



PUBLIC ACCEPTANCE OF TECHNOLOGIES IN SPAIN

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Introduction

Giving an accurate communication of the state of technology to our population is a very important fact, since it may change the way that scientific development will be enforced or weakened. Misinformation can stop improvement or development of a certain technology which in an advanced stage could be really valuable for the evolution of society.

The aim of this project is to analyze the perception of Spanish population regarding five selected technologies: **vaccines**, **cloning**, **stem cells**, **genetically modified organisms (GMO)** and **assisted reproduction techniques (ART)**. This has been acquired by risk-benefit evaluation of telematic surveys in a ten point scale.

This study will help us tell the differences of the gap between perceptions and reality, causes of these gap and some possible future solutions, which will help to improve not only the communication of science to population, but also the knowledge and confidence in science.

Objectives

Evaluate public acceptance of five selected technologies and compare their risk-benefit perception to the actual risks and benefits.

- **Select** five technologies still under public discussion.
- **Evaluate** risk-benefit perception of Spanish population regarding these selected technologies using telematics.
- **Compare** the results by dividing respondents in different groups in order to find correlations between perceptions and the group.
- **Compare** public perception with real risks and benefits.

Materials and Methods

• **Technologies selection.** Technologies selection was done after an extensive research of controversial technologies which are still on focus for public opinion. Technologies selected are: vaccines, cloning, stem cells, genetically modified organisms (GMO) and assisted reproduction techniques (ART).

• **Telematic surveys.** Surveys were done using *Google Forms* so they could be accessible online. Diffusion of the survey was broadcast through social networks such as Twitter and Facebook. The form was divided into two parts:

- **Demographic data collection** (gender, age, level of studies).
- **Specific sections for each technology.** Each technology was divided into three blocks of questions: (1) level of knowledge of the technology, (2) risk and benefits rank in 0 to 10 scale and (3) arguments used to determine the risk and benefits rank.



Figure 1. Vaccines block of the telematic survey.

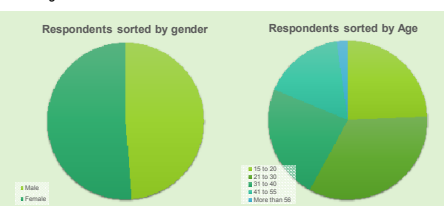
Data analysis.

- **SPSS.** This program was used to analyze numeric results of the risk-benefit scale (from 0 to 10). Respondents were divided according to their age, level of studies and knowledge of each technology in order to determine if their rank was significantly different from one group to another. An ANOVA test was run in order to obtain the significance of the differences between means of each group.
- **Word Cloud.** A Word Cloud was generated using <http://www.wordle.net/>. This gave us the most repeated words for risks and benefits of each technology. Most frequent risks and benefits introduced in the respondents answers for each technology were obtained by means of an observational analysis together with the use of this tool.

Results

Demography

- A total of 305 people participated in the survey.
- Geographical distribution, age and level of studies completed are shown in Figure 2.



Results

Demography

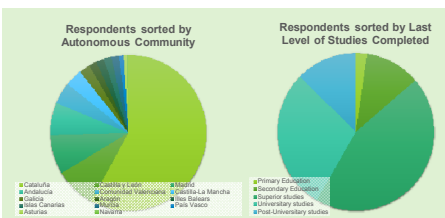


Figure 2. Respondents sorted by gender, age, level of studies and autonomous community.

Means for Risk and Benefits rank

- Technologies perceived as more beneficial are also considered less risky (figure 3).
- Cloning and GMOs are considered to have similar risks and benefits ranks.

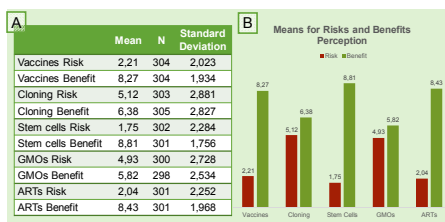


Figure 3. (A) Table with means, number of answers (N) and standard deviation for each technology studied (risks and benefits). (B) Column chart showing the means of technologies studied.

- Dividing respondents by level of studies or age no significant differences between the means of risks and benefits perceived could be told.
- Significant differences in the rank of risks and/or benefits were only detected in the following cases of respondents divided by technology knowledge:
 - **Vaccines.** Differences were found between groups of good knowledge and mid knowledge of vaccines in both risks and benefits rank.
 - **Stem cells.** Differences were found between groups of mid knowledge and no knowledge of stem cells only in benefits rank.
 - **GMOs.** Differences were found between groups of good knowledge and no knowledge of GMOs only in risks gradation.
 - **ARTs.** Differences were found between groups of good knowledge and no knowledge of ARTs only in risks gradation.

	Group I Mean	Group J Mean	Mean Difference (I-J)	Standard Error	Sig.
Vaccines Risks	2,16	3,75	-1,590	0,721	0,028
Vaccines Benefits	8,33	6,38	1,952	0,684	0,005
Stem cells Risks	8,24	9,40	-1,159	0,369	0,016
Stem cells Benefits	5,18	3,67	1,513	0,567	0,038
GMOs Risks	1,97	6,00	-4,033	1,594	0,042

Figure 4. Significant differences in groups divided by technology knowledge. Group I and group J show groups between which significant differences were found ($p < 0.05$).

Risks and Benefits introduced by respondents

Vaccines



Figure 5. Word clouds for vaccines risks (red) and benefits (green) obtained from surveys.

RISKS

- Secondary effects of the vaccine and allergies appearance.
- Chance of suffering from the disease the vaccine should protect you from.

BENEFITS

- Prevent certain diseases.
- Chance of eradicating determined diseases.

Results

Risks and Benefits introduced by respondents

Cloning



Figure 6. Word clouds for cloning risks (red) and benefits (green) obtained from surveys.

RISKS

- Abuse of the technology.
- Use to clone human beings.
- Cloning ethics.

BENEFITS

- Cure of several illnesses.
- Cloning of organs and tissues for transplantation in order to avoid rejection.

Stem Cells



Figure 7. Word clouds for stem cells risks (red) and benefits (green) obtained from surveys.

RISKS

- No risks or unknown were introduced by respondents.
- Misuse of the technique.

BENEFITS

- Cure for most diseases.
- Repair of damaged tissues and organs.

Genetically Modified Organisms



Figure 8. Word clouds for GMOs risks (red) and benefits (green) from surveys.

RISKS

- Endangering of natural species.
- Secondary effects of genetically modified food consumption.

BENEFITS

- Production increase by means of resistant crops.
- Hunger solution for the third world.
- Organisms improvement.

Assisted Reproduction Techniques



Figure 9. Word clouds for ARTs risks (red) and benefits (green) of ARTs obtained from surveys.

RISKS

- Risks associated with the technique procedure.
- Multiple pregnancies.

BENEFITS

- Opportunity for infertile couples to have children of their own.
- Chance to avoid some genetic diseases.

Discussion and Conclusions

- Most valued technologies by Spanish population are vaccines, stem cells and assisted reproduction techniques.
- Most feared technologies by Spanish population are cloning and GMOs.
- A relevant group of the Spanish population does not know the risks of stem cells and some of them think that therapy with stem cells represents no risk.
- Significant differences of risks and benefits ranks were found in some of the groups of respondents divided by knowledge of the selected technology.