Oil extraction related pollution and environmental health

Cristina O'Callaghan Gordo

Geneva Health Forum, 5th of May 2022

ISGlobal Barcelona Institute for Global Health

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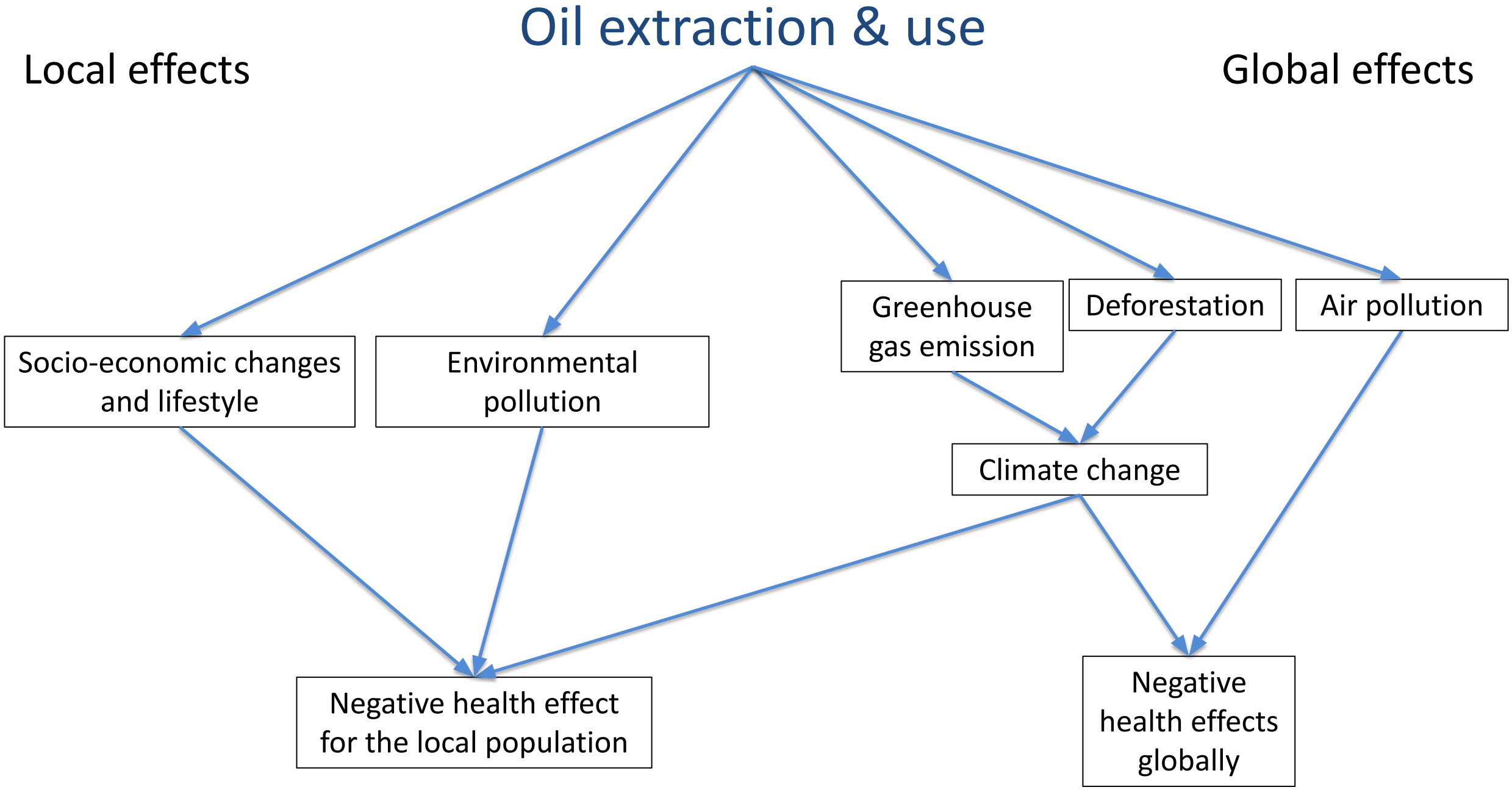
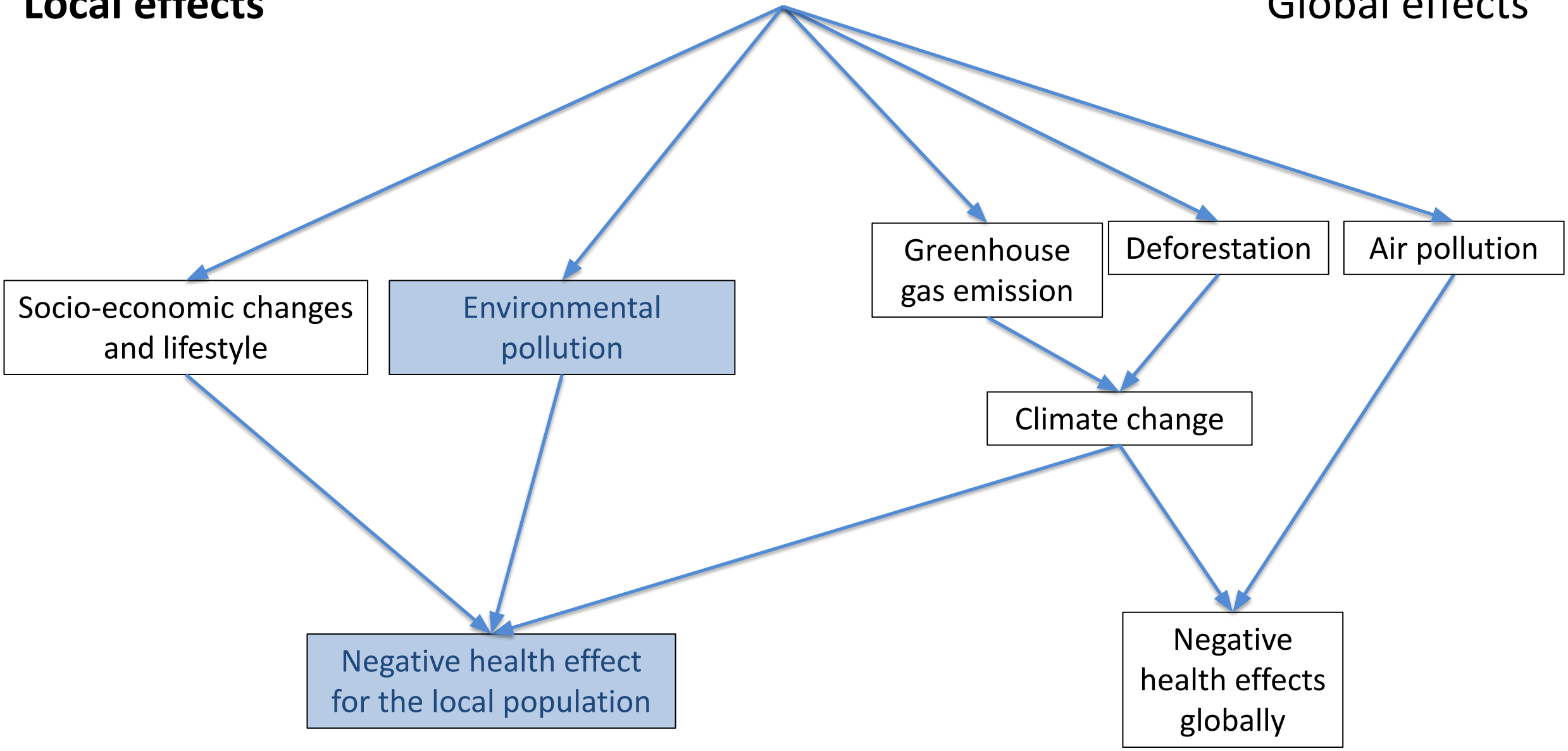

