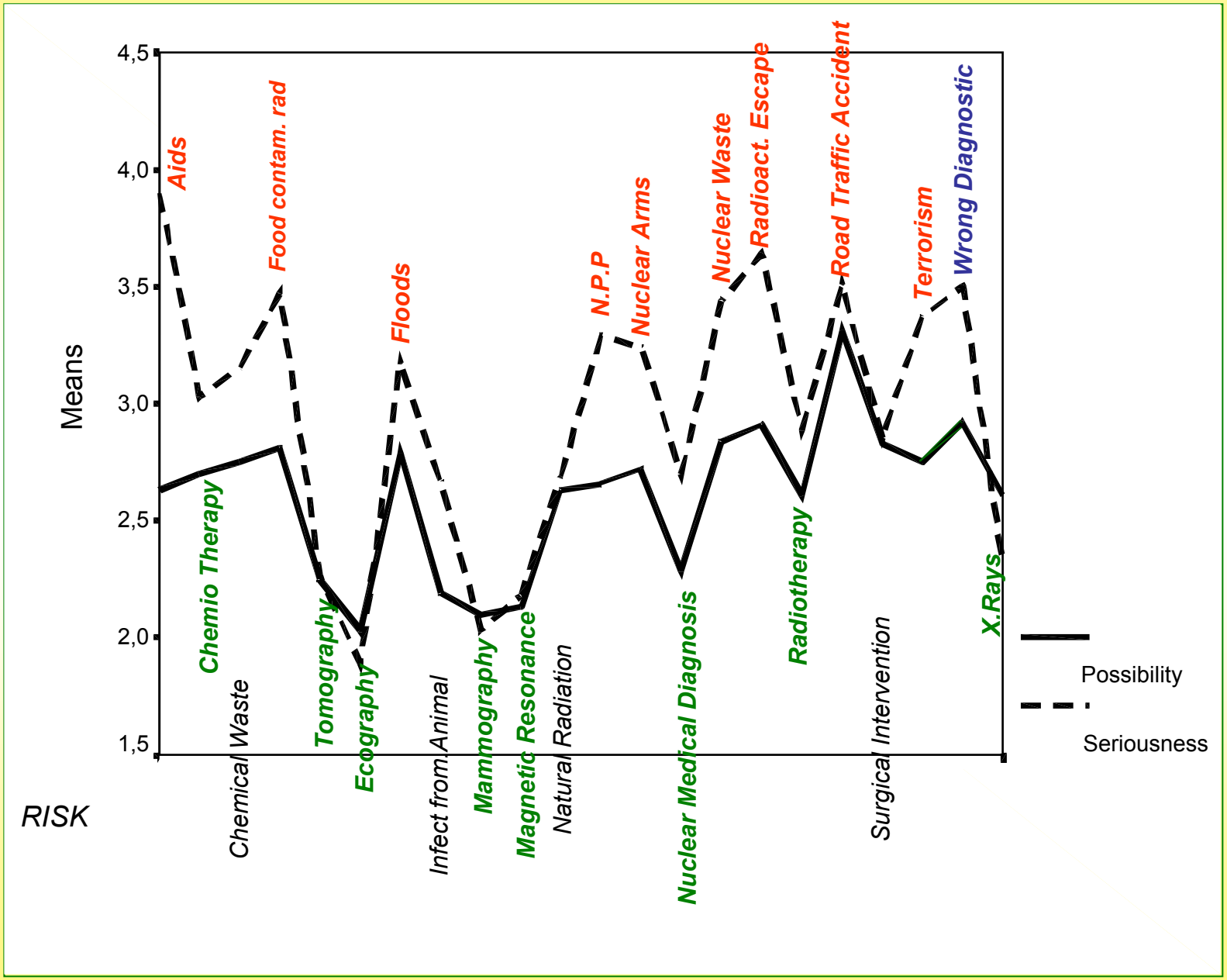
✓To achieve an acceptable response rate it was necessary to use a **face-to-face procedure** in the following countries: Cuba, Mexico, Brazil, Colombia, and Uruguay.

- Results:

