The surveys on seismic risk perception are really useful to mitigate risk?

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4) INGV-MI
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Project S2-2014 - Constraining Observations into Seismic Hazard

Task 8: Risk perception and communication
Coordinated by: Laura Peruzza (OGS, Trieste)
Francesca Pacor (INGV, Milano)
Agostino Goretti (DPC, Roma)
In the first year (2013-2014) we conducted a web survey
www.terremototest.it

La percezione del rischio sismico non dipende sempre dal reale valore del rischio, ma piuttosto dal modo in cui esso è percepito.

In generale, le persone percepiscono i rischi come trascurabili, accettabili, tollerabili o inaccettabili e li confrontano con i benefici. Diversi fattori influenzano la decisione di una persona di accettare un rischio o rifiutarlo.

Per questo il ruolo della percezione è molto importante soprattutto in assenza di stime affidabili dei rischi reali.

La chiarezza del linguaggio con cui mass media e scienziati comunicano tale informazione alla popolazione è fondamentale per una corretta conoscenza.

Per provare a conoscere meglio la percezione del rischio sismico in Italia e per avere informazioni utili per diffondere la conoscenza del rischio abbiamo avviato questo progetto di ricerca a livello nazionale.

Grazie per la partecipazione.

Il test è completamente anonimo e per essere compilato richiede circa 5 minuti di tempo.

Dopo aver compilato il test riceverai immediatamente online la risposta relativa al confronto tra la tua percezione e la pericolosità da normativa del territorio in cui vivi.
Where we were...

Differences between Hazard by law (HbL) and Hazard perception (HP) for various groups.

Web Sample (N=8,572)
Differences between Hazard "by law" and Hazard perception.
In the second year (2014-2015) our principal goals were:

- Verify our previous results on a statistical sample at national level
- Implement comparison between risk perception indicators and the “real data” of Hazard, Exposure and Vulnerability
Preparing survey

In the past S2-2012 DPC-INGV Project, the questionnaire on the perception of seismic risk was built and tested.

Semantic Differential (Osgood, 1957)
Likert Scale (Likert, 1932)

Seismic risk perception
Hazard
Exposure
Vulnerability
People and Community
Earthquake phenomenon

Semantic space

Likert Scale

new risk 1 2 3 4 5 6 7 old risk
Statistical analysis carried out on this dataset showed a good reliability of the items that compose the indicators of Hazard, Exposure, Vulnerability, People and Community and Phenomenon. The assessment of the Cronbach alpha values (Cronbach, 1951) showed good values for Hazard ($\alpha=0.86$), Vulnerability ($\alpha=0.94$), People&Community ($\alpha=0.89$), Phenomenon ($\alpha=0.65$). Otherwise Exposure indicator had an insufficient Cronbach alpha value ($\alpha=0.52$).

It was necessary to execute a factorial analysis named Principal Component Analysis (Bolasco, 1999) in order to identify two latent variables, that may be reduced to “tangible” or “intangible” elements of the territory considered. The items of Exposure indicators are grouped in these two variables, and a new computing of Cronbach alpha executed, obtaining values greater than 0.70.
Preparing survey

To discuss and preparing the survey a meeting was held at DPC in September 2014. A new aspect was considered: How to find real vulnerability data of private houses to be compared with perception data?

For this reason it was decided to implement the questionnaire with a section dedicated to collect information about the vulnerability of the interviewee house.

In collaboration with DPC, Reluis (A. Masi) and INGV-Milan (V. Pessina), the following questions were included in the questionnaire: structural typology of the building; age of building; number of floors; structural context of the building; maintenance state.

Our intent is to be able to compare information on house received by the interviewee with his perception of vulnerability.

The questionnaire was adapted for a telephone interview (CATI).

A preliminary test to check the understanding and the keeping of the questionnaire was carried out on over 50 people with good results, one month before the survey launching (December, 2014).
Preparing survey
C. Dati informativi sull’edificio in cui abita l’intervistato

Tipologia Strutturale dell’edificio
□ Muratura (es. mattoni, pietre grezze o squadrate)
□ Struttura con telaio in Cemento armato

Età di costruzione dell’Edificio
□ prima del 1919
□ dal 1919 al 1960
□ dal 1961 al 1980
□ dal 1981 in poi
□ nessuna informazione

Numero di piani dell’edificio (compreso il piano terra)
□ 1 o 2
□ da 3 a 5
□ più di 5

Contesto strutturale dell’edificio
□ edificio isolato (non collegato ad altri edifici)
□ edificio aggregato ad altri edifici

Stato di manutenzione dell’edificio
□ buono
□ cattivo
□ nessuna informazione
5. Come descriverebbe il territorio dove vive?

<table>
<thead>
<tr>
<th></th>
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</table>
Preparing survey

We choose to execute a cross-sectional study on a statistical sample of the Italian population in a fixed-time, using the Computer Assisted Telephone Interview (CATI) technique.

Our main restriction to select the sample was influenced by costs to execute a telephone survey, estimated in about 31k€ for 4,000 interviews. Using the stratified sampling method we identified a sub-populations of 4,000 people within an overall population, with specified characteristics.