Oil extraction & use
Local effects
Global effects
Socio-economic changes and lifestyle
Environmental pollution
Greenhouse gas emission
Deforestation
Air pollution
Climate change
Negative health effect for the local population
Negative health effects globally

Oil extraction & use

Local effects

Global effects

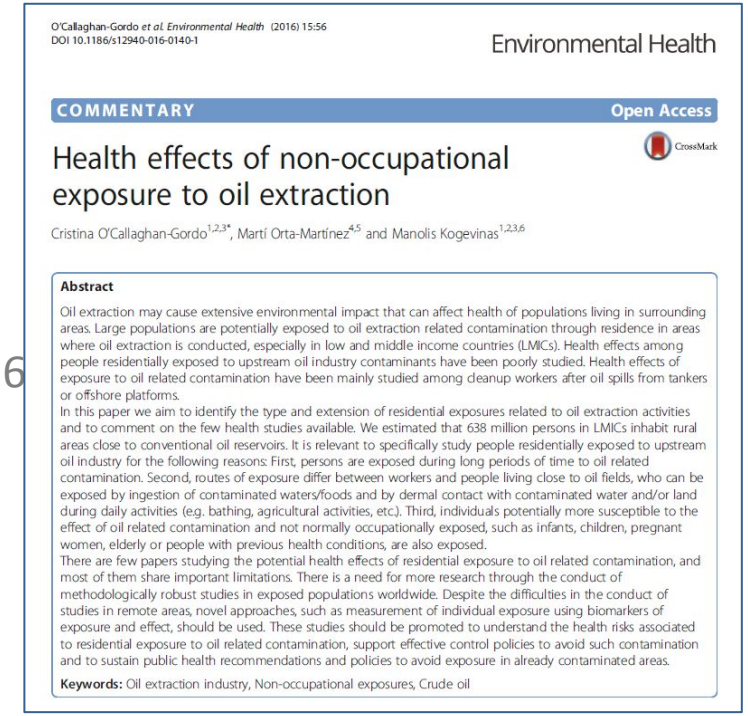


Negative health effect for the local population

The health effects of exposure to oil related contamination have been mainly studied after oil spills among cleanup workers and residents of the affected coastal areas (Levy et al. Int J Occup Environ Health 2011; Pérez-Cadahía et al. Environ Health Insights 2008)

- High levels of metals associated with adverse health effects
- Acute effects: respiratory, eye and skin symptoms, headache, nausea, dizziness and fatigue
- Chronic effects: psychological disorders, lower respiratory tract symptoms and reduction of lung function, genotoxicity and alterations in hormonal status have also been described

The health effects of exposure to oil extraction related contamination poorly studied among people residentially exposed (O'Callaghan-Gordo et al. Environmental Health 2016



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Environmental Health

COMMENTARY Open Access

Health effects of non-occupational exposure to oil extraction

Cristina O'Callaghan-Gordo[1,2,3*], Martí Orta-Martínez[4,5] and Manolis Kogevinas[1,2,3,6]

Abstract

Oil extraction may cause extensive environmental impact that can affect health of populations living in surrounding areas. Large populations are potentially exposed to oil extraction related contamination through residence in areas where oil extraction is conducted, especially in low and middle income countries (LMICs). Health effects among people residentially exposed to upstream oil industry contaminants have been poorly studied. Health effects of exposure to oil related contamination have been mainly studied among cleanup workers after oil spills from tankers or offshore platforms.

