Mercury contamination in reproductive age women in a Caribbean island: Vieques
Carmen Ortiz-Roque, Yadiris López-Rivera

RESULTS AND DISCUSSION
Reproductive age women residing in the NEPR were compared with the analogous Vieques cohort (table 1). No difference was found in their average age. The participation rate was 20% for NEPR and 31% for Vieques. The mean hair (Hg) for the Vieques cohort was 4.4 (0.5–8.9) while that of NEPR was 0.4 (0.3–0.5). Vieques’ cohort also had higher mercury 90th centiles than the NEPR counterpart (8.9 v 1.0) and than those reported for the United States 1.4 (0.9–1.7). Three of the 41 women of reproductive age in Vieques had hair (Hg) higher than 12.0 ppm (101.3, 25.3, and 15.4 ppm). None of the 45 women from NEPR nor the702 women studied in the USA had such high mercury levels.

The margin of exposure to mercury was unsafe for women of reproductive age in Vieques, 1.3, but was safe for women of reproductive age in NEPR, 12. Seafood consumption averaged 4.9 and 2.8 times per week for the Vieques and NEPR cohorts, respectively. Hair mercury concentration correlated positively with weekly consumption of local seafood for Vieques. (Spearman correlation 0.47, p = 0.002).

Mercury concentrations did not correlate with age or BMI for either cohort. Occupational, medicinal, cosmetic, and religious practices failed to reveal other possible sources of mercury contamination. Based on hair (Hg), mercury RfD was exceeded by 26.8% of the Vieques and 6.6% of the NEPR cohort.

Mercury is among the 102 violations to effluent water quality parameters committed by the US Navy in the coast of Vieques. No other source of mercury contamination has been identified in that island. The volatility of mercuric sublimate, its incorporation, biomagnification, and persistence in aquatic habitats and Viequenses dependence on marine protein, makes human mercury contamination feasible.

Abbreviations: NEPR, north eastern Puerto Rico; RfD, reference dose analysis; MOE, margin of exposure

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Mercury concentrations, seafood consumption frequency, and exposure assessment for reproductive age women in Vieques and Puerto Rico (2000–2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Vieques</td>
<td>41</td>
</tr>
<tr>
<td>NE Puerto Rico</td>
<td>45</td>
</tr>
<tr>
<td>USA 4</td>
<td>702</td>
</tr>
</tbody>
</table>

*Arithmetic mean significant (p<0.05); †MOE<10 is unsafe mercury exposure; ‡average weekly frequency of seafood consumption; †RfD=0.1 μg/kg per day; *medians significant (p<0.05); **arithmetic mean significant (p<0.01); ††data not available.
This study may have some limitations. The participation rate was low for both groups. Unfortunately, the general population in Puerto Rico (and its Vieques island) is unaware of fish consumption as a possible route for mercury contamination. Unfamiliarity with hair testing, aesthetic reasons, and unwillingness to complete a questionnaire was mentioned by non-participants. Over representation of people concerned about contamination can always be present.

Selection bias in this cohort study could have occurred if disease status (mercury hair concentration) was known at the time of entering the study. As hair mercury determinations were done months after hair sampling, the participants and the researchers were not cognisant of the results.

ACKNOWLEDGEMENTS
We thank Dr J Ortiz-Roque for his toxicological perspective and critical revision and to Dr T Schettler for his meticulous critical review. The collaboration of members of the College of Physicians and Surgeons of Puerto Rico is deeply appreciated.

CONTRIBUTORS
Carmen Ortiz-Roque, MD, MPH, MS was responsible for design, funding, data collection, analysis, drafting, and approval of the final version. Yadiris López-Rivera, CT, MS(c) was responsible for design, interpretation, data analysis, and final drafting.

Authors’ affiliations
C Ortiz-Roque, Y López-Rivera, GINECO, San Juan, Puerto Rico

Policy implications
Isolated civilian populations in the proximity of atypical industries, like the military, can be at increased risk of mercury exposure.

Funding: GINECO, a non-profit organisation dedicated to reproductive research and health education in the Caribbean.

This study was completed with the collaboration of members of the College of Physicians and Surgeons of Puerto Rico, GINECO and the first author.

Correspondence to: Dr C Ortiz-Roque, PO Box 9023930, San Juan, Puerto Rico 009023930; yadirislopez@hotmail.com

Accepted for publication 18 December 2003

REFERENCES
1 FDA. Consumer advisory for pregnant women and women of childbearing age who may become pregnant about the risks of mercury in fish. Washington: U.S. Food and Drug Administration. 2001
2 Shamberger RJ. Validity of hair mineral testing. Biol Trace Elem Res 2002;87:128
3 CDC. Blood and hair mercury levels in young children and women of childbearing age—United States, 1999. MMWR 2001 March 2;50:1403

Key point
Women of reproductive age in the island of Vieques were exposed to mercury concentrations that are unsafe to their developing fetus.

Policy implications
Isolated civilian populations in the proximity of atypical industries, like the military, can be at increased risk of mercury exposure.

Funding: GINECO, a non-profit organisation dedicated to reproductive research and health education in the Caribbean.

This study was completed with the collaboration of members of the College of Physicians and Surgeons of Puerto Rico, GINECO and the first author.

Correspondence to: Dr C Ortiz-Roque, PO Box 9023930, San Juan, Puerto Rico 009023930; yadirislopez@hotmail.com

Accepted for publication 18 December 2003

REFERENCES
1 FDA. Consumer advisory for pregnant women and women of childbearing age who may become pregnant about the risks of mercury in fish. Washington: U.S. Food and Drug Administration. 2001
2 Shamberger RJ. Validity of hair mineral testing. Biol Trace Elem Res 2002;87:128
3 CDC. Blood and hair mercury levels in young children and women of childbearing age—United States, 1999. MMWR 2001 March 2;50:1403