

# Factors associated with breast cancer mortality-per-incident case in low-to-middle income countries (LMICs)

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## Background

- 9.6 million people died of cancer in 2018<sup>1</sup> – more than from HIV/AIDS, malaria and tuberculosis combined<sup>1</sup>
- The incidence of cancer is estimated to double by 2035, with most of these cases expected to occur in low-to-middle income countries (LMICs)<sup>1</sup>
- 60% of cancer cases occur in LMICs, and 75% cancer deaths occur in these countries<sup>2</sup>
- In many LMICs, breast cancer remains the leading malignancy affecting women and the leading cause of cancer-related deaths<sup>2</sup>

- We sought to determine factors associated with age-standardized breast cancer incidence (ASI) and mortality per incident case ratio (MPI), defined as age-standardized breast cancer mortality (ASM)/ASI

<sup>1</sup> ESMO Open 2018; 3: e000285; <sup>2</sup> CA: Cancer J Clin. 2018; 68: 394-424

## Methods

- Global data regarding breast cancer ASI and ASM per 100,000 population in 71 low-to-middle income countries (LMICs) were obtained from IARC/WHO for 2018
- MPI was calculated as ASM/ASI
- Other data were obtained as follows:
  - GDP per capita (current US\$) 1990-2017: World Bank Open Data - November 2018, <https://databank.worldbank.org/data/indicator/NY.GDP.MKTP.CD/1ff4a498/Popular-Indicators#>
  - Health care expenditure (% of GDP): World Bank Open Data (December 2018), <https://datacatalog.worldbank.org/current-health-expenditure-gdp>
  - Income Inequality (GINI Index) 1990-2017: World Bank Open Data - November 2018, <https://data.worldbank.org/indicator/SI.POV.GINI?page=4>
  - Human Development Index 1995-2015: United Nations Development Program - Human Development Report – November 2015, <http://hdr.undp.org/en/data>
  - Prevalence of obesity among adults, BMI ≥ 30, age-standardized %- Estimates by country: World Health Organization - Global Health Observatory data repository, December 2018, <http://apps.who.int/gho/data/view.main.CTRY2450A?lang=en>
  - Fertility rate %, contraception prevalence %, physician density (per 1,000 people), population over 65 (% total), and literacy rate %: Democracy Cross-national data from Pippa Norris John F. Kennedy School of Government, Harvard University, USA, <https://www.pippanorris.com/data/>
  - Hospital beds (per 1,000 people): World Bank Open Data - November 2018, <https://data.worldbank.org/indicator/sh.med.beds.zs>
  - Mammography density per million people: World Health Organization, Global Health Observatory, December 2018, <http://apps.who.int/gho/data/node.main.510>
- Non-parametric statistical analyses were performed for correlations and associations between countries above and below the median for ASI and MPI

## Results

- Of the 71 LMICs for which data were available:
  - Median breast cancer ASI rate was 26.9/100,000 (range: 5-67.3)
  - Median breast cancer MPI was 49.66% (range: 27-70%)