The criteria adopted were:
- Geographic Area
- Gender
- Age group
- Peak Ground Acceleration (PGA) of residence area.
Preparing survey

In the first year of our research we chosen to refer to the seismic zones indicated in the national seismic classification (Opcm n. 3274, Gruppo di Lavoro MPS, 2004) because we considered that the seismic zone concept could be better understood by general public.

We carried out a crosscheck between seismic zones and the PGA related values. Some results of the analysis conducted by L. Peruzza (INOGS) and V. Pessina (INGV-Milan) are shown in the figure. Based on these analysis it was confirmed the values of 0.15 g as a PGA threshold value between the zones 2 and 3.

Thus, for our practical purposes, we considered the Italian territory divided into two PGA groups: PGA > 0.15 (zone 1 + zone 2) and PGA < 0.15 (zone 3 + zone 4).
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Preparing survey

Starting from the Italian population at 31.12.2013 grouped for Geographical Area, Gender, Age groups and PGA, we decided to perform about 4,000 interviews distributed as shown in the table.

<table>
<thead>
<tr>
<th>PGA</th>
<th>Geographical Area</th>
<th>18-34</th>
<th>35-54</th>
<th>55-80</th>
<th>Total</th>
</tr>
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<tr>
<td></td>
<td></td>
<td>m</td>
<td>f</td>
<td>m+f</td>
<td>m</td>
</tr>
<tr>
<td>PGA&gt;0.15</td>
<td>North</td>
<td>20</td>
<td>19</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Centre</td>
<td>60</td>
<td>58</td>
<td>118</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>South and Islands</td>
<td>131</td>
<td>128</td>
<td>259</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>211</td>
<td>205</td>
<td>416</td>
<td>312</td>
</tr>
<tr>
<td>PGA&lt;0.15</td>
<td>North</td>
<td>184</td>
<td>178</td>
<td>362</td>
<td>337</td>
</tr>
<tr>
<td></td>
<td>Centre</td>
<td>32</td>
<td>32</td>
<td>64</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>South and Islands</td>
<td>57</td>
<td>55</td>
<td>112</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>273</td>
<td>265</td>
<td>538</td>
<td>478</td>
</tr>
</tbody>
</table>
The CATI Survey

The survey was conducted by phone from the operators of the charged company (Camargo Research). The numbers and features of the survey are shown in the following table.

<table>
<thead>
<tr>
<th>Target population</th>
<th>Resident population in Italy, 18-80 years, of both sexes belonging to any social condition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of sampling</td>
<td>Nationally representative, random sample of the Italian population stratified by gender, age, geographical area, PGA.</td>
</tr>
<tr>
<td>Territorial extension of the survey</td>
<td>Throughout the national territory</td>
</tr>
<tr>
<td>Method of information collection</td>
<td>Telephone interviews - C.A.T.I. technique</td>
</tr>
<tr>
<td>Numerical consistency of the sample of respondents</td>
<td>Full interviews: 4,012</td>
</tr>
<tr>
<td>Number of non-respondents and replacements made</td>
<td>Waste / non-respondents / non-quota: 35,919</td>
</tr>
<tr>
<td>Date or period when the survey was carried out</td>
<td>07/01/2015- 09/03/2015</td>
</tr>
</tbody>
</table>
Data analysis

Distribution of the survey data for Hazard, Exposure, Vulnerability

<table>
<thead>
<tr>
<th>Likert scale</th>
<th>PGA&lt;0.15</th>
<th></th>
<th></th>
<th>PGA&gt;0.15</th>
<th></th>
<th></th>
<th>Total</th>
<th></th>
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<th>GTotal</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Ha</td>
<td>Ex</td>
<td>Vu</td>
<td>Ha</td>
<td>Ex</td>
<td>Vu</td>
<td></td>
<td>Ha</td>
<td>Ex</td>
<td>Vu</td>
</tr>
<tr>
<td>1.0 to 4.00</td>
<td>83.19</td>
<td>48.41</td>
<td>83.32</td>
<td>66.79</td>
<td>43.36</td>
<td>83.95</td>
<td>76.55</td>
<td>46.36</td>
<td>83.57</td>
<td>63.83</td>
</tr>
<tr>
<td>4.1 to 5.5</td>
<td>15.21</td>
<td>48.53</td>
<td>14.08</td>
<td>27.37</td>
<td>53.20</td>
<td>12.42</td>
<td>20.14</td>
<td>50.42</td>
<td>13.41</td>
<td>27.99</td>
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<tr>
<td>5.6 to 7.0</td>
<td>1.60</td>
<td>3.06</td>
<td>2.60</td>
<td>5.84</td>
<td>3.44</td>
<td>3.63</td>
<td>3.32</td>
<td>3.22</td>
<td>3.02</td>
<td>3.18</td>
</tr>
</tbody>
</table>
Data analysis