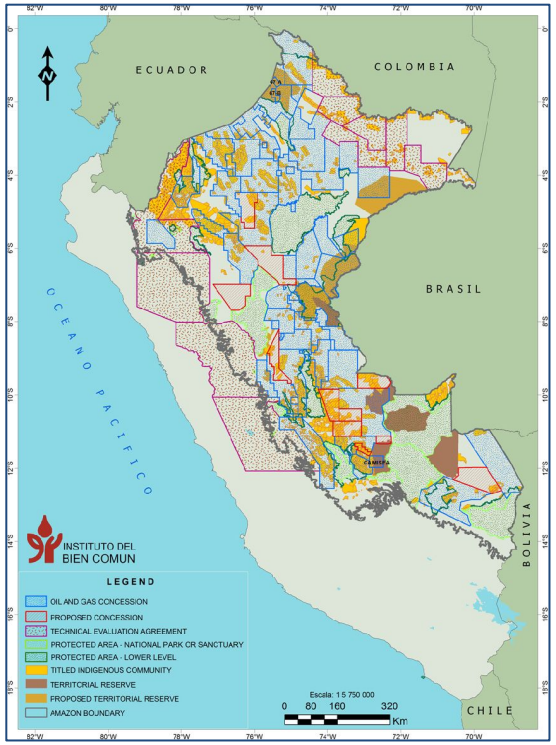
In this paper we aim to identify the type and extension of residential exposures related to oil extraction activities and to comment on the few health studies available. We estimated that 638 million persons in LMICs inhabit rural areas close to conventional oil reservoirs. It is relevant to specifically study people residentially exposed to upstream oil industry for the following reasons: First, persons are exposed during long periods of time to oil related contamination. Second, routes of exposure differ between workers and people living close to oil fields, who can be exposed by ingestion of contaminated waters/foods and by dermal contact with contaminated water and/or land during daily activities (e.g. bathing, agricultural activities, etc.). Third, individuals potentially more susceptible to the effect of oil related contamination and not normally occupationally exposed, such as infants, children, pregnant women, elderly or people with previous health conditions, are also exposed.

There are few papers studying the potential health effects of residential exposure to oil related contamination, and most of them share important limitations. There is a need for more research through the conduct of methodologically robust studies in exposed populations worldwide. Despite the difficulties in the conduct of studies in remote areas, novel approaches, such as measurement of individual exposure using biomarkers of exposure and effect, should be used. These studies should be promoted to understand the health risks associated to residential exposure to oil related contamination, support effective control policies to avoid such contamination and to sustain public health recommendations and policies to avoid exposure in already contaminated areas.

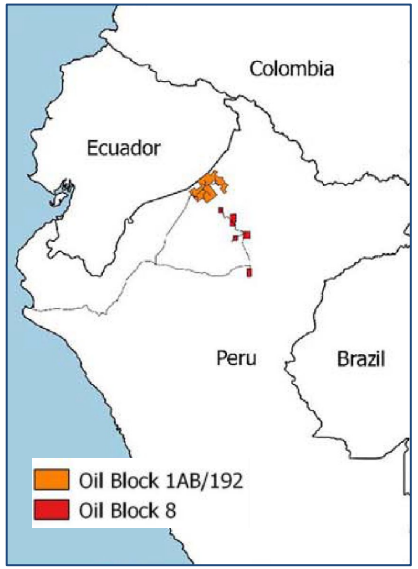
Keywords: Oil extraction industry, Non-occupational exposures, Crude oil

Oil extraction in the Peruvian Amazon

- Extraction activities in the Peruvian Amazon started in the 60's
- Two-thirds of oil extraction areas in the Peruvian Amazon are within indigenous territories
- Overlap also between oil extraction areas and protected areas



Current oil and gas concessions, proposed concessions, technical evaluation agreement lots and protected areas and indigenous peoples' territories in the Peruvian Amazon (Finer & Orta-Martínez, ERL 2010)



Case study area (map prepared by Orta-Martinez)

Recurrent oil spills and poor environmental practices, such as dumping of produced water contaminated this area

1969-71	1AB and 8 oil Blocks were leased
1972	First Production Well
1974	North Peruvian Pipeline
1982	Maximum oil production (120.000 bopd)
1984	ONERN: “one of the most damaged areas in the country” IIAP: High levels (275ppm) of lead in fish tissues
1998	MEM (1998): “High concentrations of TPH, Ba and Pb in samples of surface water”; “Petroleum spills of varying sizes were identified on the surface of rivers and on land”
2004	OSINERG (2004): “levels of contamination above maximum permissible limits” due to high TPH in soils and river water
2006	MINSA (2006): High levels of cadmium and lead in blood among the local population of this area: 66% of children BLL >10 µg/dl; 79% of adults BLL >10 µg/dl, 99% of children and adults Cd cadmium levels in urine >0.1 µg/dl
2013	Peruvian government (2013): state of environmental emergency in the Corrientes, Pastaza and Tigre river basins (RM-263-2013-MINAM, RM-094-2013-MINAM and 370-2013-MINAM)
2014	Peruvian government (2014): state of the health emergency in these river basins and in the Marañon river basins (SD-006-2014-SA)

