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Cancer incidence and mortality are associated with human development index and health setups in Africa

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ABSTRACT

Background: This study aimed to analyse the correlation between cancer incidence and mortality and the Human Development Index (HDI) in Africa. Furthermore, to analyse the variations in cancer Mortality to Incidence Ratio (MIR) based on health care systems in African countries.

Material and Methods: Cancer incidence and mortality data for 53 countries were obtained from GLOBOCAN database. Country-wise data on National-HDI were obtained from Human Development Report 2015. Health System Attainment (HSA) data were acquired from World Health Report 2000. The parametric data were analysed by Pearson-correlation and Linear-regression analysis for the effect of HDI and HSA on MIR in African Countries. One-way ANOVA was used to test the differences of MIR in each HDI group. All analyses were performed in SPSS version 20.

Results: An inverse correlation was revealed by cancer MIR with both HDI ($r = -0.897$, $p < 0.001$) and HSA ($r = -0.750$, $p < 0.001$). A significantly low MIR was reported from high HDI countries compared to medium and low HDI countries by one-way ANOVA analysis ($p < 0.001$). Linear regression analysis also reported a negative effect of MIR with both HDI (adjusted $R^2 = 0.801$, $\beta = -0.897$, $p < 0.001$) and HSA (adjusted $R^2 = 0.554$, $\beta = -0.750$, $p < 0.001$).

Conclusions: Based on their HDIs, different African countries has different health system attainments, which is the cause of variations in MIR in these countries. To control their cancer burden, these low and medium HDI countries should focus on improvement of their economic status and policies making, regarding the provision of better health systems to the masses.

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Introduction

Cancer is recognised as a critical public health issue in Africa. In the year 2008, Approximately 715,000 new cancer cases and 542,000 cancer mortality were reported from Africa [1]. It is expected that this number will double with 1.28 million new cancer cases and 970,000 mortalities in 2013 due to population growth, ageing and lifestyle changes [2]. The changing lifestyle (smoking, diet, exercise etc.), socioeconomic condition and demographic factors are responsible for the changing trend in cancer incidence and mortality in the developing countries, as well as the infectious diseases in Africa, account for 33% of cancer burden [3]. Those cancers that were once more prevalent in developed

countries are now diagnosing in underdeveloped countries with higher rates [4].

Africa has extremely diverse population based on country of origin, language, culture, economic condition, religion, sociodemographic features etc. that affect the cancer incidence and its aspects. In most of the sub-Saharan region, indigenous black population are living, while the northern African region (i.e. Algeria, Egypt, Libya, Morocco, Sudan, and Tunisia) is dominated by Arab populations. However, in 9% of the south Africa and some parts of sub-Saharan regions, the white population of European origin are inhabited. The life expectancy ranges from 45 years in Zambia and Zimbabwe to more than 70 years in Libya, Algeria, and Tunisia [5].

Great variations exist in the incidence of cancer in different parts of Africa, with the highest incidence in southern Africa with a standardised rate of 235.9 per 100,000, followed by eastern Africa (121.3), and sub-Saharan Africa (115.9). The lowest incidence rate is reported from middle Africa with a rate of 88.1 per 100,000 [1].

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Previously we analysed the female breast cancer mortality to incidence ratio in African countries in relation to their socio-economic development and health care setups [6]. This study aims to investigate the correlation between overall cancer burden and Human Development Index (HDI) and to analyse the variations in cancer Mortality to Incidence Ratio (MIR) for all types of cancer, based on Health Systems Attainment (HSA) in African countries.

Material and method

Data collection

We obtained data from the GLOBOCAN-2012 database on the incidence and mortality of all cancer in Africa [7]. The detailed procedures for data collection and statistical analysis for different

countries are also given in the website of GLOBOCAN- 2015 [7]. MIRs were calculated by dividing the mortality rate of a country by the incidence rate of the respective country.

HDI data was available for 53 African countries on the database of United Nations Development Program [8]. HDI is a combined index of three parameters (life expectancy at birth, mean and expected years of schooling, and gross national income per capita). The index ranges from 0 to 1. It has four categories (low HDI <0.536, medium HDI 0.536–0.711, high HDI 0.712–0.804, and very high HDI \geq 0.805). The African countries are classified into three categories on the basis of HDI as no country has HDI \geq 0.805.