Risk Perception

Request for information

Figure 1. Possibility versus Seriousness



Request for information

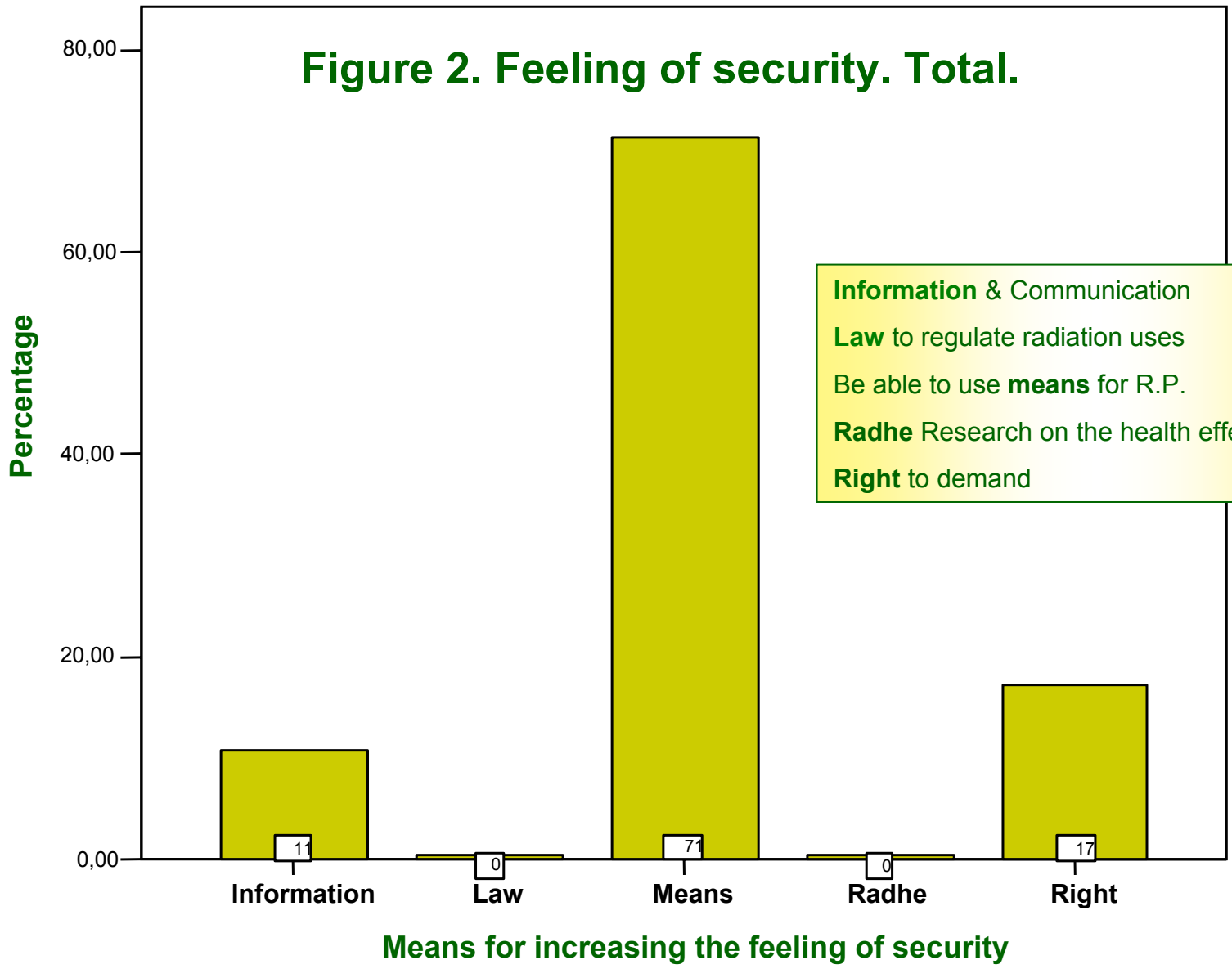


Figure 3. Preferred sources of information. Total.

