Design and implementation of an epidemiological study for the characterization of potential pathway human exposure in a contaminated estuary environment

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Background

Sado estuary is located in the west coast of Portugal. Previous environmental studies identified industrial contamination, non-point anthropogenic sources and contamination coming from the river, all promoting accumulation of polluted sediments with known impacts on the ecological system. Surrounding small village human population have intense economic fishery activities. Together with agriculture, estuary fishing products are available to local residents. Food usage previously characterized through ethnographic studies suggests exposure to estuarine products, farming products, and water in daily activities, as potential routes of contamination. Few epidemiologic studies have been conducted to study associations of environmental contamination and health effects in Portugal. No epidemiological study has been identified in this particular geographical area.

Objectives

HERA project (Environmental Risk Assessment of a contaminated estuarine environment) is financed by the National Science Foundation and co-financed by FEDER through the Communitarian Program COMPETE (FCT-PTDC/SAU-ESA/100107/2008) and includes an epidemiological study aiming to characterize exposure pathways to estuarine products and its potential health effects.

Materials and Method

Study Design

A cross-sectional comparative study of residents in Carrasqueira (exposed population) and residents in a second different population, Vila Nova de Mil Fontes (VNMF), selected as the non-exposed population (Figure 1).

Figure 1. Geographical localization of the population under study

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

VNMF sits near another river estuary with similar fishing and agricultural activities but no known industrial or other contamination exposures.

Planning

Study planning consisted on the following steps:

1. **Questionnaire design:** The first draft of the questionnaire resulted from previous knowledge of the population's habits about exposure characteristics, initial interviews with local residents and the inputs of the entire work team . This draft was later on submitted to a pre-test that was held in the Health Center of VNMF. During this pre-test, information on 12 individuals was collected by personal interview and an evaluation of the questionnaire was performed.
2. **Ethical procedures**: The study protocol and the questionnaire was submitted and approved by the "Comissão de Ética do Instituto Nacional de Saúde Dr Ricardo Jorge, I.P" and by "Comissão Nacional de Protecção de Dados".
3. **Dissemination of the study**: In order to increase the level of the participation, leaflet and posters (Figure 2) were created and distributed in both population.

Leaflet | Poster

Figure 2. Dissemination of the study : leaflet and poster.

Field work

Sampling: The sample was selected from the list of registered users of the National Health Service.

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. The envelope contained the invitation letter, a leaflet and contacts for any clarification.

Data collection: Data on exposed and non-exposed population was collected at home by trained interviewers by face to face interviews of selected individuals using Computed Assisted Personal Interview (CAPI). All participants were included after a written informed consent.

Final questionnaire was composed by 31 questions related to the following themes: 1)Health effects: morbidity, use of health services, reproductive history; 2) potential routes of exposure: socio-demographic, occupational (fishing and farming related occupations), leisure habits and hobbies (including recreational fishing), lifestyles (tobacco, alcohol); 3) Potential routes of human contamination from the estuary (including use of water, subsistence fishing and farming).

Results

Response rates were 72.9% in Carrasqueira and 45.7% in VNMF. Main reason for not responding was the mobility of the selected participant and similar results were verified in both places (Table 1).

Table 1. Implementation of the study: process indicators

	Carrasqueira	VNMF	TOTAL
Population (health centers lists) (n)	**403**	**2070**	**2473**
Sample (n)	**140**	**219**	**359**
Respondents (n)	**102**	**100**	**202**
Response Rate (%)	**72.9**	**45.7**	**56.3**
Motives for non-responses (n)	**38**	**86**	**124**
Moved out of the household (%)	*36.8*	*36.0*	*36.3*
Temporarily absent from the household because of work, tourism, studies or for other reasons (%)	*28.9*	*17.4*	*21.0*
Refusal (%)	*23.7*	*11.6*	*15.3*
Insufficient data (%)	*0.0*	*16.3*	*11.3*
Other situation (%)	*7.9*	*7.0*	*7.3*
Unoccupied household (%)	*0.0*	*4.7*	*3.2*
Died (%)	*2.6*	*3.5*	*3.2*
Secondary Household (%)	*0,0*	*3.5*	*2.4*
Contacts not realized (n)	**0**	**33**	**33**
Refuse Rate (%)	**7.2**	**6.9**	**7.0**
Participation Rate (%)	**81.6**	**69.0**	**74.8**
Mean Duration of Interview (min)	**30.3**	**25.6**	**28.0**
Minimum Duration of Interview (min)	**10**	**10**	**10**
Maximum Duration of Interview (min)	**80**	**56**	**80**
Number of attempts to obtain Complete Interview			
One (%)	74.5	59.0	66.8
Two (%)	18.6	31.0	24.8
Three (%)	6.9	10.0	8.4

