American Journal of Infection Control 42 (2014) 1044-8

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

National HIV/AIDS mortality, prevalence, and incidence rates are associated with the Human Development Index

Li-Xia Lou MD [a], Yi Chen MD [b], Chao-Hui Yu PhD [b], You-Ming Li PhD, MD [b], Juan Ye PhD, MD [a,*]

[a] Department of Ophthalmology, The Second Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China
[b] Department of Gastroenterology, The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China

Key Words:
Socioeconomic status
Global epidemic
Less-developed countries

Background: HIV/AIDS is a worldwide threat to human health with mortality, prevalence, and incidence rates varying widely. We evaluated the association between the global HIV/AIDS epidemic and national socioeconomic development.

Methods: We obtained global age-standardized HIV/AIDS mortality, prevalence, and incidence rates from World Health Statistics Report of the World Health Organization. The human development indexes (HDIs) of 141 countries were obtained from a Human Development Report. Countries were divided into 4 groups according to the HDI distribution. We explored the association between HIV/AIDS epidemic and HDI information using Spearman correlation analysis, regression analysis, and the Kruskal-Wallis test.

Results: HIV/AIDS mortality, prevalence, and incidence rates were inversely correlated with national HDI ($r = -0.675$, -0.519, and -0.398, respectively; $P < .001$), as well as the 4 indicators of HDI (ie, life expectancy at birth, mean years of schooling, expected years of schooling, and gross national income per capita). Low HDI countries had higher HIV/AIDS mortality, prevalence, and incidence rates than that of medium, high, and very high HDI countries. Quantile regression results indicated that HDI had a greater negative effect on the HIV/AIDS epidemic in countries with more severe HIV/AIDS epidemic.

Conclusions: Less-developed countries are likely to have more severe HIV/AIDS epidemic. There is a need to pay more attention to HIV/AIDS control in less-developed countries, where lower socioeconomic status might have accelerated the HIV/AIDS epidemic more rapidly.

The HIV/AIDS pandemic entered its third decade in 2011. In 1981 when it was first reported, no one expected the rampant spread of this universally fatal disease.[1] The Joint United Nations Program on HIV/AIDS (UNAIDS) estimates that in 2011, a total of 34.2 million persons were living with HIV infection, 2.5 million persons were newly infected, and 1.7 million died.[2] However, these global figures hide a wide diversity. The prevalence of HIV infection among adults in sub-Saharan Africa continues to be the highest, followed by Eastern Europe and the Caribbean.[3] Considerable HIV/AIDS differences among nations might be due to poverty inequality, economic instability, migration, education, access to health services, drug use, and sexually transmitted diseases.[4] Even within a country, the HIV/AIDS epidemic varies widely according to region and risk group.

There have been plenty of studies focusing on HIV/AIDS epidemiology. However, many of these articles are narrowed to a small region, a single country, or parts of a country.[5-7] On the basis of the national reports reviewed, HIV/AIDS is suggested to impede development of African countries and hence reverse the social and economic gains that these countries are striving to attain.[6] Nevertheless, the extent of this conclusion remains unknown. The purpose of our study was to review the global HIV/AIDS mortality, prevalence, and incidence rates, and to explore the association between HIV/AIDS epidemic and national socioeconomic development assessed according to the Human Development Index (HDI).

METHODS

Global HIV/AIDS epidemic

The global age-standardized HIV/AIDS mortality rates, prevalence rates, and incidence rates of different countries in 2011 were obtained from the World Health Statistics Report 2013 of the World Health Organization.[8]

* Address correspondence to Juan Ye, PhD, MD, Department of Ophthalmology, The Second Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou 310000, China.
E-mail addresses: yejuan@zju.edu.cn (J. Ye), zlym@zju.edu.cn (Y.-M. Li).
L-XL and YC contributed equally to this work.
Conflicts of interest: None to report.

0196-6553/$36.00 - Copyright © 2014 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.ajic.2014.06.029

Table 1
Medians, interquartile ranges, and Kolmogorov-Smirnov test results of global HIV/AIDS epidemiologic parameters per 100,000 individuals

Global HIV/AIDS epidemic	n	Median	Interquartile range	Kolmogorov-Smirnov test (*P* value)
Mortality	137	11	1.25-49.5	.000
Prevalence	139	255	96-810	.000
Incidence	63	53	18-191	.000

HDI

The HDI data of Union Nation members in 2011 were obtained from the United Nations Development Programme database (http://hdr.undp.org/), according to the 2011 Human Development Report.[9] The HDI is a composite index measuring average achievement in 3 basic dimensions (4 indicators) of human development: long and healthy life (life expectancy at birth), education (mean and expected years of schooling), and decent standard of living (gross national income [GNI] per capita). The index ranges from 0-1, with higher scores reflecting a higher degree of human development. Based on quartiles of HDI distribution in the 2011 Human Development Report,[9] countries were placed into 4 predefined socioeconomic groups as follows: very high (HDI $\geq$ 0.793), high (0.793 $>$ HDI $\geq$ 0.698), medium (0.698 $>$ HDI $\geq$ 0.522), and low (HDI $<$ 0.522).