Figure 1: Geographic distribution of breast cancer ASI

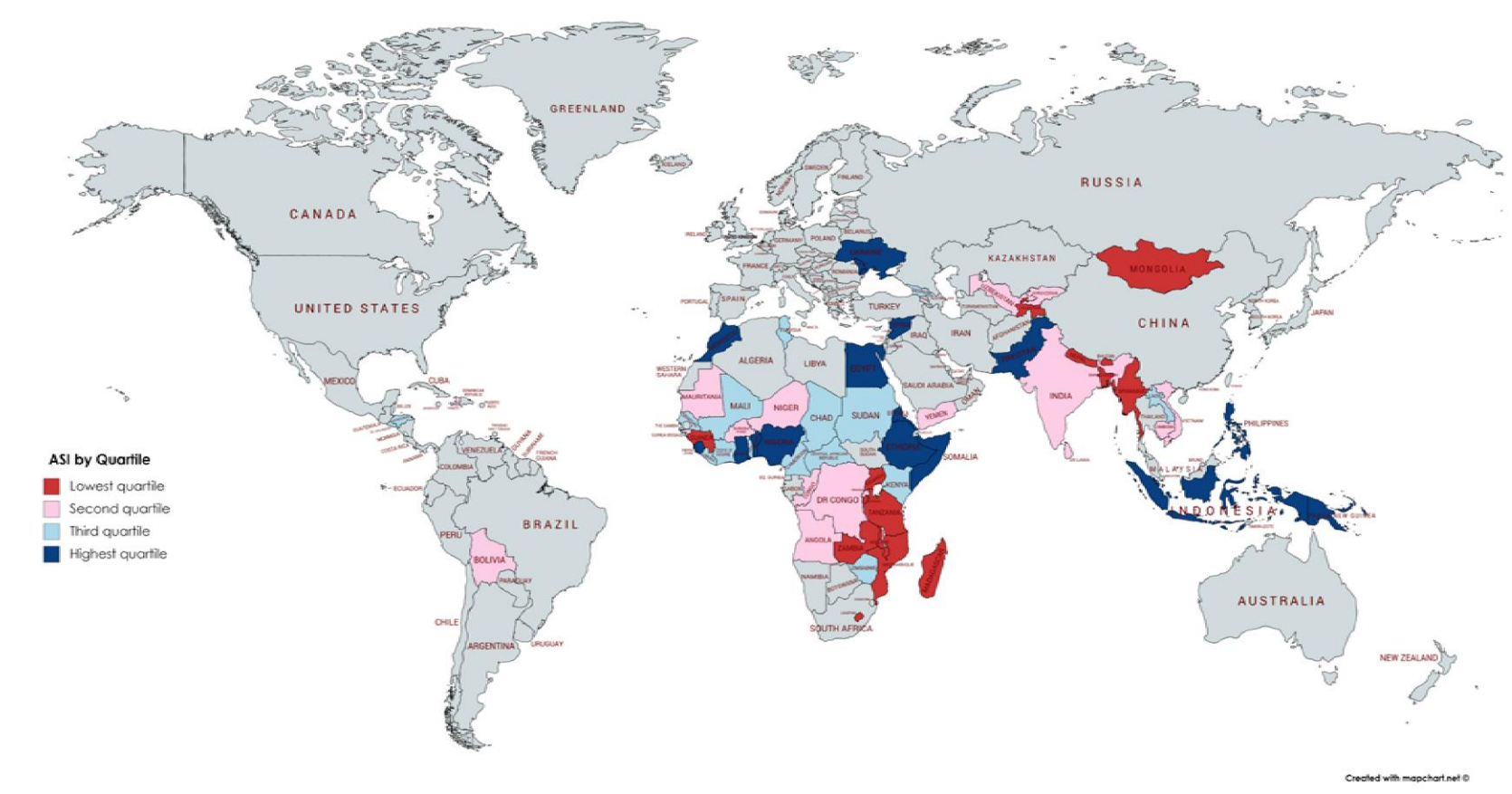


Figure 2: Geographic distribution of breast cancer MPI

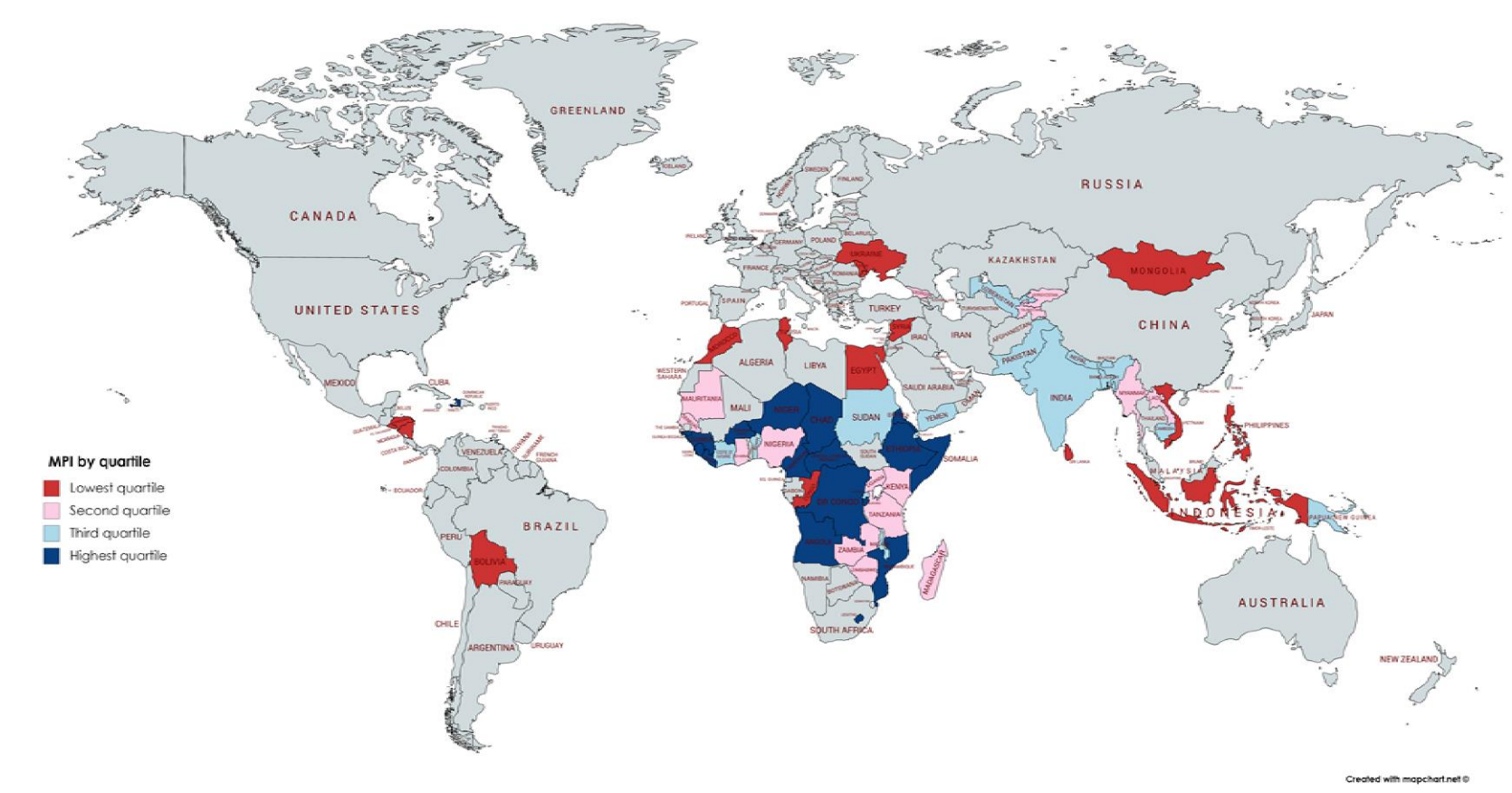


Table 1: Non-parametric correlations with ASI

Factor	Spearman rho	P-value
GDP per capita US\$ (2017)	0.292	0.017
Health expenditure % of GDP (2015)	-0.070	0.567
Population over 65 as % total (2017)	0.130	0.283
Human Development Index (2015)	0.077	0.527
Hospital bed density per 1,000 people (2015)	0.177	0.738
Physician density per 1,000 people (2016)	-0.036	0.939
Mammography density per million people (2014)	0.187	0.219
Literacy rate % (2017)	0	1.000
BMI>30, adult women age-stand. % (2016)	0.351	0.003