For health system attainment (HSA), data were obtained from World Health Report 2000 [9]. The value of HSA ranges from 0 to 100 and the average of five indices (i.e. health level (25%), health distribution (25%) level of health care responsiveness (12.5%),

Table 1
Cancer incidence, mortality, mortality to incidence ratio, National HDI, and health system attainment by African countries.

HDI Category	Countries	Incidence	Mortality	MIR	HDI-2015	HSA	
High HDI	Mauritius	180.20	101.50	0.56	0.777	76.20	
	Seychelles	187.70	81.90	0.44	0.770	91.90	
	Algeria	123.50	74.60	0.60	0.736	74.40	
	Libya	124.10	75.10	0.61	0.724	75.30	
	Tunisia	110.60	66.00	0.60	0.721	77.50	
Medium HDI Countries	Botswana	107.60	71.30	0.66	0.698	57.40	
	Egypt	152.00	103.40	0.68	0.690	73.50	
	Gabon	90.20	54.60	0.61	0.684	64.50	
	South Africa Republic	187.10	117.90	0.63	0.666	61.00	
	Cape Verde	74.90	50.20	0.67	0.646	68.30	
	Morocco	82.70	51.90	0.63	0.628	58.80	
	Namibia	117.80	78.40	0.67	0.628	75.70	
	Congo, Republic	88.20	59.90	0.68	0.591	60.10	
	Equatorial Guinea	86.40	65.70	0.76	0.587	60.20	
	Zambia	136.20	104.90	0.77	0.586	55.60	
	Ghana	91.70	63.60	0.69	0.579	65.80	
	Low HDI Countries	Kenya	181.80	135.30	0.74	0.548	64.30
		Angola	100.80	75.60	0.75	0.532	52.40
Swaziland		115.30	85.00	0.74	0.531	59.00	
Tanzania		123.70	91.80	0.74	0.521	60.00	
Nigeria		100.10	72.10	0.72	0.514	51.70	
Cameroon		97.60	69.50	0.71	0.512	59.10	
Madagascar		137.50	103.70	0.75	0.510	57.80	
Zimbabwe		190.30	142.70	0.75	0.509	62.30	
Mauritania		85.70	67.20	0.78	0.506	57.20	
Comoros		101.50	81.40	0.80	0.503	66.40	
Lesotho		103.00	78.30	0.76	0.497	56.00	
Togo		91.10	71.20	0.78	0.484	60.00	
Rwanda		169.70	134.20	0.79	0.483	59.30	
Uganda		135.80	108.10	0.80	0.483	56.50	
Benin		94.30	73.10	0.78	0.480	64.20	
Sudan		91.10	72.90	0.80	0.479	62.30	
Djibouti		92.70	73.00	0.79	0.470	56.80	
South Sudan		132.70	106.30	0.80	0.467	–	
Senegal		101.20	78.70	0.78	0.466	70.50	
Cote d' Ivoire		89.00	70.70	0.79	0.460	60.00	
Malawi		156.00	124.40	0.80	0.445	52.30	
Ethiopia		108.00	84.50	0.78	0.442	50.50	
The Gambia		68.20	58.20	0.85	0.440	60.20	
Congo, Democratic		107.80	93.10	0.86	0.433	60.10	
Liberia		89.20	75.80	0.85	0.430	50.40	
Guinea-Bissau		83.10	67.50	0.81	0.420	52.40	
Mali		111.40	89.90	0.81	0.419	53.30	
Mozambique		136.80	114.80	0.84	0.416	50.60	
Sierra Leone		92.30	82.10	0.89	0.413	35.70	
Guinea		90.00	73.90	0.82	0.411	56.30	
Burkina		88.20	75.80	0.86	0.402	59.40	
Burundi		135.80	117.00	0.86	0.400	59.30	
Chad		88.10	72.60	0.82	0.392	53.60	
Eritrea	101.70	83.40	0.82	0.391	53.70		
Central	92.90	74.30	0.80	0.350	45.90		
Niger	63.40	53.90	0.85	0.348	50.10		
Somalia	139.10	106.20	0.76	0.285	49.40		

The data for HDI [8] and HSA [9] was also used in the previous study [6].

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