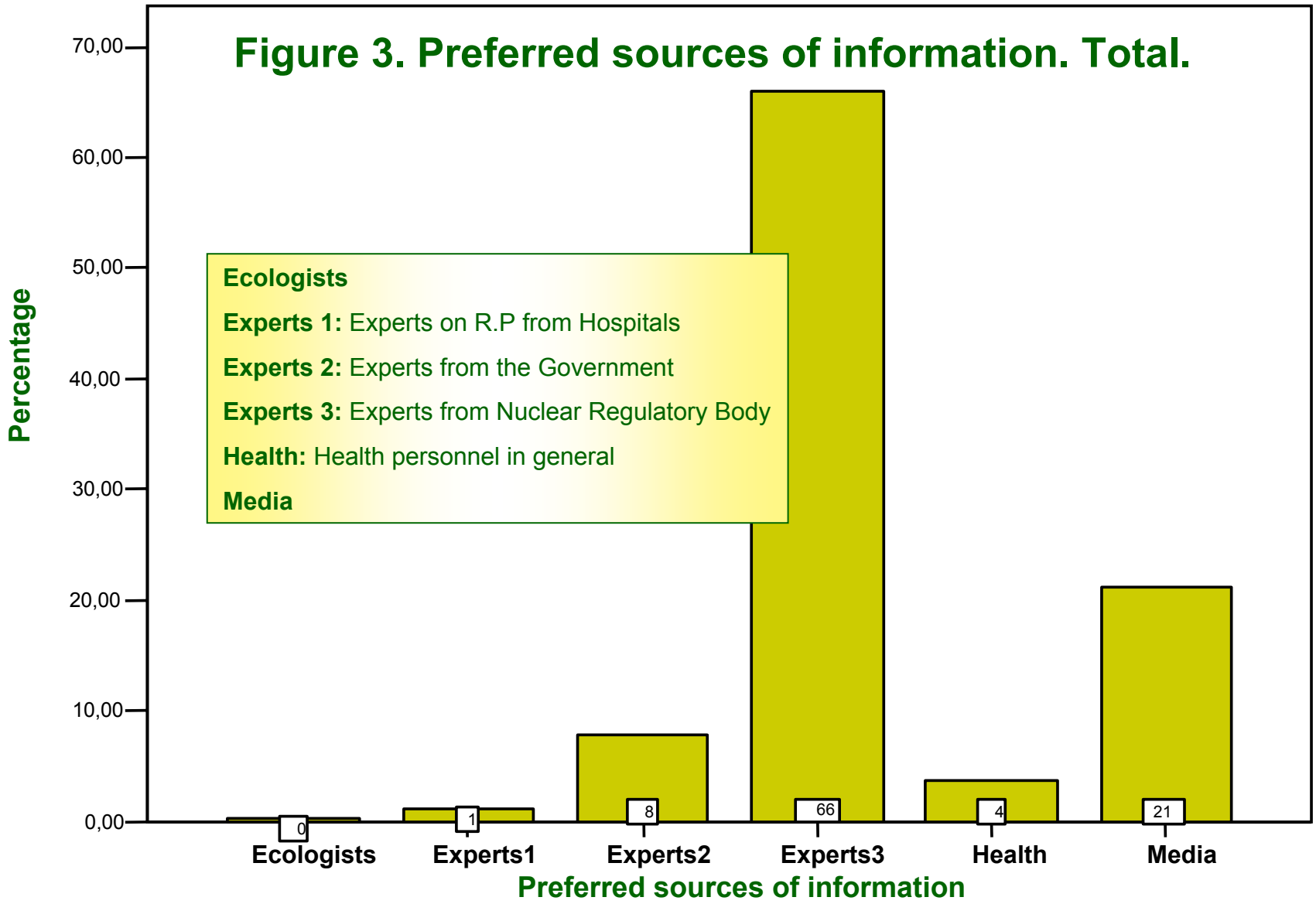


Figure 4. Preferred sources of information by country.

