Occupational exposure in a contaminated estuarine environment

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Previous environmental studies on Sado river estuary indicated high concentrations of heavy metals (Cu, Zn, Ni, As, Cr, e Pb) in sediments possibly linked to industrial contamination along with non-point anthropogenic sources;

This contamination was already detected on some species living in the estuary which can reflect and amplify local contamination, posing potentially serious health problems to humans;

• Local population has intense fishing activity.

• Along with agriculture products, fishery products of the estuary are daily available for local residents.
Background
Background

No previous studies of human exposure routes and its potential health effects

HERA project
Environmental Risk
Assessment of a contaminated estuarine environment: a case study

WP 1 - Epidemiological characterization of the target population of the village of Carrasqueira

WP 2 - Characterization of the contamination of local agricultural food

WP 3 - Sample collection and laboratorial quantification of sediments contamination and estuarine species bioaccumulation and health biomarkers

WP 4 - Characterization of the genotoxic and endocrine disrupting activities of sediments from areas of fishing activities

WP 5 - Data processing and data analysis for the association between food intake, human and endocrine disrupting genotoxicity and health effects

funded by Fundação para a Ciência e Tecnologia (FCT- PTDC/SAU-ESA/100107/2008)
An epidemiological study, was implemented in a small fisherman community living in Carrasqueira Village at Sado Estuary (exposed population) and in Vila Nova de Mil Fontes- VNMF (non exposed).

Results to be presented are focused on the analysis of occupational exposure in two populations (exposed and non exposed population)
Study Design
Cross-sectional comparative study of residents in exposed population (Carrasqueira) and residents in a second different population, Vila Nova de Mil Fontes (VNMF), selected as the non-exposed population.

Material and Methods

Carrasqueira (Exposed Population)

A small riverside village in the south channel of the Sado Estuary.

Vila Nova de Mil Fontes (Non-exposed Population)

VNMF sits near another river estuary (Mira estuary) with similar fishing and agricultural activities but with no known industrial or other contamination exposures (considered a pristine estuary).
Field work

**Sampling**: All ages and both sex, were selected by simple randomization, using the medical registrations lists of local Health Centers.

**Contact with selected participants**:  
- One week before the scheduled day for data collection, a letter was sent to each selected participant, explaining the purpose of the study and asking for participation of the contacted person.

**Data collection**: Data collected at home by trained interviewers by face to face interviews of selected individuals using Computed Assisted Personal Interview (CAPI), during June and July 2011.

Participants were included only after a written informed consent.
Material and Methods

Analysis

- Data were checked for completion and consistency of pre-coded information.
- Each respondent was required to describe the tasks inherent to their actual and past jobs and also
- Period of time performing the main profession (or last applied)
Material and Methods

Analysis

➢ From this description indicators of a potential route exposure to contaminants were created:

   a. Direct exposure (fishing inherent tasks);
   b. Indirect exposure (agriculture inherent tasks),
   c. Other routes of contamination (tasks with other sources of contamination such as painting).
   d. The absence of the previous exposures indicates that no relevant exposure existed.

➢ Statistical analysis was performed using descriptive, Chi-squared test and significance level was set at 5%.
A total of 202 participants were included in the study: 102 in Carrasqueira (response rate = 72.9%) and 100 in VNMF (response rate = 45.7%).

**Results**

**Population**
- Medical registrations lists of local Health Centers (n = 2473)
  - Carrasqueira (Exposed) (n = 403)
  - VNMF (Non-exposed) (n = 2070)

**Selected sample**
- Carrasqueira (Exposed) (n = 140)
- VNMF (Non-exposed) (n = 219)

**Non eligible and refusals (%)**
- Moved out from the household: 36.8%
- Temporarily absent from the household: 28.9%
- Refusal: 23.7%
- Other situation: 7.9%
- Died: 2.6%
- Moved out of the household: 36.0%
- Temporarily absent from the household: 17.4%
- Refusal: 11.6%
- Insufficient data: 16.3%
- Other situation: 7.0%
- Unoccupied household: 4.7%
- Died: 3.5%
- Secondary Household: 3.5%

**Participants**
- Carrasqueira (n = 102)
- VNMF (n = 100)
## Results

### Socio-Demographic Characteristics

<table>
<thead>
<tr>
<th>Location</th>
<th>Carrasqueira (exposed)</th>
<th>VNMF (unexposed)</th>
<th>p-value</th>
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<tr>
<td>Sex</td>
<td>n=102</td>
<td>n=100</td>
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<td></td>
<td>%=57.8</td>
<td>%=44.0</td>
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<tr>
<td></td>
<td>%=42.2</td>
<td>%=56.0</td>
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<tr>
<td>Age group (years)</td>
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<td>n=100</td>
<td>0.267</td>
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<tr>
<td>≤17</td>
<td>%=14.7</td>
<td>%=14.0</td>
<td></td>
</tr>
<tr>
<td>18-44</td>
<td>%=29.4</td>
<td>%=26.0</td>
<td></td>
</tr>
<tr>
<td>45-64</td>
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<td>%=33.0</td>
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</tr>
<tr>
<td>65-74</td>
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<tr>
<td>≥75</td>
<td>%=5.9</td>
<td>%=15.0</td>
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n, number of valid answers
### Results

