Social Science & Medicine 70 (2010) 401–411

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Morbidity and mortality disparities among colonist and indigenous populations in the Ecuadorian Amazon☆

William Kuang-Yao Pan [a,*], Christine Erlien [b], Richard E. Bilsborrow [c]

[a] The Johns Hopkins Bloomberg School of Public Health, Department of International Health, 615N Wolfe Street, E5545, Baltimore, MD 21205, United States
[b] Duke University, Thompson Writing Program, Durham NC 27708, United States
[c] University of North Carolina at Chapel Hill, Department of Biostatistics, Chapel Hill, NC 27516, United States

ARTICLE INFO

Article history:
Available online 10 November 2009

Keywords:
Colonists
Indigenous
Morbidity and mortality
Human-environment dynamics
Ecuadorian Amazon
Land use

ABSTRACT

Rural populations living in the northern Ecuadorian Amazon (NEA) experience the highest health burden of any region in the country. Two independent studies of colonist and indigenous groups living in the NEA are used to compare their morbidity and mortality experiences. Colonist data are from a probability sample of land plots in 1999, while indigenous data are from a representative sample of the five largest ethnicities (Quichua, Shuar, Huaorani, Cofan, Secoya) collected in 2001. Poisson regression was used to compare morbidity. Results indicate clear differences in health between populations. Indigenous groups had 30% higher probability of mortality and 63% higher incidence rate of all-cause morbidity compared to colonists. Vector-borne, chronic, gastrointestinal, and diseases of unknown origin were particularly high among indigenous groups. Factors associated with morbidity varied: morbidity rates were similar for the two youngest age groups (0–4 and 5–9), but indigenous people aged 15–39 and 40+ had almost double the morbidity compared to colonists; larger households, later months of data collection and less pollution were associated with less morbidity in both groups; better infrastructure access (electricity and roads) was generally associated with lower morbidity in both groups; and associations of land use were different by group with more cultivation of perennials and fewer annuals associated with less morbidity for colonists, but more for indigenous groups. These results demonstrate the health disparities that exist among indigenous and non-indigenous populations even when living in the same geographic region. Land use itself exemplifies the cultural and contextual differences that are evident in health, since land use decisions are related to broader demographic and economic factors that influence overall ecological and human health. Ongoing population-environment and/or environment-health research needs to recognize the broader factors involved when studying relationships between population health, development and deforestation.

Introduction

There is a growing global concern regarding the fate of the Amazon forest and its impact on climate change, infectious disease transmission, and irrevocable loss of natural resources. The fate of the forests is tied to colonist and indigenous populations that inhabit the Amazon Basin and who have been identified as primary agents of land use change in the tropics (Carr & Bilsborrow, 2001; Gray, Bilsborrow, Bremner, & Lu, 2008; Rudel & Roper, 1996). People living in the Amazon are among the most vulnerable in Latin America and are often constrained in their decisions pertaining to agricultural land use, labor opportunities (particularly for women), fertility regulation, migration, and health care due to factors that include limited access to infrastructure and technical assistance, severe poverty, low education, and environmental conditions (e.g.,

☆ This research is made possible through grants from the US National Aeronautics and Space Administration (NASA) (NCC5-295), the Mellon, Summit, and Compton Foundations, PROFORS (Proyecto Forestal, in Lago Agrio, Ecuador, funded by GTZ, the German foreign aid program), and the National Institute for Child Health and Human Development (HD07168 and HD054939). Financial support for the 1990 data collection was provided by the US National Science Foundation, the World Wildlife Federation, and the Carolina Population Center (CPC), with logistical support from several Ecuadorian government agencies, including CONADE (the former National Planning Agency), the Ministry of Agriculture, and IERAC (Ecuadorian Institute for Agrarian Reform and Colonization). We would like to thank all the families who participated in our surveys.

* Corresponding author. Tel.: +1 410 502 2141; fax: +1 410 502 6733.
E-mail address: wpan@jhsph.edu (W.K. Pan).

0277-9536/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.socscimed.2009.09.021

Angelsen & Kaimowitz, 1999; Carr, Pan, & Bilsborrow, 2006; Coomes, Grimard, & Burt, 2000; Murphy, 2001; Pichón, 1997). At a macro-level, these constraints are often framed within a vicious cycle of poverty, rising population (i.e., high fertility), ill health, and environmental degradation (Carr, 2004; Dasgupta, 1995). At the micro level, consensus on factors associated with household decisions has yet to be attained, and although health outcomes have been directly tied to environmental degradation (Patz et al., 2004; Sawyer, 1993; Yasuoka & Levins, 2007), land use and land cover change research has largely ignored health.

Data on the health status of rural populations in developing countries are usually obtained from Demographic and Health Surveys (DHS) or studies focused on individual health outcomes. In the Amazon, DHS data highlight regional or country-level health outcomes, such as malnutrition, reproductive health, and infant mortality (Ali, Cleland, & Shah, 2003; Cleland, Bicego, & Fegan, 1992; Larrea & Freire, 2002; MACRO, 1997; Valdivia, 2004). However, DHS data have been criticized for often not being representative of rural areas and possibly exhibiting reporting bias (Manesh, Sheldon, Pickett, & Carr-Hill, 2008). A number of focused epidemiological studies have been conducted in the Amazon that provide invaluable information pertaining to health burden, such as gastrointestinal illnesses and malnutrition, elevated blood-mercury levels, tuberculosis, and vector-borne and zoonotic diseases (e.g., Akhavan, Musgrove, Abrantes, & Gusmão, 1999; Basta et al., 2006; Carvalho-Costa et al., 2007; Passos et al., 2008). An unfortunate shortcoming of these studies is the (usually) inherent focus on a few key health outcomes due to study design and objectives that exclude the wider array of ailments that affect inhabitants and potentially overstating the impact of a particular disease for a region.