Statistical analysis

The medians (interquartile ranges) for the HIV/AIDS mortality, prevalence, and incidence rates across countries were calculated. National HIV/AIDS epidemiologic parameters were tested for normality using the Kolmogorov-Smirnov test.[10] The relationships between HIV/AIDS epidemic and national HDI were evaluated by calculation of Spearman correlation coefficient after the hypotheses of normality were rejected by Kolmogorov-Smirnov test. We further performed linear regression analyses, which estimated the average effect of independent variable (ie, HDI) on dependent variable (ie, HIV/AIDS mortality, prevalence, and incidence rates); and quantile regression analyses, which estimated the effect of the independent variable at different quantiles of each dependent variable's conditional distribution.[11] The statistical significance of differences in HIV/AIDS mortality, prevalence, and incidence rates among 4 HDI countries was determined by Kruskal-Wallis test after the heterogeneity of variances were confirmed.[12] HIV/AIDS mortality, prevalence, and incidence rates were compared in low HDI countries versus medium, high, and very high HDI countries using Mann-Whitney *U* test.[13] All statistical analyses, except regression analyses, were performed using SPSS 20 (IBM-SPSS Inc, Armonk, NY), and results were plotted using GraphPad Prism 6 (GraphPad, San Diego, Calif). Regression analyses were performed using Stata 12 (Stata Corp, College Station, Tex). *P* values $<$ .05 were considered significant.

RESULTS

HIV/AIDS epidemic and national HDI

Data on the global HIV/AIDS mortality, prevalence, and incidence rates were available for 137, 139, and 63 countries, respectively. HDI and its 4 indicators were available for 141 countries. The medians (interquartile ranges) and Kolmogorov-Smirnov test results of

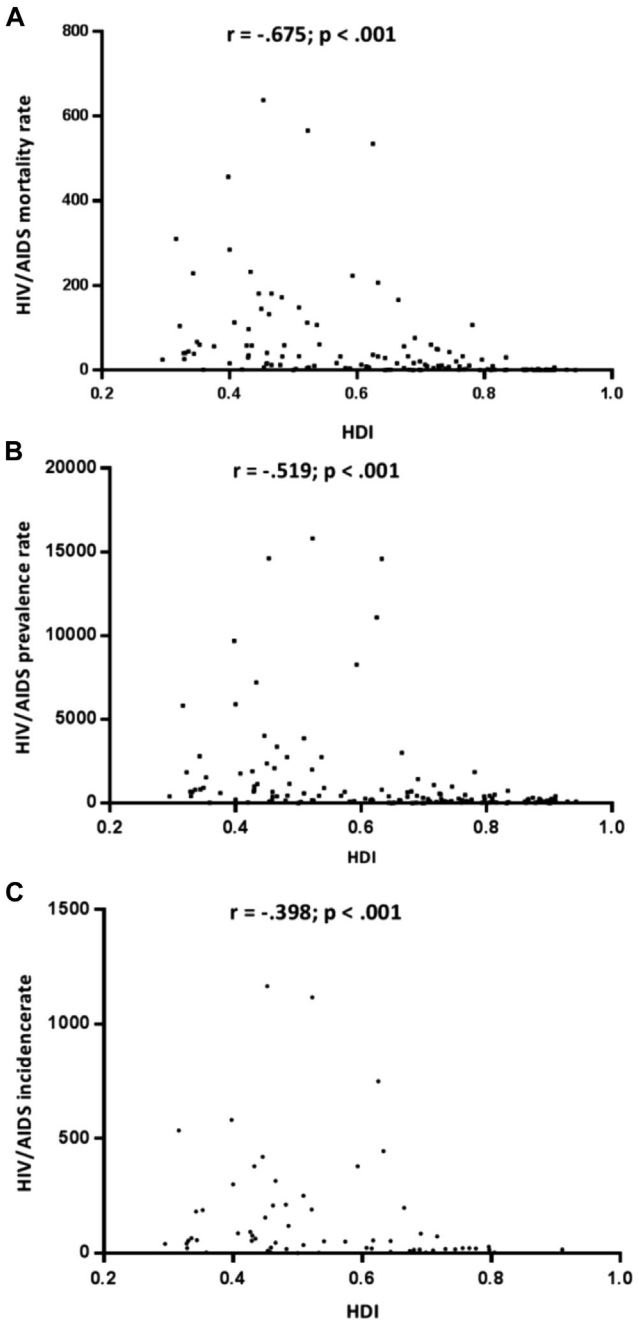

Fig 1. Scatter plots show Spearman correlation coefficients between Human Development Index (HDI) and (A) HIV/AIDS mortality, (B) HIV/AIDS prevalence, and (C) HIV/AIDS incidence rates (per 100,000 individuals).

Table 2
Spearman correlation coefficients between Human Development Index (HDI), its 4 indicators, and HIV/AIDS epidemiologic parameters

Variable	Mortality	Prevalence	Incidence
HDI	−0.675***	−0.519***	−0.398***
Life expectancy at birth, y	−0.662***	−0.529***	−0.464***
Mean years of schooling	−0.613***	−0.475***	−0.337**
Expected years of schooling	−0.634***	−0.484***	−0.310*
Gross national income per capita, $	−0.633***	−0.462***	−0.297*

*$P < .05$.
**$P < .01$.
***$P < .001$.