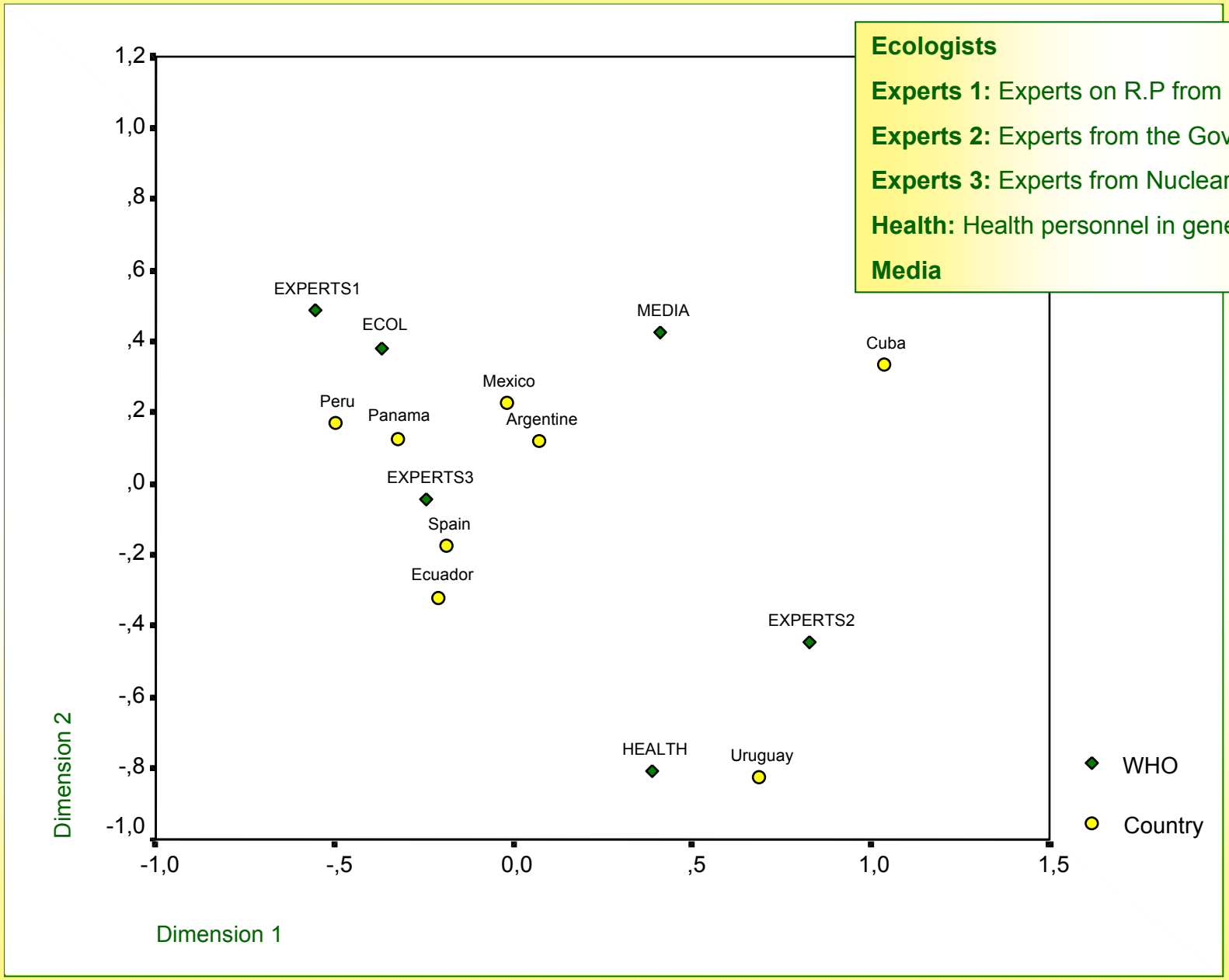


Figure 5. Kind of information. Total

