Corruption and its relation to prevalence and death due to noncommunicable diseases and risk factors: a global perspective

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ABSTRACT

Objective. To describe the relation between corruption indicators and statistics on noncommunicable diseases and their risk factors by continent.

Methods. An ecological study was conducted to examine the relation of the GINI coefficient, the Country Policy and Institutional Assessment (CPIA), and the Corruption Perception Index (CPI) with noncommunicable diseases, using the Spearman's rank correlation test.

Results. There is a moderate and positive correlation between Corruption Perception Index and cause of death due to noncommunicable diseases and risk factors for these diseases ($r = 0.532$), prevalence of schizophrenia ($r = 0.526$), bipolar disorder ($r = 0.520$), and eating disorders ($r = 0.677$). There is a moderate negative association between the GINI index and cause of death due to noncommunicable diseases ($r = -0.571$) and smoking prevalence ($r = -0.502$), and between the Corruption Perception Index and mortality caused by cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases between the exact ages of 30 and 70 years ($r = -0.577$) and malnutrition prevalence ($r = -0.602$).

Conclusions. This study indicates a correlation between corruption and noncommunicable diseases and their risk factors. This suggests that the high prevalence of noncommunicable diseases and risk factors could be related with political practices that negatively impact the population. Further research should study the weight of these associations, to take action on the way corruption is impacting on the health of societies.

Keywords   Corruption; noncommunicable diseases; chronic disease; global health strategies; delivery of health care; politics.

Politics are inherent to societies. Political decisions affect all the individuals who live in a specific society, as well as the interaction that a group has with other groups of people. Because of this, political decisions have an impact on health indicators through public policies, but also concerning the money that is accounted for creating and perpetuating public policies that respond to the changing needs in health of the specific population.

Rudolf Virchow defined medicine as a social and political science and compared it several times to politics. He also proposed that the only way to impact on public health is through politics (1). Therefore, some studies have tried to link well-being and health with countries' political factors, suggesting that democracy is usually linked with better health indicators and globalization usually linked to worse health status (1, 2).

The influence of politics on global health is recognized. In 1966, James Wolfensohn, former president of the World Bank, called for attention to the "cancer of corruption" (3). Nowadays, the representation of corruption as a disease fits the idea that corruption can negatively influence public health in a given country (4, 5).

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Corruption has been linked to lesser economic growth, poor public infrastructure, increase in public spending, higher inequality and growth of poverty, and risks to national security (6–8). Corruption has also been linked to poor outcomes in health, as it influences government spending on health and education and tends to distort the motivations and incentives of decisionmakers and providers of health services, as it also tends to subordinate common welfare to private gain (3, 4, 9–11).

Two ways in which corruption can affect the health care system have been described. First, corruption affects a nation's ability to provide health care, as it can reduce the investment that government makes in the health system and in promotion of public health. The second way in which corruption affects the health care system is by corrupting the system itself (11). Corruption within the health system can manifest in many ways, including illegal payments, failure to deliver services, or corrupting of pharmaceutical and medical supply chains (12, 13). Within the health system, corruption represents a double burden of disease and limits human and economic development (3, 14).

Nowadays, cardiovascular disease, cancer, diabetes, and chronic lung diseases—referred to here as noncommunicable diseases (NCDs)—are responsible for two out of three deaths globally (15). These diseases are all linked to modifiable causes (or risk factors) such as tobacco use, harmful use of alcohol, obesity, excessive salt, sugar, and sedentarism. This is especially relevant as one-quarter of these deaths occur in people under 60 years of age, severely impacting on economic growth (16). Because NCDs and their risk factors are influenced by long-term processes such as corruption and health care investment, and by public health policies, we hypothesized that a major level of corruption would be associated with worse outcomes on NCDs. Therefore, the objective of this article is to describe a relation between corruption indicators and NCD statistics globally.