It must be considered that the value 4 is the median of the Likert scale used in the questionnaire. Then, scores less than 4.0 must be considered low scores of perception. We think that people living in areas with PGA<0.15, to have an adequate hazard perception, should reached scores between 4.0 to 5.5; while people living in areas with PGA>0.15 should have scores higher than 5.5.
According to this interpretation the perception of risk seems be underestimated for all factors. As already noted, both vulnerability factor scores are extremely low (2.77 per PGA<0.15; 2.83 per PGA>0.15) and moreover they are contrariwise than expected. When we will have processed house information data of the respondents, we will comment better these scores of vulnerability. We will able to know if these scores are low because the respondents' houses are safe, or on the contrary, these scores show a low vulnerability perception.
Data analysis

Area North
Seismic Risk Perception Factors for PGA <0.15 and PGA >0.15

Area Centre
Seismic Risk Perception Factors for PGA <0.15 and PGA >0.15

Area South and Islands
Seismic Risk Perception Factors for PGA <0.15 and PGA >0.15
We compare data collected on the web (N=8,572) with data of the CATI survey (N=4,012). We expected not to find big differences between the two sets of data collected by different techniques, instead we observed that as a whole, the data collected on the web have higher perception values than the CATI survey data.
Data analysis

Web Sample (N=8,572)
Distribution of Hazard perception scores for the PGA intervals

CATI sample (N=4,012)
Distribution of Hazard perception scores for the PGA intervals
Preliminary analysis made without considering the year of the classification of the municipality.

*Bernardini's Method (Bernardini et al., 2008)*

Vulnerability index ($I_v$) variable in the range $[-20, 47]$

$I_v$ medio = 3.1
Vulnerability

Distribution of Vulnerability scores for classes of buildings

- A-B: 17.3%
- C: 61.5%
- D: 21.2%
- E-F: 0.0%
Vulnerability

Distribution of Vulnerability Perception scores

A-B

- 2.50-1.00: 36.36%
- 4.00-2.51: 37.88%
- 5.50-4.01: 20.61%
- 7.00-5.51: 5.15%

C

- 2.50-1.00: 50.54%
- 4.00-2.51: 33.79%
- 5.50-4.01: 12.86%
- 7.00-5.51: 2.81%

D

- 2.50-1.00: 61.06%
- 4.00-2.51: 28.85%
- 5.50-4.01: 8.77%
- 7.00-5.51: 1.32%
Description of Method

Starting point Regional PIL 2013 (Istat)
Regional PIL, expressed in absolute terms, is an indicator of richness of the geographic entity, rather than the inhabitants.

<table>
<thead>
<tr>
<th>Coefficient Area</th>
<th>Coefficient Municipalities</th>
<th>Coefficient Population</th>
<th>Coefficient Dwelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio: Regional surface / regional surface zone1-2</td>
<td>Ratio: #regional municipalities / #municipality zone1-2</td>
<td>Ratio: #inhabitants of region / inhabitants zone1-2</td>
<td>Ratio: #dwelling of region / #dwelling zone1-2</td>
</tr>
</tbody>
</table>
The Exposure in the Italian Regions (PIL-2012)

- Veneto
- Valle d’Aosta
- Umbria
- Trentino-Alto Adige
- Toscana
- Sicilia
- Sardegna
- Puglia
- Piemonte
- Molise
- Marche
- Lombardia
- Liguria
- Lazio
- Friuli-Venezia Giulia
- Emilia-Romagna
- Campania
- Calabria
- Basilicata
- Abruzzo

- PIL
- Ex+
Exposure

The perception of the tangible and intangible goods

Intangible goods
Tangible goods

Abruzzo Basilicata Calabria Campania Emilia-Romagna Friuli-Venezia Giulia Lazio Lombardia Marche Molise Puglia Sicilia Toscana Umbria Veneto
The Exposure classes for Perception score (tangible goods)
Data analysis

Earthquake information

Sources of Information

1. Very much
2. Somewhat
3. Slightly
4. Not at all

N/A
Other
Friends
Associations
Province
Research Institutions and University
Municipality
Internet
Region
Books
Television
Civil Protection
Newspaper
None

0% 10% 20% 30% 40%
Data analysis

Earthquake occurrence versus Other Natural Hazards

Floods: 36% More, 25% Same, 12% Lower
Hurricanes or tornadoes: 20% More, 22% Same, 19% Lower
Tsunamis: 8% More, 17% Same, 26% Lower
Volcanic eruptions: 6% More, 15% Same, 27% Lower
Landslides: 29% More, 21% Same, 16% Lower
Data analysis

Participation at risk reduction initiatives

Level of involvement

- Low: 10.40%
- Medium: 8.09%
- High: 81.50%

Pie chart: 95.29% No, 4.71% Yes
Conclusions

- The CATI survey carried out on a statistical sample (N=4,012) and the data collected on the web (N=8,575) represent a good reference basis of the seismic perception of Italian population.

- We are able to complete the interpretation and comparison of scores of perception with all indicators of risk. This important advancement was possible by introducing in the questionnaire some questions on the characteristics of the house and by introducing in the work group some specific skills.

- Similarly, we are already working in order to compare the other indicators considered in the questionnaire: People & Community and Phenomenon.

- We consider that analysis of risk perception data is able to produce useful indications to design seismic risk reduction activities. The processing of the data collected on the seismic risk perception will give us detailed information on the national territory to launch campaigns of awareness and improve risk reduction.