Short Communication

A New Perspective about How the Changes in Income are Associated with Breast Cancer Mortality

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Abstract

Background: In many places, income and income inequality are studied as factors that influence people's health. Many of the theories that associate income with health outcomes analyze the individual, the environment, and how income influences health, but not the effects of income on health. **Main text:** We present a new theory that explains how income change influences people's health. We have based the example of breast cancer mortality and per capita income in Brazil, where the emerging socioeconomic development makes it a developing country with characteristics of developed countries. For this, we used two databases consolidated in scientific research: the atlas for human development in Brazil made available on the basis of the United Nations Development Program and the National Cancer Institute's base on cancer mortality in Brazil. Age-standardized breast cancer Mortality and per capita income in Brazilian rears was collected. Annual Percentual Change was used to estimate the variation in the period and Simple Linear Regression to estimate the relationship between mortality and mortality and the variation of mortality with income variation. The confidence level was 5%. The program used was Stata ® (StataCorp. LLC) 11.0. **Conclusion:** We find that change in income influences mortality differently, proving our theory. More studies are needed to better develop and understand this relationship.

Keywords: Income; Mortality; Breast cancer; Brazil

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Relationships between income and health are constantly evaluated in order to understand how income can determine the health of the individual or population, [1] as well as the association with clinical outcomes such as stroke [2] and cancer. [3] This relationship is based on three main theories, which analyze in different ways how income can influence people's health (individual income theory, psychosocial environment theory, and neo-materialist theory). [4]

From our studies on how income inequality could influence breast cancer mortality through a longitudinal analysis, we have identified a pattern that explains differently these theories known as health and income are associated. Thus, we have developed a theory in which we believe that it is not only income that can influence health but also changes in income and the ways in which this change can occur and explains why there are healthy and unhealthy populations in different regions with Same income. [5]

To test this theory, we performed some analyses with secondary data of the Brazilian population obtained from databases used in scientific research, with the database of the United Nations Development Program (UNDP- http: //www.br.undp. Org) [6] and one of the main cancer databases in Brazil, which is made available by the National Cancer Institute (INCA - www2.inca.gov.br). [7]

We collected data on age-standardized breast cancer mortality as well as data on the average income for each federal unit and the Federal district of Brazil for the years 1990, 2000 and 2010. We describe the values of age-standardized breast cancer mortality [8] per 100,000 women, the per capita income (in Brazilian reais) and the variation of these indicators between 2000 and 2010. To analyze the relationship between age-standardized breast cancer mortality and per capita income (in Brazilian reais) we used linear regression. The level of significance was set at 5%. We use Stata ® Software (StataCorp, LLE) 11.0.

Table 1 shows the age-standardized mortality from breast cancer and per capita income in Brazilian federal units in 2000 and 2010, as well as the variation of these indicators between those years.

We observed an increase in the age-standardized breast cancer mortality in several Federal Districts, as well Paraíba, (variation = 3.16) and Piauí (variation = 2.22). On the other hand, the age-standardized breast cancer mortality was decreased between 2000 and 2010 in some federal districts. The Amapá (variation = -2.17) and Federal District (variation = -1.23) were the districts with major variations. Only increase of the per capita income was observed in the Brazilian Federal Districts. The major and the minor increase in per capita income was observed in Federal District (+ R$ 515.67) and Pará (+ R$ 111.00), respectively [Table 1].

We analyzed by linear regression the relationship between mortality and per capita income in 2000 in 2010 and how the

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Table 1: Age-standardized breast cancer mortality (per 100,000 women) and per capita income in the federative units and federal district of Brazil.