MATERIALS AND METHODS

Variables

Corruption was measured through the Corruption Perception Index (CPI), which is an index published by Transparency International that ranks countries by their perceived levels of public sector corruption, determined by expert assessments and opinion surveys (17, 18). A CPI of 100 indicates the country is perceived as very clean and 0 indicates it is perceived as totally corrupt (17, 18). Inequality was measured using the GINI index, which is a measure of statistical dispersion that represents the wealth distribution among the population of a nation (19). A GINI coefficient of 0 expresses no inequality whereas a GINI coefficient of 100 expresses maximal inequality (19). To measure country performance ratings and the ability of countries to make effective use of aid, the Country Policy and Institutional Assessment (CPIA) was used. The CPIA was created by the World Bank to measure and classify the ability of countries to make international aid effective (20). It evaluates 16 criteria in four domains: economic management, structural policies, policies for social inclusion and equity, and public and private sector management. It is determined by technical analysts who assess the institutional policy frameworks for poverty reduction, sustainable growth, and effective use of the aid received (21). All the data were from 2013 to 2017, and each country's mean was analyzed.

Data related to NCDs and risk factors were extracted from the World Bank, Our World in Data, and the Human Development Indicators databases (22–24). Information regarding the following variables was extracted: malnutrition prevalence (% of the population); total smoking prevalence (age > 15); diabetes prevalence (% of the population aged 20 to 79); mortality due to cardiovascular disease, cancer, diabetes, chronic respiratory diseases between the ages of 30 and 70 years (%); total alcohol consumption per capita (liters of pure alcohol, over 15 years); deaths due to NCDs (% of total); suicide (per 100 000 population); schizophrenia prevalence; bipolar disorder prevalence; eating disorders prevalence; anxiety prevalence; and depression prevalence. All countries with available data were included.[1]

Statistical analysis

The mean of corruption, inequality, NCD, and risk factor data between continents were compared through one-way analysis of variance (ANOVA). Corruption, inequality, NCD, and risk factor data were tested for normality using the Shapiro–Wilk test. Corruption, inequality, and NCD data were related through the Spearman's rank correlation test according to the result of the Shapiro–Wilk test of normality (25). A value of $p < 0.05$ was interpreted as significant for our analysis.

In addition, bivariate analysis of each government indicator variable was made with each of the health outcomes variables by means of Spearman's rank correlation. We present the rho and the p-value of each correlation. Analysis and graphics were performed using R® software, version 3.6.1 for Windows.

RESULTS

In total 224 countries were included. Considering the epidemiological transition and the differences between populations, the entire continent of America was subdivided into North America, Central America and the Caribbean, and South America. Additionally, stratified analysis was made by the continents Europe, Africa, Asia, and Oceania.

Corruption, inequality, and performance scores of countries grouped by continents are summarized in Table 1. Concerning inequality, there were differences in the GINI index between all continents ($p = 0.007$). Countries in Europe had a mean of 32.24 (standard deviation [SD] = 4.56), compared with 48.55 (SD = 3.78) for countries in America. Performance ratings and the effective use of aid measured through the CPIA index showed differences between continents, with the lowest mean in Africa 2.72 (SD = 0.62) and the highest mean in America 3.44 (SD = 0.72). There was no difference in the CPI between the continents ($p = 0.378$).

Comparing NCDs and risk factors between regions, malnutrition prevalence was higher in Africa (mean = 21.09, SD = 13.54, $p < 0.001$), whereas smoking prevalence was higher in Europe (mean = 28.83, SD = 7.74, $p = 0.004$). Total alcohol consumption per capita was higher in Europe (mean = 9.97,

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[1] The datasets used or analyzed in this study are available from the corresponding author on reasonable request.