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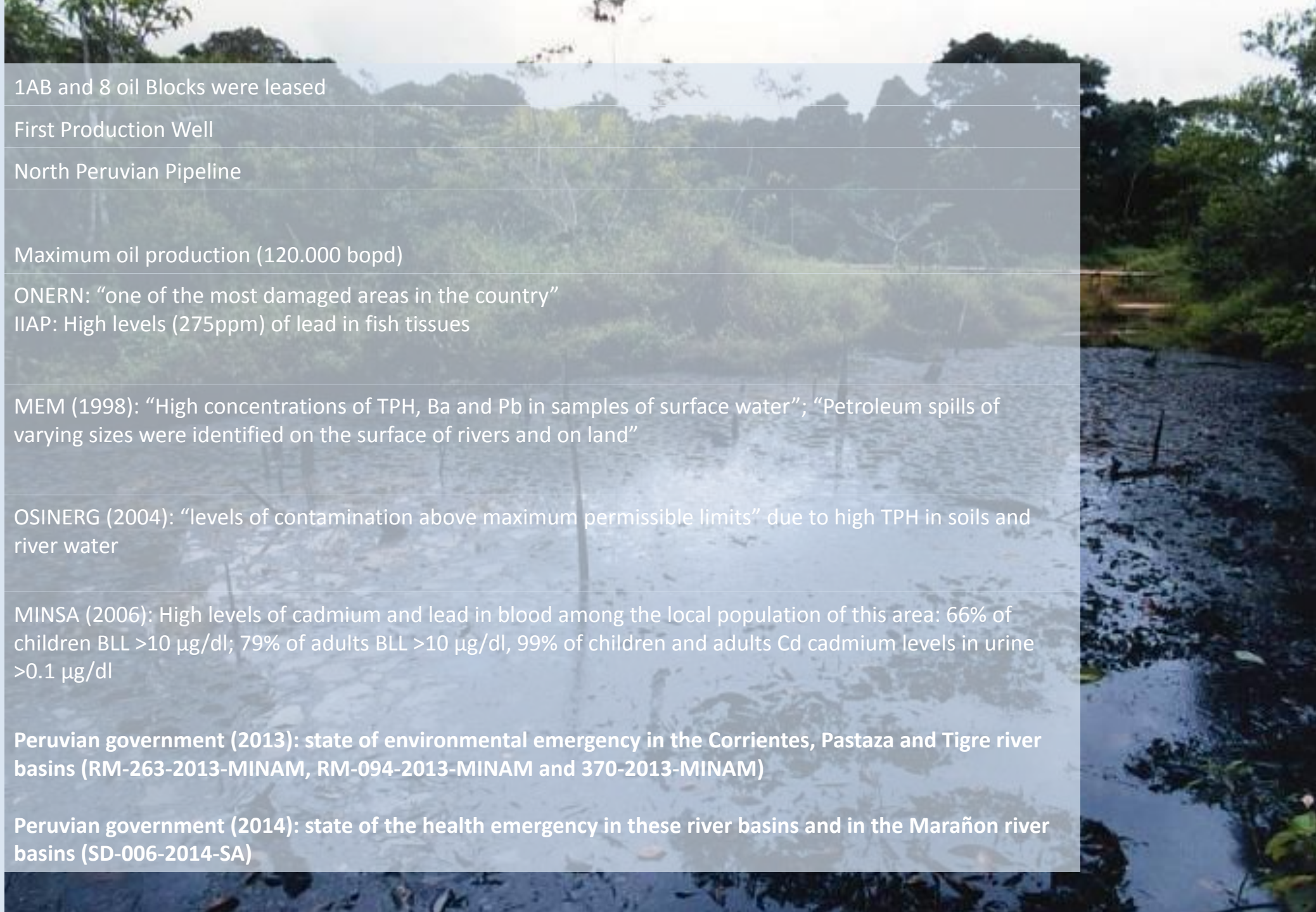

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Not a problem from the past

VIDEO: NUEVO DERRAME DE PETRÓLEO EN LOTE 192 AFECTA A COMUNIDADES ACHUAR NUEVO NAZARETH Y NUEVO JERUSALÉN

20 febrero, 2018

El petróleo ha llegado a casas de las familias. La fuente de agua de la comunidad también se ha contaminado. La población indígena reclama que la empresa petrolera Frontera Energy preste ayuda con agua y alimentos, y que el Estado declare en emergencia la zona. PUINAMUDT,

Fotografía: FECONACOR (Federación de Comunidades Nativas de la Cuenca del Corrientes)

Health risks – Lead exposure

- Cross-sectional study to assess levels of exposure to lead in the local population and establish risk factors for exposure
- May and June 2016
- 1047 participants from 39 indigenous communities selected (out of 60)
- Information on socio-demographic variables and information on occupational/environmental exposures was collected in structured questionnaires
- Concentrations of lead in blood using atomic absorption spectrophotometry (AAS)

- Mean BLL in the study population was higher than 5 µg/dL
- 49% of children and 60% of adults had BLL above this threshold