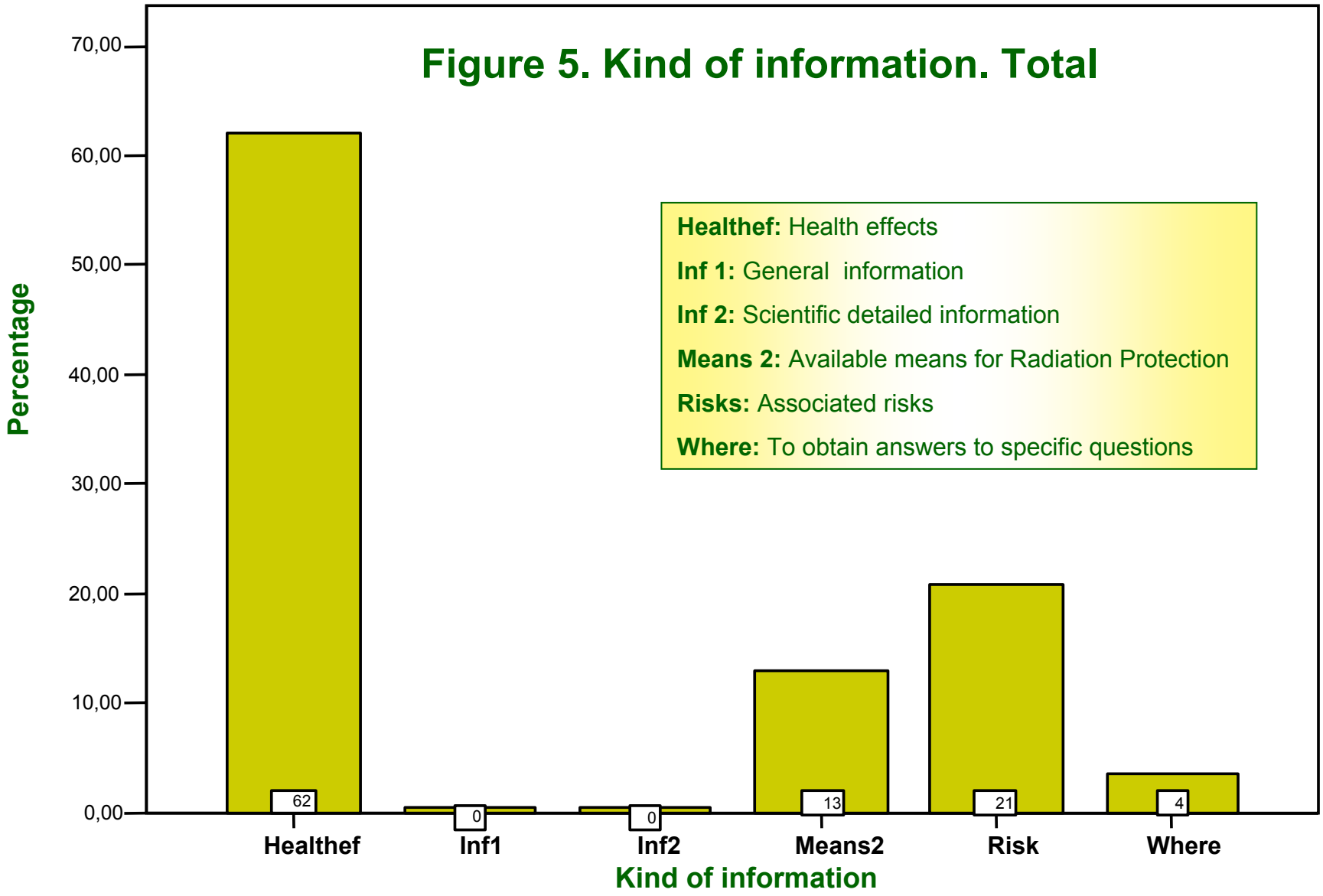
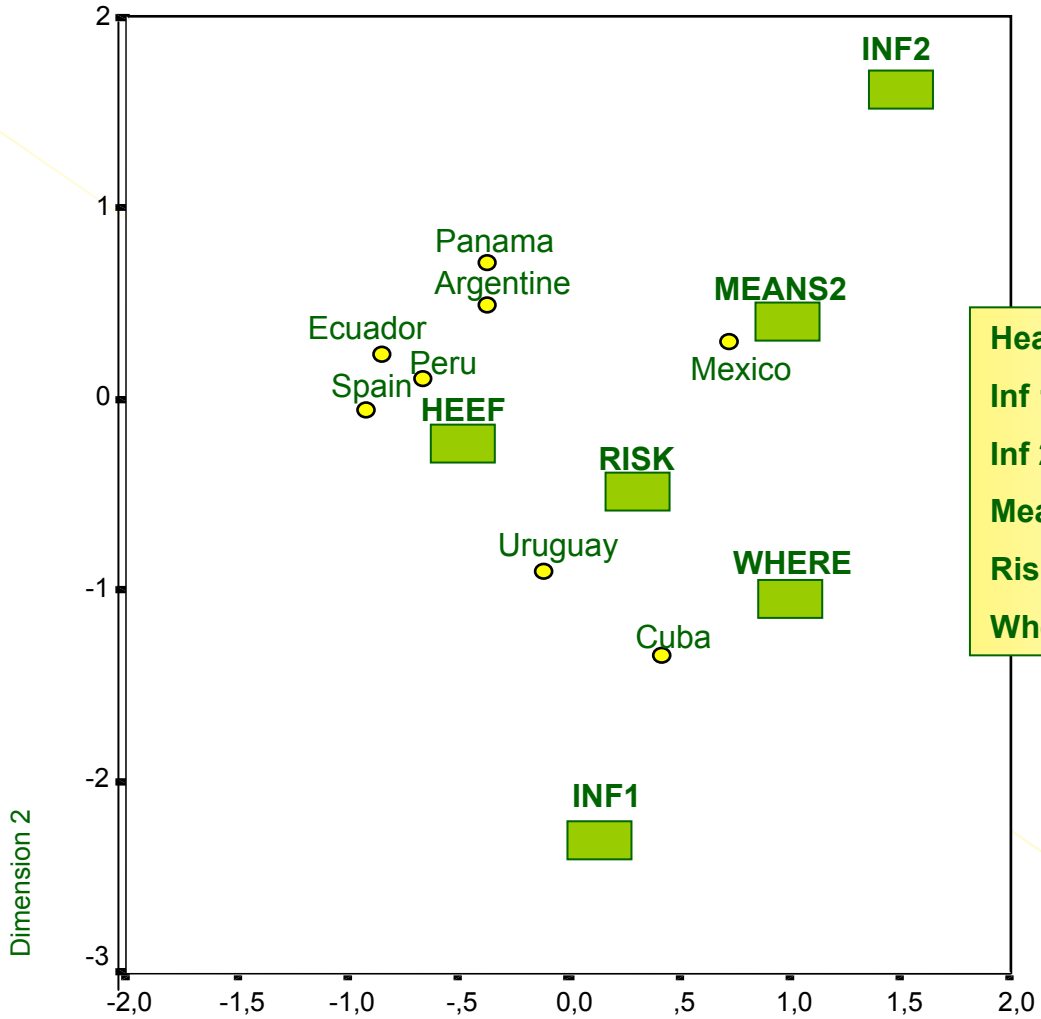