Of selected Carrasqueira participants 57,8% were male (total population=55,3%) and no major differences were observed in the age group distribution when comparing to the population. In VNMF, 44,2% were male (total population=48,4%)(Figure 3).

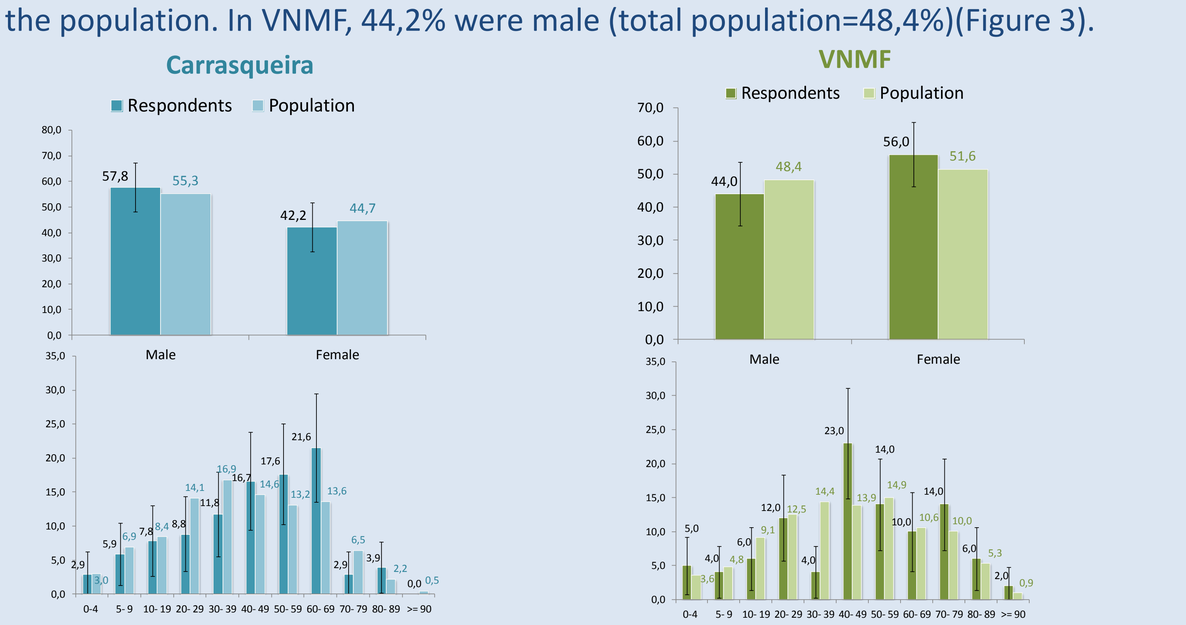

Figure 3. Distribution of respondents and population (Carrasqueira, VNMF) by gender and age group.

Conclusions

Planning and implementation of epidemiological studies on exposure, contamination routes and health effects of estuarine pollution should involve local Public Health professionals since early stages of planning and study design as conducted in this study. Data collection and field work had no major drawbacks with a good response rate in the exposed population but lower in the comparison population. The summer time may explain lower than expected response rates especially in the comparison population. This epidemiological study will give important information for the characterization of potential pathway human exposure in a contaminated estuary environment.