Variable	Category	< 12 years old, n=309 n (%)	< 12 years old, n=309 GM (95%CI)	≥ 12 years old, n=738 n (%)	≥ 12 years old, n=738 GM (95%CI)
Age (years), median (IQR)		7 (4)	-	35 (24)	-
Sex	Male	152 (49%)	6.2 (5.4, 7.1)	347 (47%)	7.8 (7.2, 8.4)
	Female	157 (51%)	4.0 (3.5, 4.5) **	391 (53%)	4.3 (4.0, 4.7) **
River basin	Marañón	70 (23%)	2.4 (2.0, 3.0)	167 (23%)	3.1 (2.7, 3.4)
	Pastaza	95 (31%)	4.2 (3.6, 4.9)	262 (36%)	5.2 (4.8, 5.7)
	Tigre	21 (7%)	6.5 (5.1, 8.2)	60 (8%)	9.2 (8.1, 10.4)
	Corrientes	123 (40%)	8.0 (7.1, 9.0) **	249 (34%)	8.4 (7.6, 9.2) **

** p-value for ANOVA <0.001

Important differences by river basin


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Blood lead levels in indigenous peoples living close to oil extraction areas in the Peruvian Amazon

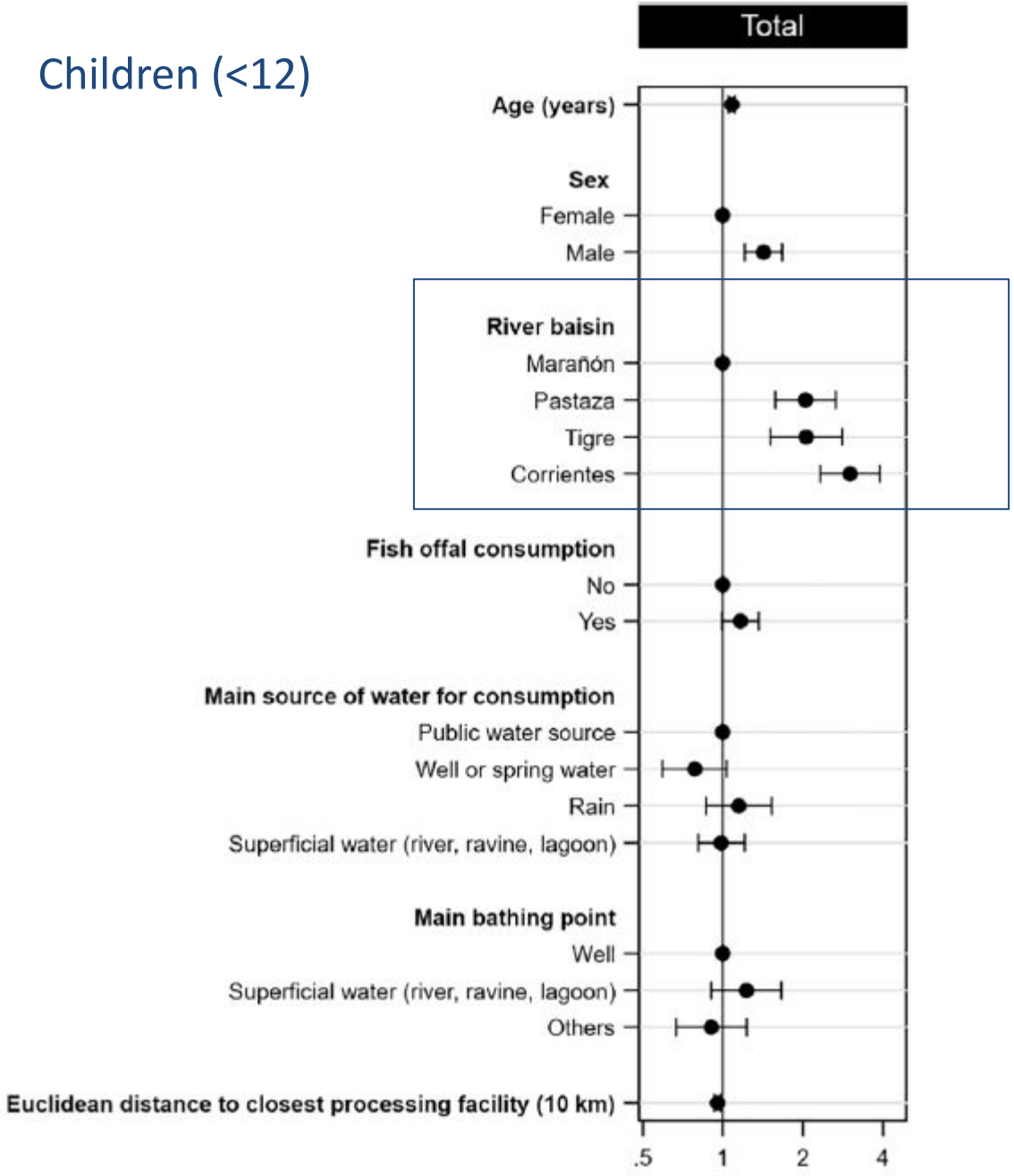
Cristina O'Callaghan-Gordo, Jaime Rosales, Pilar Lizárraga, Frederica Barclay, Tami Okamoto, Diana M. Papoulias, Ana Espinosa, Martí Orta-Martínez, Manolis Kogevinas, John Astete