<table>
<thead>
<tr>
<th>Socio-Demographic Characteristics</th>
<th>Location</th>
<th>Carrasqueira (exposed)</th>
<th>VNMF (unexposed)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Education level</td>
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<tr>
<td>No formal education</td>
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<td>14.1</td>
<td>94</td>
<td>11.7</td>
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<tr>
<td>Primary and lower secondary education</td>
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<td>42.6</td>
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<tr>
<td>Upper secondary education</td>
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<td>21.3</td>
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</tr>
<tr>
<td>Post - secondary or Higher education</td>
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<td>24.5</td>
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<tr>
<td>Labour status</td>
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<td>94</td>
<td>11.7</td>
</tr>
<tr>
<td>Self employed</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Employee</td>
<td>23.5</td>
<td>34.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fulfilling domestic tasks</td>
<td>5.1</td>
<td>5.3</td>
<td></td>
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<tr>
<td>Retired</td>
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<td>25.5</td>
<td></td>
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<tr>
<td>Unemployed</td>
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<td></td>
</tr>
<tr>
<td>Student</td>
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<td>11.7</td>
<td></td>
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n, number of valid answers
### Exposure Factors: Potential routes of exposure

<table>
<thead>
<tr>
<th>Profession</th>
<th>Location</th>
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<th>p-value</th>
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<tbody>
<tr>
<td></td>
<td>Carrasqueira (exposed)</td>
<td>VNMF (unexposed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Managers, Professionals and Armed forces occupations</td>
<td>80</td>
<td>84</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>Technician and associate professionals</td>
<td>8.8</td>
<td>10.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled agricultural, forestry and fishery workers; craft</td>
<td>12.5</td>
<td>32.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and related trades workers; plant and machine operators, and assemblers</td>
<td>67.5</td>
<td>44.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary occupations</td>
<td>11.3</td>
<td>12.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
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<th>Carrasqueira (exposed)</th>
<th>VNMF (unexposed)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Agriculture and fishing</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0-7 yrs</td>
<td>54</td>
<td>9.3</td>
<td>19</td>
</tr>
<tr>
<td>8-20 yrs</td>
<td>54</td>
<td>20.4</td>
<td>19</td>
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<tr>
<td>21-35 yrs</td>
<td>54</td>
<td>25.9</td>
<td>19</td>
</tr>
<tr>
<td>36 yrs</td>
<td>54</td>
<td>44.4</td>
<td>19</td>
</tr>
<tr>
<td>Other professions</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0-7 yrs</td>
<td>26</td>
<td>42.3</td>
<td>63</td>
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<tr>
<td>8-20 yrs</td>
<td>26</td>
<td>19.2</td>
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<td>26</td>
<td>11.5</td>
<td>63</td>
</tr>
</tbody>
</table>

n, number of valid answers
Exposure Factors: Potential routes of exposure, analysis of the tasks

No relevant exposure
- VNMF (n=84): 53.6%
- Carrasqueira (n=80): 17.5%
  - p < 0.001

Other routes of contamination
- VNMF (n=84): 36.9%
- Carrasqueira (n=80): 31.3%
  - p = 0.004
  - p = 0.445

Indirect exposure
- VNMF (n=84): 11.9%
- Carrasqueira (n=80): 30.0%

Direct exposure
- VNMF (n=84): 1.2%
- Carrasqueira (n=80): 48.8%

n, number of valid answers
The population of Carrasqueira had higher frequency of:

1. Professions like fishers and agricultures that are more likely to have higher risks of exposure to estuary river contaminants (directly or indirectly);

2. Also the period of time that was spent in the fishing and agricultures activities in Carrasqueira was higher than in VNMF;

3. Tasks inherent to their actual job, promoting direct and/or indirect exposure to contaminants;
4. There were no significant differences in the other routes of contamination;

5. On the opposite VNMF participants were not exposed to any contaminant route. Similar results were found in the analysis of tasks in previous professions.

The population of Carrasqueira has higher risk of occupational exposure to the estuary contaminants
Discussion

The population of Carrasqueira has higher risk of occupational exposure to the estuary contaminants.

These results should be analyzed carefully:

✓ Small sample size, not dimensioned to the study design;

✓ Differences on the non participants in both locations, particularly important in VNMF where the response rate was lower

✓ Information was self-reported;

✓ Recall bias
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Thank you