Figure 6. Kind of information by country



Healthef: Health effects

Inf 1: General information

Inf 2: Scientific detailed information

Means 2: Available means for R. P.

Risks: Associated risks

Where: To obtain answers

Type of Information

Country

• Conclusions:

1. Possibility versus Seriousness

The **"optimistic bias"** ("Psychometric Paradigm") is confirmed by our data: seriousness is rated higher than possibility in most risks. There were few exceptions, most of them related to medical applications.

2. Risk ranking

Risk ranking was very similar in all the countries, with **the known, voluntary, and beneficial risks remaining at the bottom positions**. As in other studies, radiological risks related to industrial activities were at the top positions. The correlations of the risk ratings from the eight countries are quite high.

Request for information

1. Conditions for feeling safe and Role of information.

- **MEANS** (*Being able to use means for radiological protection*)**:** Most preferred
- **Neither RADHE** (*Research on health effects*) **nor LAWS:** are useful at all

2. Sources of information.

- **Experts from nuclear regulatory bodies:** Most preferred source *(70% chose them).*
- **Experts on radiation protection from hospitals:** Not a suitable source *(Only 1% chose that option).*
- **Media: Second preferred source**. *(Selected by 21% of the sample)*
- **Ecologists:** Not considered in the health context *(The least mentioned source).*

3. Type of Information

- **"Effects of Radiation on Health":** Most preferred *(60 % chose this option).*
- "**Available means for radiation protection":** Second option.
- **"General and detailed Information":** Little interest, almost none.

Population preferences' focus on Practical knowledge
(How they may be affected and how to protect themselves).

4. Cross-Cultural Differences

- **Cuba:** Unusual profile
- **Spain, Peru and Ecuador:** Quite similar profiles
- **Uruguay and Mexico:** Vary depending on the area under consideration