ARTICLE INFO

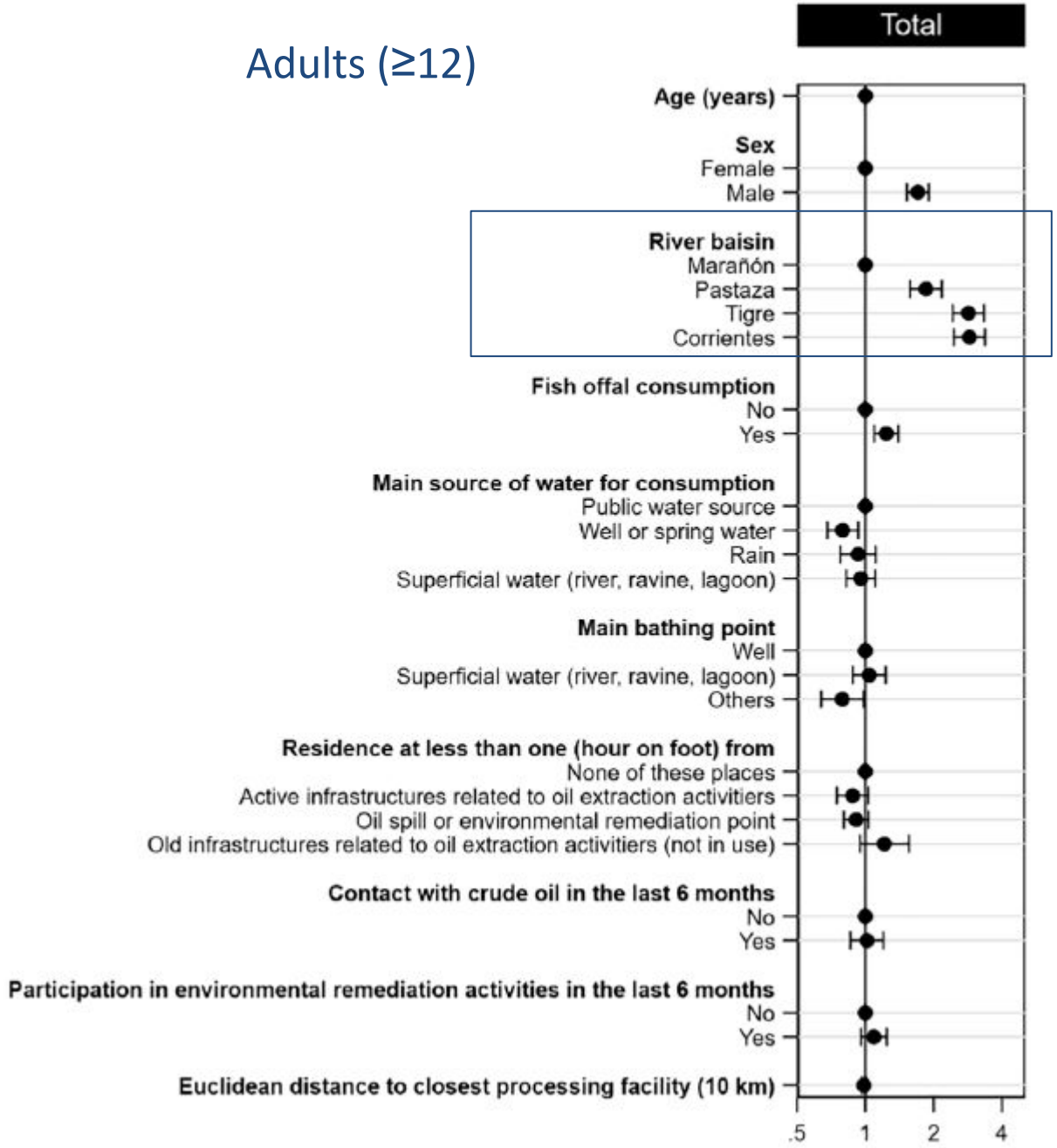
ABSTRACT

(O'Callaghan-Gordo, C, et al. Environment International 2021)

Children (<12)



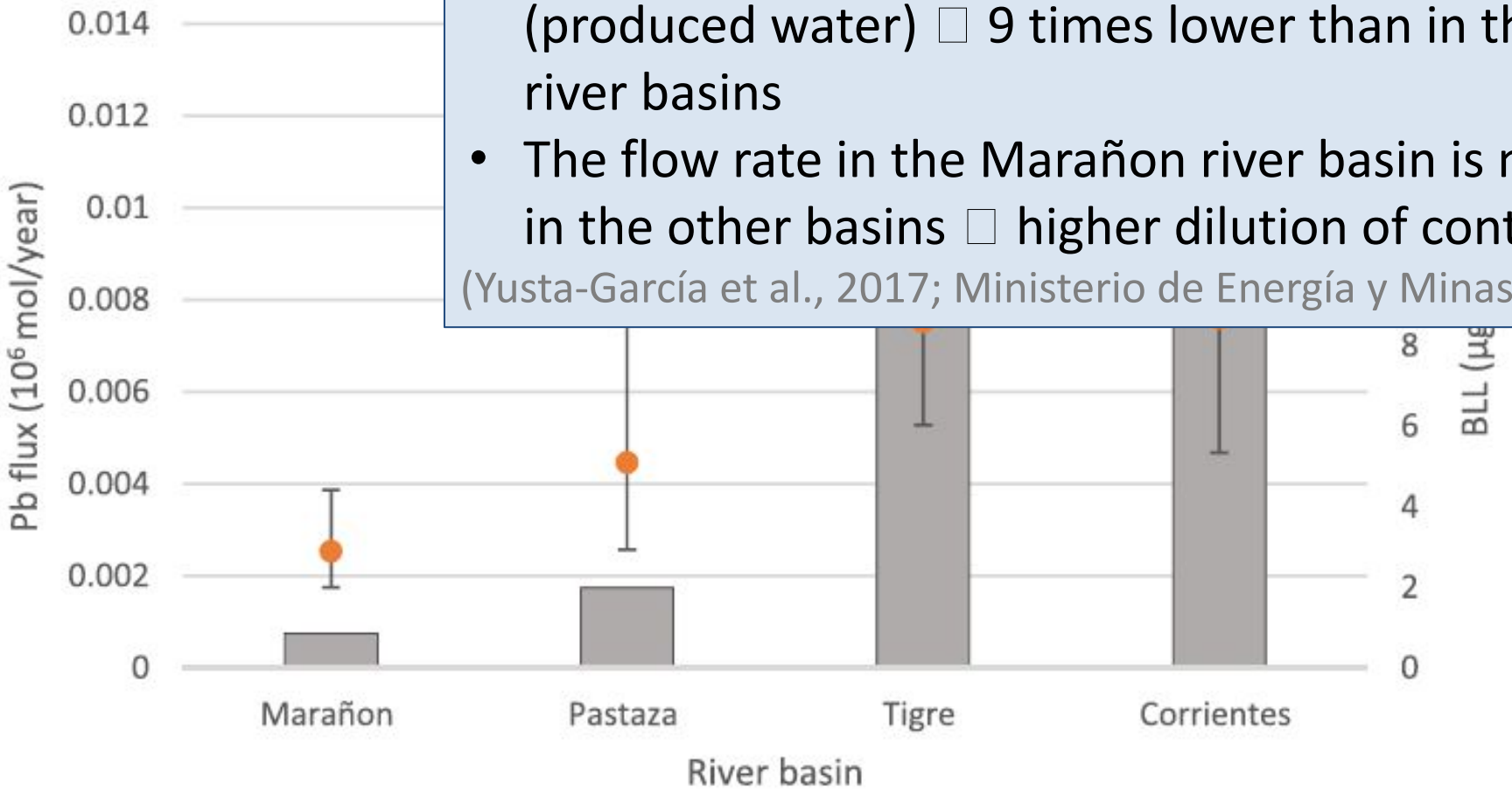
Adults (≥12)