Federal units and Federal District	Age-standardized breast cancer mortality *			Per capita income (R$)		
	2000	2010	Variation	2000	2010	Variation
Acre	2.00	1.35	-0.65	360.63	522.15	161.52
Alagoas	2.89	4.76	1.87	285.29	432.56	147.27
Amazonas	3.50	3.88	0.38	351.63	539.80	188.17
Amapá	4.22	2.05	-2.17	424.57	598.98	174.41
Bahia	3.30	4.57	1.27	322.04	496.73	174.69
Ceará	4.00	5.74	1.74	310.21	460.63	150.42
Distrito Federal	8.47	7.24	-1.23	1199.44	1715.11	515.67
Espírito Santo	4.19	6.04	1.85	574.17	815.43	241.26
Goiás	4.15	5.14	0.99	571.49	810.97	239.48
Maranhão	1.35	3.03	1.68	218.27	360.34	142.07
Minas Gerais	4.14	5.12	0.98	548.87	749.69	200.82
Mato Grosso do Sul	4.48	6.48	2.00	576.33	799.34	223.01
Mato Grosso	3.44	4.74	1.30	582.62	762.52	179.90
Pará	2.34	3.24	0.90	335.76	446.76	111.00
Paraíba	1.84	5.0	3.16	299.09	474.94	175.85
Pernambuco	4.89	6.74	1.85	367.31	525.64	158.33
Piauí	2.09	4.31	2.22	254.78	416.93	162.15
Paraná	5.96	6.34	0.38	638.27	890.89	252.62
Rio de Janeiro	9.08	9.07	-0.01	826.04	1039.3	213.26
Rio Grande do Norte	3.42	5.01	1.59	351.01	545.42	194.41
Rondônia	2.90	2.59	-0.31	467.16	670.82	203.66
Roraima	2.54	2.71	0.17	462.18	605.59	143.41
Rio Grande do Sul	8.13	8.27	0.14	708.12	959.24	251.12
Santa Catarina	6.16	6.46	0.30	693.82	983.90	290.08
Sergipe	3.64	5.45	1.81	326.67	523.53	196.86
São Paulo	7.94	7.3	-0.64	882.4	1084.46	202.06
Tocantins	1.34	3.23	1.89	344.41	586.62	242.21

*per 100,000 women, Variation was defined by differences between 2000 and 2010 data.

Table 2: Association between per capita income and Age-standardized breast cancer mortality.

Per capita Income	Age-standardized breast cancer mortality		
	β (IC 95%)	r^2	p*
Income in 2000	0.8 (0.6; 1.0)	0.73	<0.001
Income in 2010	0.4 (0.2; 0.6)	0.35	<0.001
Range 2000-2010	-0.6 (-1.2; 0.6)	0.10	0.07
*Linear regression			

variation in income influences the variation of age-standardized breast cancer mortality and is present in Table 2 this relation.

In Table 2 there is a relationship between income and age-standardized breast cancer mortality in both 2000 (0.8 (95% CI 0.6, 1.0); p<0.001) and in 2010 (0.4 (95% CI 0.2, 0.6); p<0.001). However, when we analyzed the relationship between income variation and mortality variation, there are no statistically significant differences (-0.6 (95% CI -1.2, 0.6); p=0.07).

The direction may be increasing - when there is an increase in income - or a decrease in income when there is a decrease in income. Temporality, on the other hand, can be transversal - where health is affected concomitantly with the change in income - or longitudinal - where in the long term health changes arise as a result of income. Regarding the level, changes at the individual level are different from changes that occur at the population level.

From a transverse perspective, where increased income can provide individuals with changes such as housing and health services. On the other hand, changes in long-term income can influence health, such as changes in eating habits for unhealthy eating, physical inactivity, and habits such as alcoholism and smoking, related to a large part of the chronic diseases that affect people In the 20th century and are related to the incidence of various types of cancer. [9]

Although we are in the initial phase of studies about this theory, we believe that it can be used to create more effective public policies, which can help people in poverty and extreme poverty to have better health conditions.

Conclusion

These differences found of the relationship between per capita income and age-standardized breast cancer mortality reinforces our theory. Our theory that different changes in income have different effects on the health of the population. We also believe that other aspects can influence this relationship. We understand that both the direction of change and the timing and level of change can influence population's health differently.

Conflict of Interest

All authors disclose that there was no conflict of interest.

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