OTHER RESULTS OF THE STUDY

Structure of Risk Perception

Differences between patients and experts

Differences within patients: gender and age

OTHER RESULTS OF THE STUDY

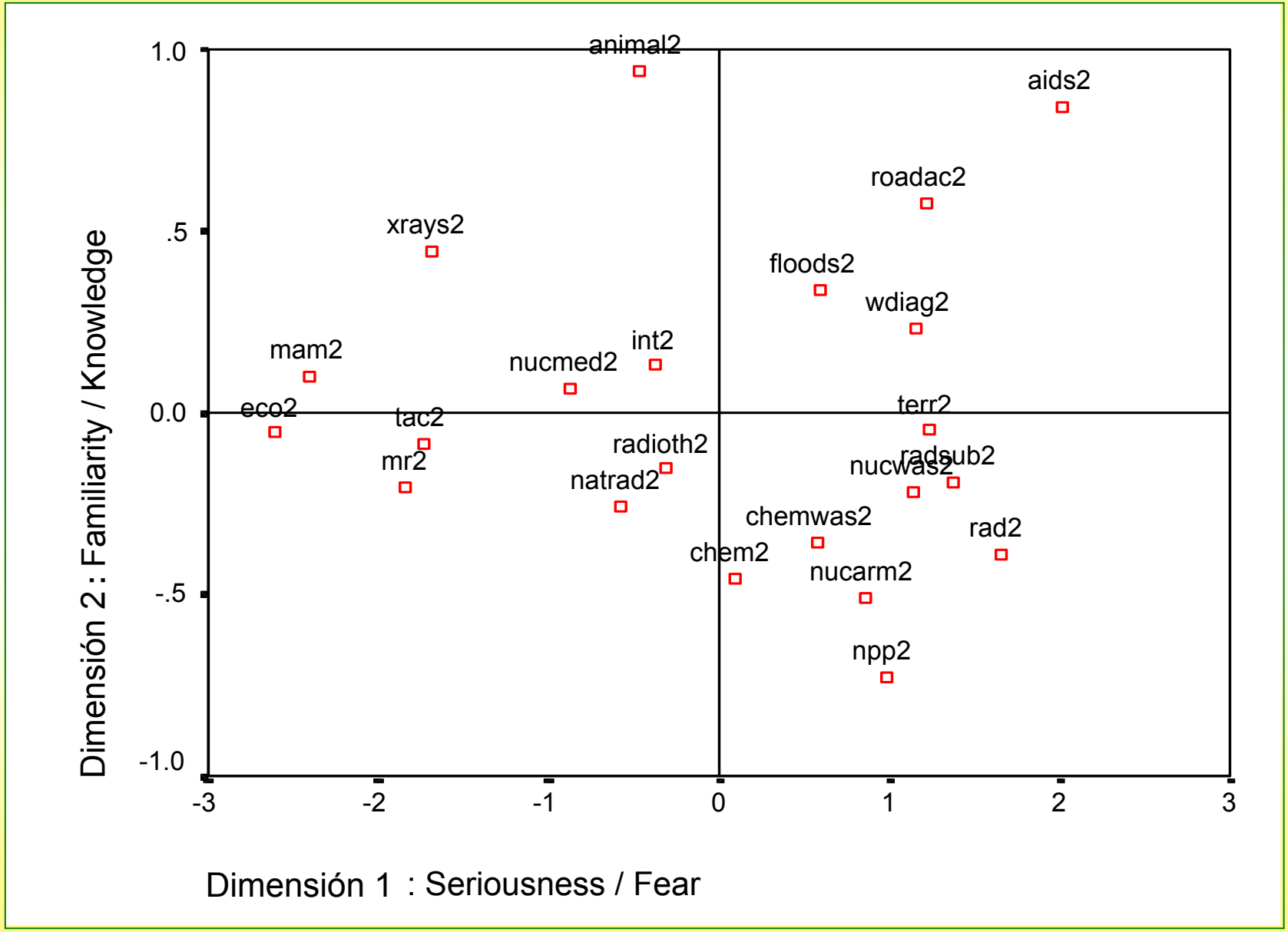
Structure of Risk Perception

Risk ratings on seriousness show a bi-dimensional structure in all countries, both for patients and for experts.

- First dimension: Risks perceived as serious and feared.
  It could be compared with the "catastrophic potential" factor.

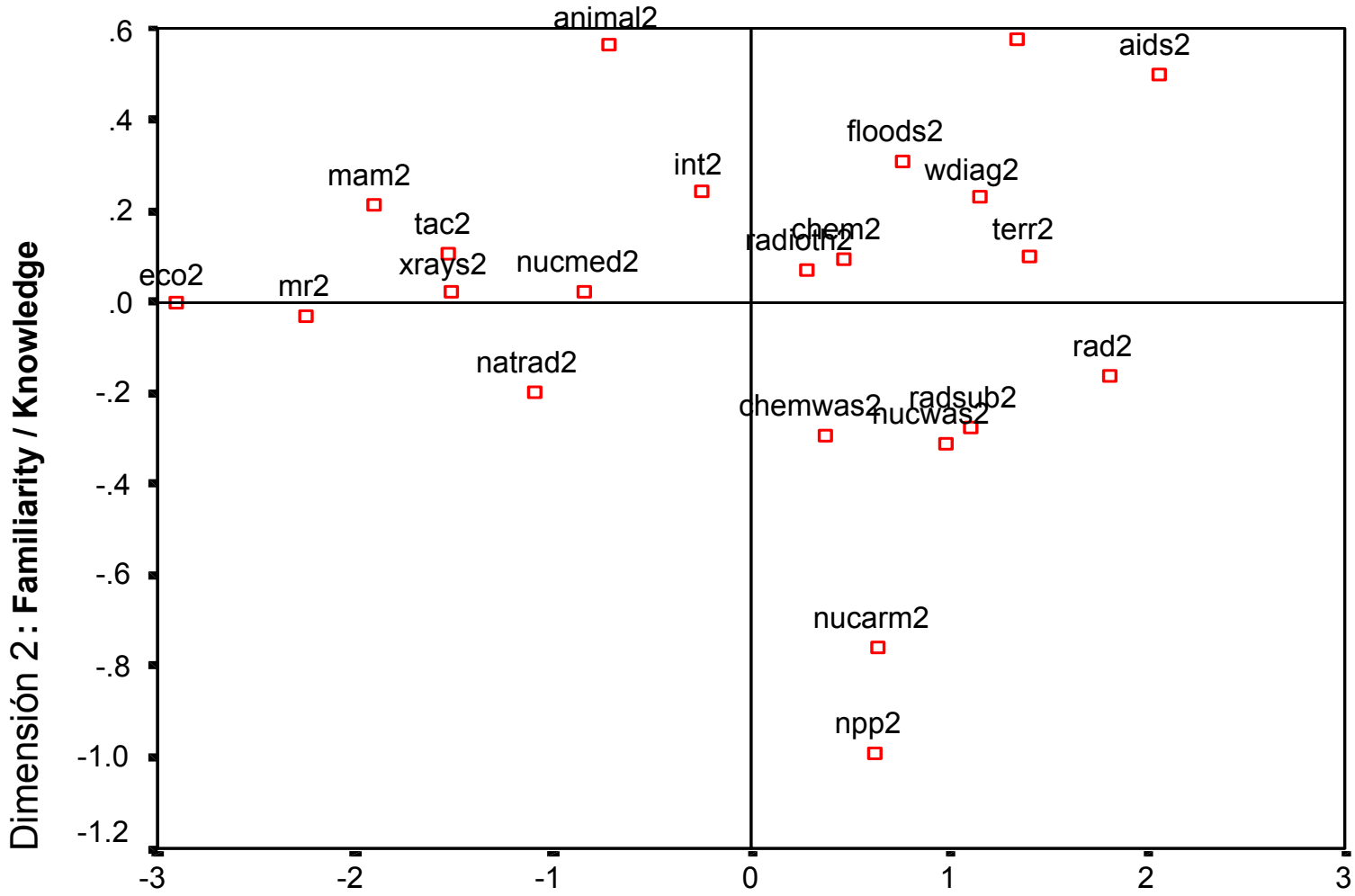
- Second dimension: Almost all health applications of radiation.
  It could be associated to the "familiarity" factor.

