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Invited Review

Neglected tropical diseases in Central America and Panama: Review of their prevalence, populations at risk and impact on regional development

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ABSTRACT

A review of the literature since 2009 reveals a staggering health and economic burden resulting from neglected tropical diseases in Panama and the six countries of Central America (referred to collectively here as 'Central America'). Particularly at risk are the 10.2 million people in the region who live on less than \$2 per day, mostly in Guatemala, Honduras, Nicaragua and El Salvador. Indigenous populations are especially vulnerable to neglected tropical diseases. Currently, more than 8 million Central American children require mass drug treatments annually (or more frequently) for their intestinal helminth infections, while vector-borne diseases are widespread. Among the vector-borne parasitic infections, almost 40% of the population is at risk for malaria (mostly *Plasmodium vivax* infection), more than 800,000 people live with Chagas disease, and up to 39,000 people have cutaneous leishmaniasis. In contrast, an important recent success story is the elimination of onchocerciasis from Central America. Dengue is the leading arbovirus infection with 4–5 million people affected annually and hantavirus is an important rodent-borne viral neglected tropical disease. The leading bacterial neglected tropical diseases include leptospirosis and trachoma, for which there are no disease burden estimates. Overall there is an extreme dearth of epidemiological data on neglected tropical diseases based on active surveillance as well as estimates of their economic impact. Limited information to date, however, suggests that neglected tropical diseases are a major hindrance to the region's economic development, in both the most impoverished Central American countries listed above, as well as for Panama and Costa Rica where a substantial (but largely hidden) minority of people live in extreme poverty.

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1. Overview of extreme poverty and disease in Central America

There is a well-described link between extreme poverty and neglected tropical diseases (NTDs). While those associations are often viewed as underdevelopment issues in sub-Saharan Africa or southern and southeastern Asia, there is also a high level of disease and poverty in the western hemisphere. In the Latin American and Caribbean (LAC) region, approximately 48 million people live below the World Bank poverty figure of \$1.25 per day, while 99 million people live on less than \$2 per day (Hotez et al.,

2013). Indeed there are seven LAC countries whose human development index (HDI) ranks below 100 and exhibit levels of poverty equivalent to many poor African or southeastern Asian countries (Hotez et al., 2013). Of those seven impoverished nations, four – Guatemala, Nicaragua, Honduras and El Salvador – are countries in Central America (Fig. 1).

As shown in Table 1, of the estimated 44 million people who live in Panama and the six countries of Central America (referred to collectively here as 'Central America'), approximately 10.2 million live on less than \$2 per day (Central Intelligence Agency, 2013; World Bank, 2014a,b). Unfortunately, Central America "punches above its weight" in terms of poverty in the Americas, contributing to 7.7% of the population in the LAC region (based on a total population of 578 million (Hotez et al., 2013)), but 10% of its poor.

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Fig. 1. Map of Central America and Panama showing Guatemala, Nicaragua, Honduras and El Salvador. These are the four Central American countries that are included in the seven Latin American and Caribbean countries whose human development index ranks below 100 and exhibit levels of poverty equivalent to many poor African or southeastern Asian countries (Hotez et al., 2013). http://en.wikipedia.org/wiki/File:Centroamerica_politico.png.

Table 1
Population and poverty in Central America.

Country	Population ^a	Population living on less than \$2 per day (year) ^b	HDI and comparisons with other African countries (2013 estimates for 2012) ^c	Gini index ^d
Total	44 million ^e	23.18% ^e 10.2 million ^e		
Belize	0.3 million	22.00% (1999) 0.1 million ^e	96 (0.702)	No data
Costa Rica	4.8 million	5.97% (2009) 0.3 million ^e	62 (0.773)	50.7
El Salvador	6.1 million	16.94% (2009) 1.0 million ^e	107 (0.68) Gabon	48.3
Guatemala	14.6 million	26.33% (2006) 3.8 million ^e	133 (0.581) Ghana	No data
Honduras	8.6 million	29.84% (2009) 2. million ^e	120 (0.632) Botswana South Africa	57.0
Nicaragua	5.8 million	31.74% (2005) 1.9 million ^e	129 (0.599) Namibia	No data
Panama	3.6 million	13.80% (2010) 0.5 million ^e	59 (0.780)	51.9

HDI, human development index.

^a Central Intelligence Agency (2013).

^b World Bank (2014a).

^c United Nations Development Program (2013).

^d World Bank (2014b).

^e Calculated using population numbers from Central Intelligence Agency (2013) and percentages from United Nations Development Program (2013).

country – Guatemala – contributes 40% of the impoverished in Central America (Central Intelligence Agency, 2013; United Nations Development Program, 2013). As a comparison to sub-Saharan African countries, Guatemala, Honduras and Nicaragua exhibit HDIs similar to Ghana, South Africa and Namibia, respectively (United Nations Development Program, 2013). A high percentage of the people who live in poverty in these Central American countries belong to indigenous and pre-Columbian groups. For instance, according to the World Bank more than one-half of the total population of Guatemala lives in poverty (Hall and Patrinos, 2006). But that country also has the largest indigenous population in the region and almost three-quarters of its indigenous people are poor (Hall and Patrinos, 2006).

Another feature about poverty in Central America is its huge disparity between wealth and poverty, as five of the seven countries exhibit Gini indices exceeding 50% (Central Intelligence Agency, 2013). The higher the Gini index, the higher the level of inequality is in a country. Thus, even the two wealthiest Central American countries – Panama and Costa Rica – have a substantial number of poor people. For instance, Panama has one of the fastest growing economies in the western hemisphere, such that ‘The Economist’ magazine has asked whether it could become the ‘Singapore of Central America’ (The Economist, 2011). However, this prosperity has left behind an estimated 500,000 people (13.8% of its population) who remain trapped in extreme poverty.

In this setting of extreme poverty in Central America emerge high levels of NTDs. Shown in Table 2 is a summary of the major NTDs in Central America, led by more than 17 million people at risk for *Plasmodium vivax* malaria, 8 million pre-school and school-aged children who require regular and periodic deworming for their intestinal helminth infections, 4–5 million people who become infected with dengue fever annually, and more than 800,000 people with Chagas disease (Bern et al., 2011; Pan-American Health Organization, 2011b; Bhatt et al., 2013; World Health Organization, 2013b,c). NTDs such as cutaneous leishmaniasis (CL) and onchocerciasis are also important to the region, as are leprosy, trachoma and other diseases (World Health Organization, 2012a;

The “bottom 10 million” in Central America are not evenly distributed. The four worst HDI countries mentioned above contribute 96% of the people living in poverty in Central America, while Guatemala, Honduras and Nicaragua contribute 85%, and just one

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