Contraception prevalence % (2017)	0.017	0.966
Fertility rate % (2016)	-0.062	0.606

Table 2: Non-parametric correlations with MPI

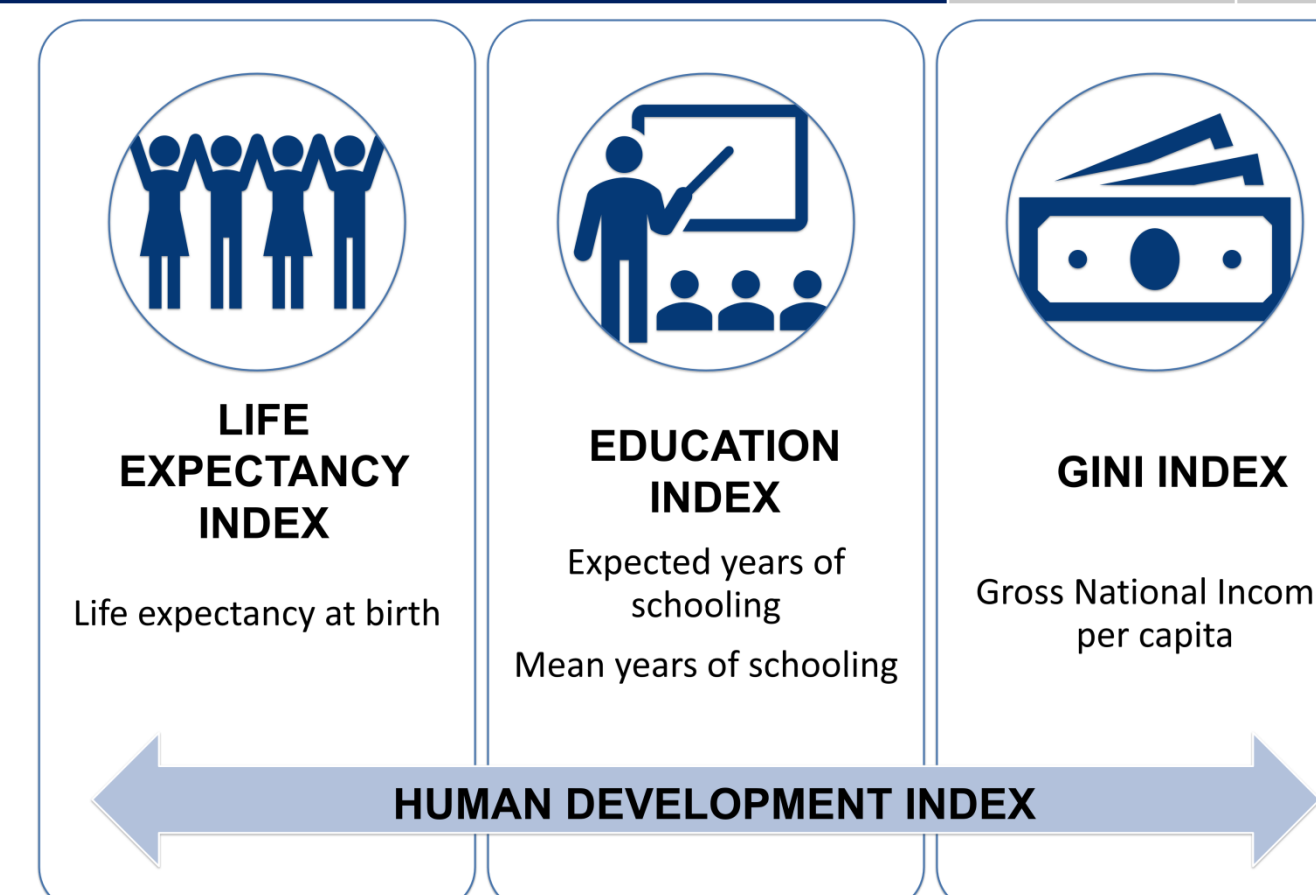
Factor	Spearman rho	P-value
GDP per capita US\$ (2017)	-0.680	<0.001
Health expenditure % of GDP (2015)	-0.031	0.802
Population over 65 as % total (2017)	-0.500	<0.001
Human Development Index (2015)	-0.794	<0.001
Hospital bed density per 1,000 people (2015)	-0.971	0.001
Physician density per 1,000 people (2016)	-0.179	0.702
Mammography density per million people (2014)	-0.385	0.009
Literacy rate % (2017)	-0.800	0.200
BMI>30, adult women age-stand. % (2016)	-0.421	<0.001
Contraception prevalence % (2017)	-0.417	0.265
Fertility rate % (2016)	0.552	<0.001