Sample of Patients



Sample of experts

MDS: Multi Dimensional Scaling



Differences between experts and patients

Differences were found for most of the risks although lower than in other studies.

Differences regarding perceived seriousness "as patient" and as "professionally exposed"

Means are similar in the two groups. Statistically significant differences were only found for ECOGRAPHY (patients rating higher) and for RADIOTHERAPY (experts rating higher)

These results are very different from the ones obtained in other context, such as the one of chemical or nuclear industry.

Figure 7. Risk ratings of experts and the public

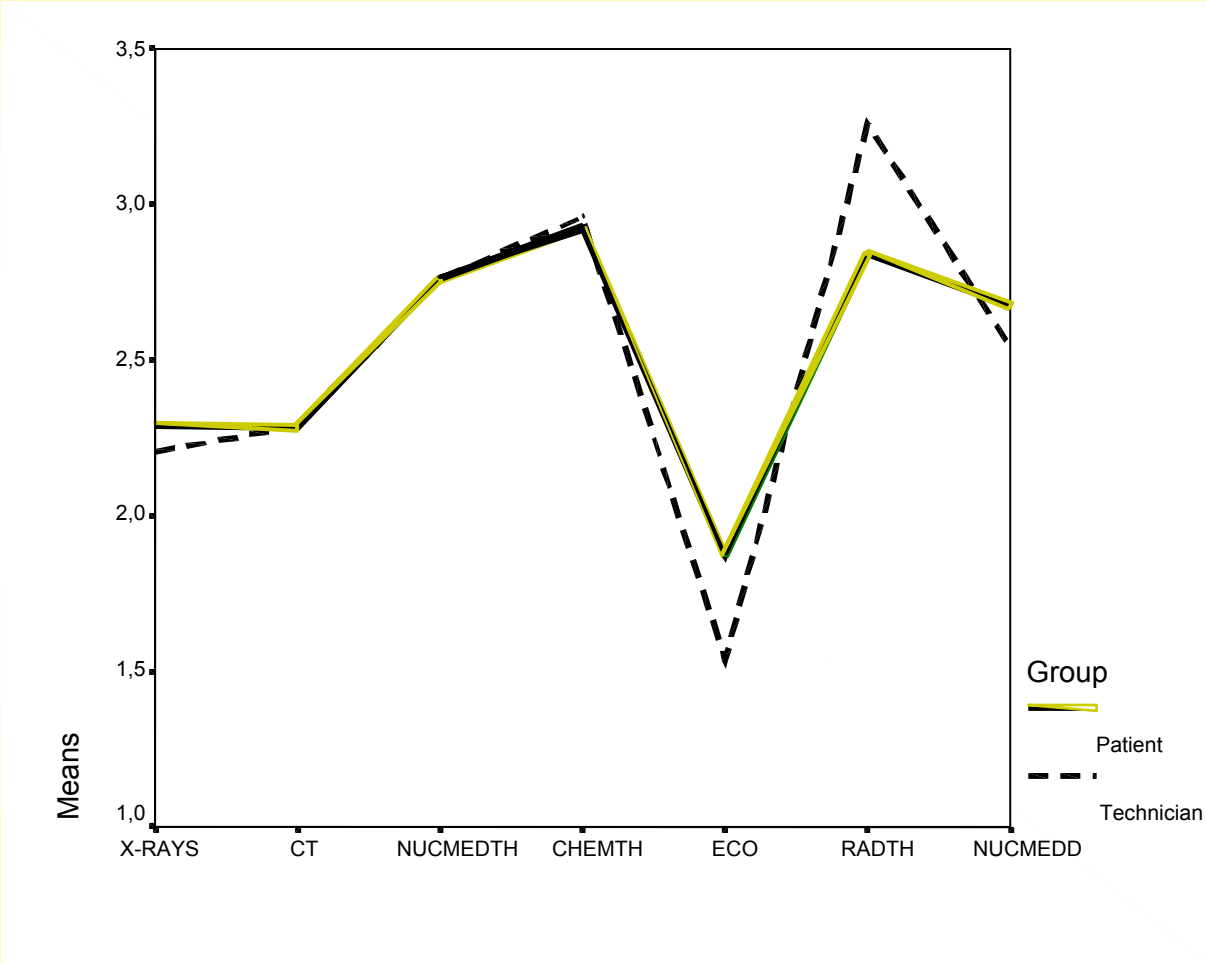
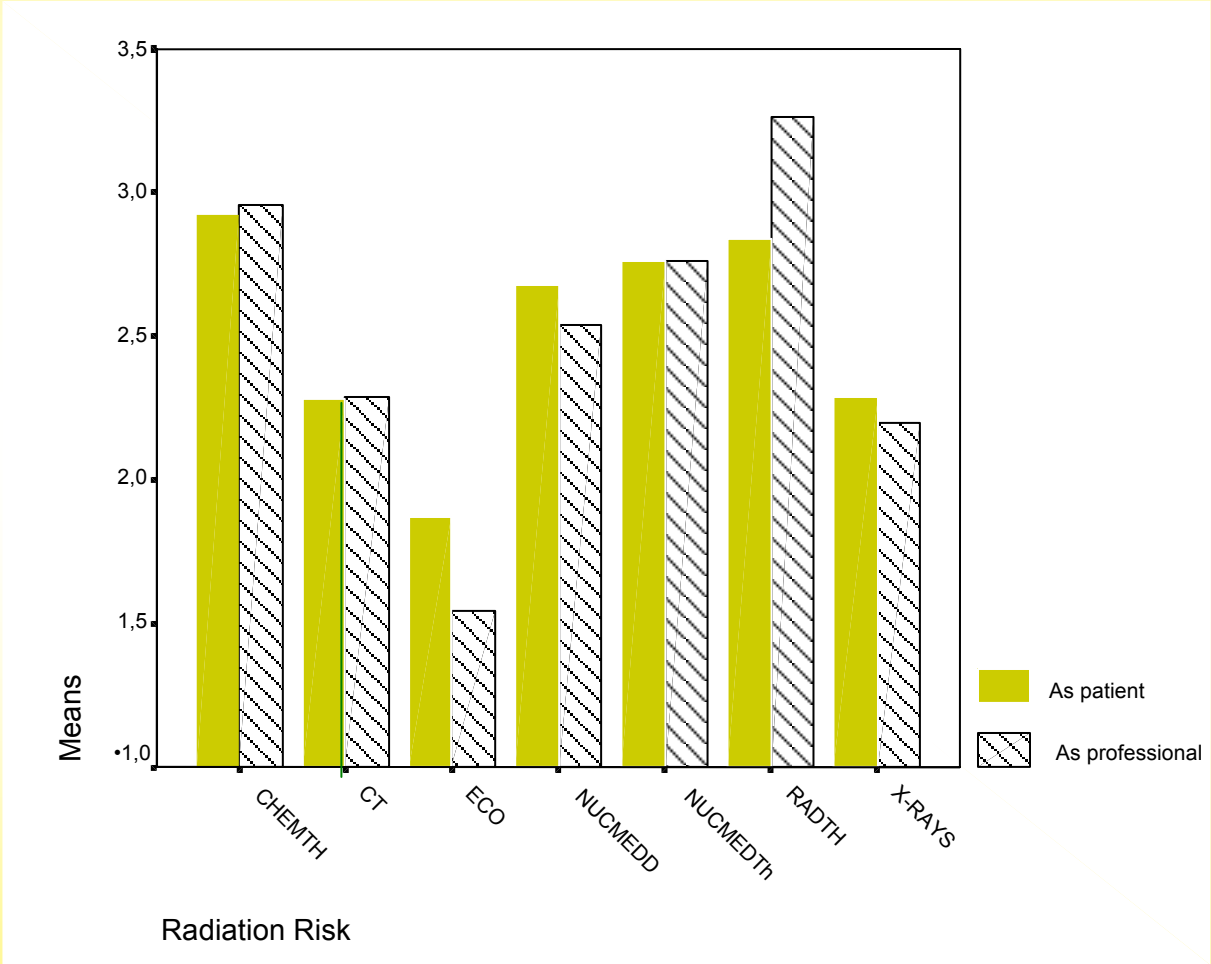


Figure 8. Risks rated “as a patient” and “as a professional at risk”



Individual differences in the patients' sample

Gender and age were not relevant in order to explain the perception of medical applications of radiation.

This result is partially consistent with previous research, as no permanent pattern has been identified in this regard.