Estimated average lead flux (10^6 mol/year) from dumping of produced water in 2008 in the Marañon, Pastaza, Tigre and Corrientes river basins (extracted from Yusta-García et al. 2017) and BLL (µg/dL) detected in the current study in the same river basins

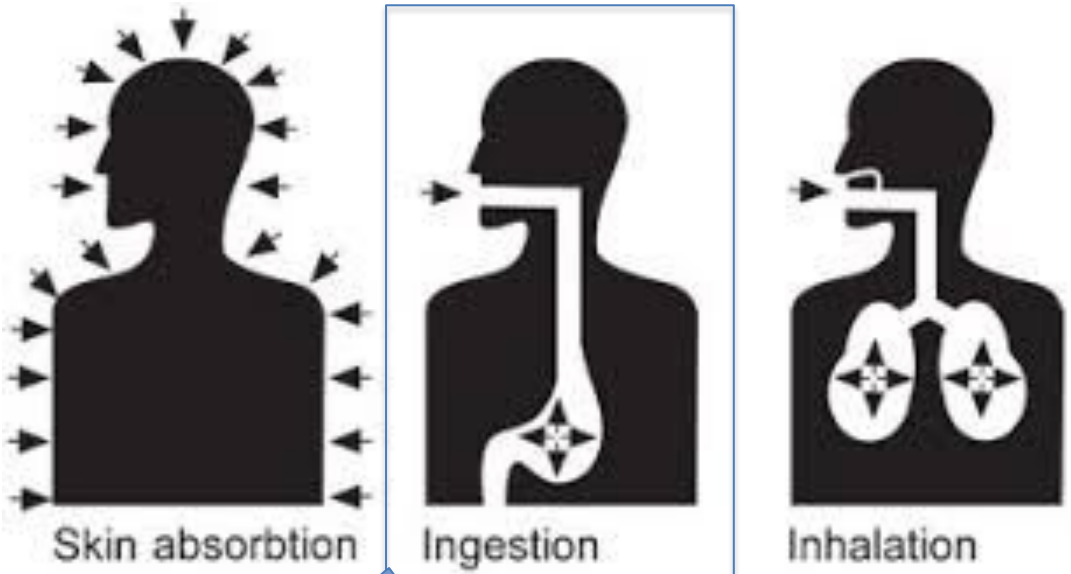
- In the Marañón and Pastaza river basins, dumping of Pb (produced water) □ 9 times lower than in the other two river basins
- The flow rate in the Marañon river basin is much higher than in the other basins □ higher dilution of contaminants.

(Yusta-García et al., 2017; Ministerio de Energía y Minas del Perú, 2005)



(O'Callaghan-Gordo, C, et al. Environment International 2021)

Routes of exposure for the local population

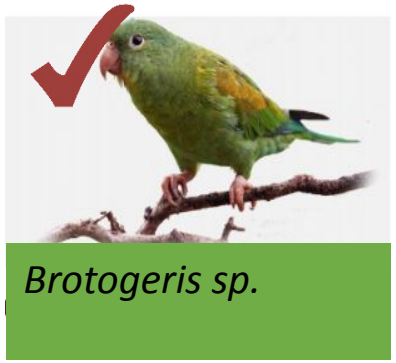


Is consumption of wild game an important source of exposure to lead?