Regardless of whether one is concerned (or not) with potential biases in regional data or focused studies, one easily surmises that health quality is not equally distributed. In Amazon Basin countries, publically available data easily display these disparities at a regional level and across some large municipalities. However, the extent to which regional disparity exists in the Amazon itself is not well defined. Thus, the primary objective for this study is to evaluate disparities in health between two distinct populations living in the northeastern Ecuadorian Amazon (NEA): migrant colonists and indigenous people. We address disparities associated with (1) overall morbidity and mortality and (2) factors associated with morbidity. Data are from two independent studies of anthropogenic land use change that obtained information from colonists living in the Northern Ecuadorian Amazon (NEA) in 1999 and from five indigenous groups in 2001. Surveys administered focused on factors associated with land use decisions, with modules exclusively designed to capture morbidity and mortality of each person living in a household. Established demographic methods of mortality estimation are applied and regression methods are used to compare factors associated with morbidity. The findings from this study highlight important health disparities in tropical regions.

Ecuador's Amazon

The three geographic regions of Ecuador include: the *Costa* (~6.9 million population, INEC, 2009) along the Pacific Ocean; the *Sierra* (~6.3 million, INEC, 2009) along the central highlands of Ecuador that include the Andes Mountains and Quito, Ecuador's capital; and the *Oriente* (~0.7 million, INEC, 2009) comprised of six provinces in the Amazon Basin and home to a number of Ecuador's indigenous tribes (i.e., Quichua, Siona, Secoya, Huaorani, Cofán, Shuar, Saparo, Achuar). The *Oriente* population has increased 10-fold since 1960 (when it was mostly indigenous) to an estimated 2001 census population of about 500,000 with approximately 30% indigenous (INEC, 2001b). In-migration has been rapid since 1967 when oil was discovered near the Colombian border, leading to extensive road construction, laying of oil pipelines, and regional development. Over 90% of these migrants are from outside the Amazon, mostly from rural areas of the Sierra (Bilsborrow, Barbieri, & Pan, 2004; Pichón, 1997; Rudel & Richards, 1990). The convergence of new land settlement and regional development resulted in Ecuador experiencing the highest deforestation rate among all Amazon Basin countries since 1980 (FAO, 2001, 2005, 2007), leading to 282 endemic plant species being critically endangered and almost 50 endemic species already extinct (Pitman, Jørgensen, Williams, León-Yánez, & Valencia, 2002).

Our study region, the NEA, covers an area greater than 700,000 hectares (ha), including much of the provinces of Sucumbios and Orellana and parts of Napo and Pastaza. The study region is expansive due to the very low population density among both colonist and indigenous settlements throughout the region (Fig. 1); however, the area extent is also a key strength as most research on health and/or environment in tropical regions are based on convenience samples of limited geographic size. Colonist settlements are considerably different from indigenous. Colonists occupy government-defined plots (*fincas*, typically 40–60 ha) that are arranged in lines parallel to roads in settlement "sectors" (i.e., line 1 is on the road, line 2 is ~2 km from the road, line 3 ~4 km, etc.). Colonist farms are relatively new, with most *fincas* first established during the early 1980s. Almost all colonist families live on their land and have variable access to infrastructure depending on the *finca* line, sector's proximity to a town, and road quality. In contrast, most indigenous settlements are arranged in household clusters (communities) with farm land located in surrounding areas and most family members born and raised in the *Oriente*. Over half of the indigenous communities in the NEA are located in the same general area as colonist settlements, with groups such as the Shuar claiming land in a similar fashion as colonists. These differences led to the design of two separate studies to examine factors associated with land use change (viz. deforestation) among colonist and indigenous groups, respectively.

Indigenous populations in the northern Ecuadorian Amazon

The indigenous population of the NEA comprises just under one-third of the region's population (INEC, 2001b). In the NEA, the Quichua are the most numerous (~21,000 people), followed by the Shuar (~1,700 people), the Cofán (~500), and the Huaorani and Secoya (each ~300). Other ethnicities in the NEA numbered fewer than 100 in the 2001 Ecuadorian census. Previous studies have discussed several key differences among ethnic groups ranging from land use, fertility and market orientation (Bremner, Bilsborrow, Feldacker, & Holt, 2009; Bremner & Lu, 2006; Gray et al., 2008). The Quichua are widely dispersed with equally diverse economic activities that range from small-scale subsistence agriculture to cash-cropping, hunting, and timber extraction. The Shuar are the largest group in the *southern* Ecuadorian Amazon, but have several communities in the NEA as a result of migration. Thus, many Shuar communities have claimed land along roads in a similar way to colonists and are thus more market-oriented than other ethnicities. The Cofán are limited to just seven communities in the NEA and southern Colombia. Activities of the Cofán differ among those communities that have chosen to isolate themselves in the Cuyabeno Wildlife Refuge and those in close proximity to colonists (Dureno and Duveno) who, as expected, are more market-oriented. The Huaorani were traditionally semi-nomadic with a violent reputation; however, missionaries in the 1950s influenced the establishment of permanent settlements. In general, the Huaorani rely on subsistence agriculture, but also depend on wage labor income from oil companies. Finally, the Secoya have been greatly