Table 3: Factors associated with ASI above/below median

Factor	Bivariate Analysis			Multivariate analysis	
	Below median ASI	Above median ASI	P-value	OR (95% CI)	P-value
GDP per capita US\$ (2017)	1136.80	1968.60	0.048	1.000 (1.000 – 1.001)	0.647
Health expenditure % of GDP (2015)	5.98	5.33	0.533		
Population over 65 as % total (2017)	3.16	3.65	0.388		
Human Development Index (2015)	0.53	0.53	0.819		
Hospital bed density per 1,000 people (2015)	0.80	1.20	0.400		
Physician density per 1,000 people (2016)	0.38	0.11	0.381		
Mammography density per million people (2014)	6.28	10.39	0.400		
Literacy rate % (2017)	82.39	66.35	0.667		
BMI>30, adult women age-stand. % (2016)	11.50	15.20	0.005	1.096 (1.016-1.183)	0.018
Contraception prevalence % (2017)	28.50	34.75	0.730		
Fertility rate % (2016)	4.00	3.81	0.662		

Table 4: Factors associated with MPI above/below median

Factor	Bivariate Analysis			Multivariate analysis	
	Below median MPI	Above median MPI	P-value	OR (95% CI)	P-value
GDP per capita US\$ (2017)	2314.07	824.50	<0.001	1.001 (1.000-1.002)	0.267
Health expenditure % of GDP (2015)	5.59	5.44	0.787		
Population over 65 as % total (2017)	4.39	3.15	0.009	1.209 (0.555-2.637)	0.633
Human Development Index (2015)	0.63	0.48	<0.001	7.15 X 10 <sup>-19</sup> (1.42 X 10 <sup>-29</sup> – 3.59 X 10 <sup>-8</sup> )	0.001
Hospital bed density per 1,000 people (2015)	1.75	0.55	0.133		
Physician density per 1,000 people (2016)	0.91	0.27	1.000		
Mammography density per million people (2014)	12.86	5.88	0.057		
Literacy rate % (2017)	80.80	72.89	1.000		
BMI>30, adult women age-stand. % (2016)	94.37	11.40	0.005	0.921 (0.823-1.030)	0.150
Contraception prevalence % (2017)	35.70	28.50	0.556		
Fertility rate % (2016)	2.93	4.53	0.002	0.352 (0.122-1.011)	0.052



## Conclusions

- There is heterogeneity in LMICs in terms of their incidence and mortality related to breast cancer
- While increasing GDP per capita is associated with a higher incidence of breast cancer, obesity (BMI > 30) is an independent factor which also increases breast cancer incidence in LMICs; suggesting that attention should be paid to lowering obesity in developing countries seeking to reduce breast cancer incidence
- Improving the Human Development Index is the most significant independent factor reducing mortality per incident case of breast cancer, suggesting that developing “countries of opportunity” with improvements in life expectancy, education and standard of living is critical to reducing mortality from breast cancer among LMICs