(Orta-Martinez et al, ER 2017)

Trap cameras in:
3 natural salt licks
15 oil-polluted sites

2083 camera-days
8,206 videos
+
Soil collection



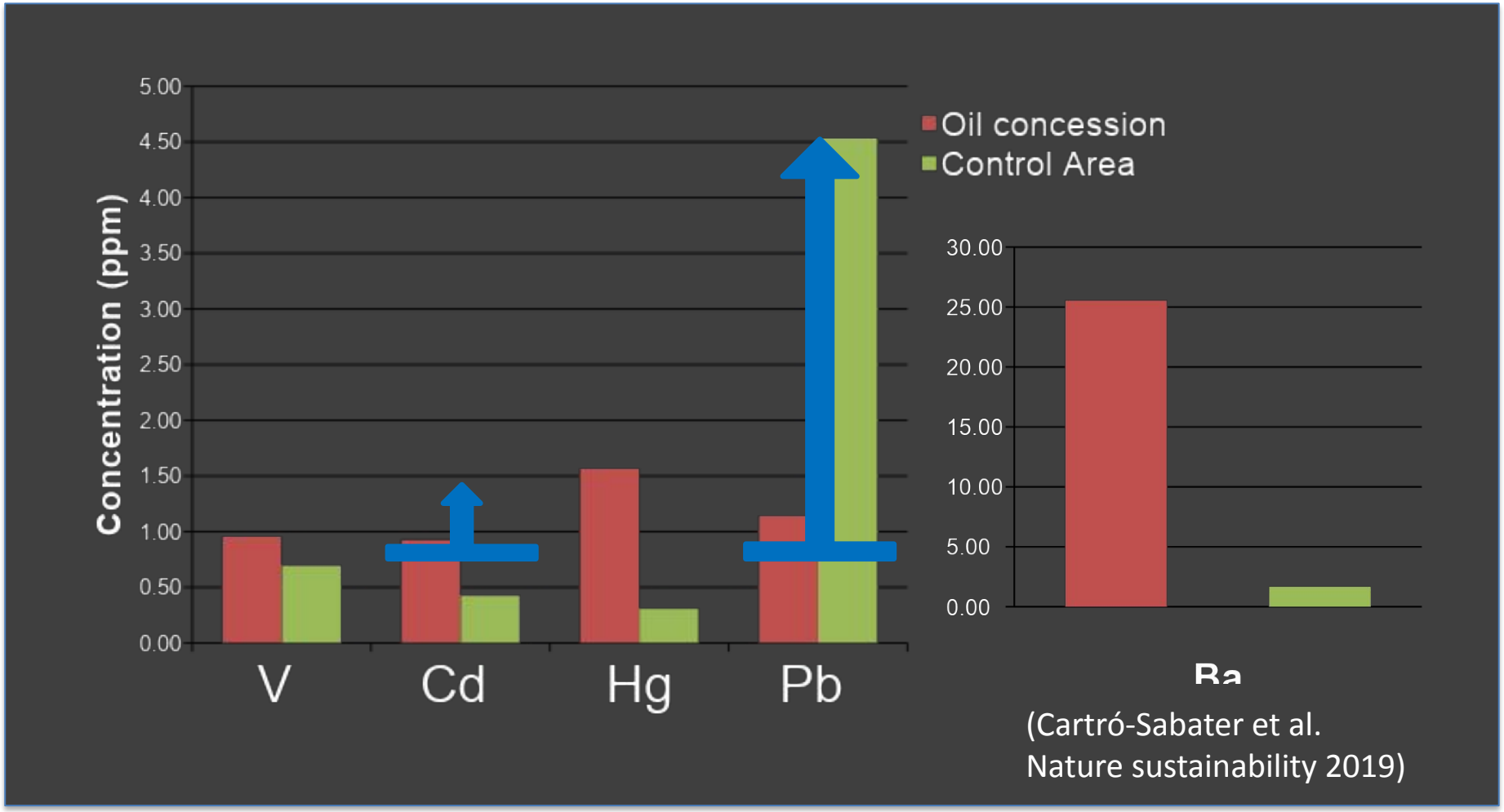
✓Species recorded **ingesting** soil/water in oil polluted salt licks

Species recorded in oil-polluted salt licks represent 49%-68% of hunted biomass (Bodmer and Lozano 2010; Zapata-Ríos et al. 2009)

(Slide from Orta-Martinez)

- High average concentration of Pb (0.49 µg/g WW) in livers from Amazonian wild game

- 50 % of the samples had Pb above acceptable limits of offal for human consumption (0.5 µg/g WW), (European Regulation CE 1881/2006 on viscera for human consumption (Cd and Pb))



(Cartró-Sabater et al. Nature sustainability 2019)

Final remarks (I)

- Our study shows extensive oil pollution and human exposure at all ages
- Very important to have valid data on environmental exposures and conditions of life of understudied populations
- Practically impossible to conduct long term cohort studies similar to what was done in HICs. We don’t need these complex studies to act!

Final remarks (II)

- Negative health effect of oil extraction activities are major issue of global health inequities Local communities in the Amazons are a clear example

- Important issue of empowerment of local populations

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- Ana Espinosa

Universitat de Barcelona, Barcelona, Spain
- Martí Orta Martínez

ICTA-UAB, Barcelona, Spain
- Pedro Mayor
- Mar Cartro

CENSOPAS-INS, Lima, Peru
- Antonio Flores
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- John Astete

Pontificia Universidad Católica del Perú, Lima, Peru
- Tami Okamoto

E-Tech International, Santa Fe, NM, USA
- Diana M. Papoulias

Centro de políticas Públicas y Derechos Humanos - Perú Equidad, Lima, Peru
- Frederica Barclay

Indigenous federations
- **FECONACOR**
- **FECONAT**
- **FEDIQUEP**
- **ACODECOSP**
- **PUINAMUD**