TABLE 1. Mean differences by continent

	Africa	Asia and the Pacific	Eastern Europe	South America	Western Europe and others	Central America and the Caribbean	North America	Oceania	ANOVA *p*-value
GINI index (mean (SD))	43.41 (8.10)	34.86 (4.63)	31.33 (4.63)	48.88 (3.50)	32.40 (4.30)	48.30 (4.55)	40.71 (6.77)	39.09 (2.44)	0.415
CPI (mean (SD))	31.95 (11.76)	40.39 (20.16)	44.13 (11.36)	39.22 (16.24)	70.75 (15.14)	45.61 (16.54)	63.00 (26.47)	43.67 (35.00)	<0.001
CPIA (mean (SD))	2.72 (0.62)	2.76 (0.58)	2.94 (0.26)	3.15 (0.37)	…	3.53 (0.79)	…	3.32 (0.31)	<0.001
Malnutrition (mean (SD))	21.09 (13.54)	11.59 (9.20)	3.65 (1.25)	7.94 (4.81)	3.00 (0.00)	10.95 (8.58)	3.33 (0.58)	5.11 (3.67)	<0.001
Smoking prevalence (mean (SD))	15.05 (6.98)	23.04 (7.58)	31.93 (6.33)	17.72 (10.71)	26.78 (6.00)	12.99 (9.05)	17.53 (4.35)	27.80 (11.73)	0.021
Diabetes prevalence (mean (SD))	5.62 (4.10)	9.79 (4.64)	7.15 (2.02)	8.36 (2.48)	6.41 (2.43)	10.88 (2.52)	8.35 (4.74)	16.65 (7.41)	<0.001
Mortality due to cardiovascular disease, cancer, diabetes, chronic respiratory diseases (mean (SD))	20.72 (3.86)	20.09 (6.21)	20.76 (3.58)	17.43 (4.88)	10.80 (1.67)	17.78 (4.22)	13.38 (3.09)	22.66 (7.50)	<0.001
Alcohol consumption per capita (mean (SD))	4.80 (3.78)	3.80 (3.46)	10.40 (3.35)	6.93 (2.08)	9.95 (2.97)	6.61 (2.23)	8.40 (1.71)	3.54 (3.61)	0.01
Deaths due to noncommunicable diseases (mean (SD))	41.78 (17.55)	72.76 (12.54)	91.76 (2.53)	74.03 (6.41)	89.03 (2.01)	75.27 (8.22)	85.47 (4.91)	76.36 (11.19)	<0.001
Suicide (mean (SD))	7.35 (3.66)	7.90 (5.85)	15.46 (7.93)	12.03 (7.78)	12.06 (4.27)	6.36 (4.95)	11.00 (5.07)	7.96 (4.31)	0.239
Schizophrenia prevalence (mean (SD))	0.19 (0.02)	0.25 (0.06)	0.23 (0.01)	0.21 (0.01)	0.27 (0.04)	0.20 (0.01)	0.30 (0.07)	0.31 (0.03)	<0.001
Bipolar disorder prevalence (mean (SD))	0.65 (0.08)	0.67 (0.18)	0.67 (0.03)	0.90 (0.10)	1.02 (0.11)	0.87 (0.06)	0.81 (0.04)	0.62 (0.38)	<0.001
Eating disorders prevalence (mean (SD))	0.10 (0.04)	0.17 (0.10)	0.13 (0.02)	0.20 (0.04)	0.42 (0.10)	0.17 (0.04)	0.30 (0.10)	0.14 (0.15)	<0.001
Anxiety prevalence (mean (SD))	3.46 (0.66)	4.00 (0.94)	3.27 (0.34)	4.83 (1.39)	5.46 (0.67)	3.87 (0.61)	5.10 (1.38)	4.08 (1.36)	<0.001
Depression prevalence (mean (SD))	4.26 (0.53)	3.69 (0.59)	3.29 (0.71)	3.62 (0.78)	4.08 (0.46)	3.35 (0.26)	4.66 (1.46)	3.66 (0.60)	0.006

Note: ANOVA, one-way analysis of variance; SD, standard deviation; CPI, Corruption Perception Index; CPIA, Country Policy and Institutional Assessment; … not available.
Source: Prepared by the authors based on published data mentioned in the text.

SD = 3.29, *p* < 0.001). There was no difference in diabetes prevalence between the continents. Mortality due to NCDs was higher in Asia (mean = 20.85, SD = 6.19, *p* < 0.001); however, the percentage of deaths due to NCDs as a percentage of all deaths was higher in Europe (mean = 89.80, SD = 4.59, *p* < 0.001).

Europe had a higher prevalence of mental health-related NCDs compared to the rest of the continents (suicide: mean = 13.84, SD = 6.29, *p* = <0.001; schizophrenia: mean = 0.26, SD = 0.04, *p* < 0.001; eating disorders: mean = 0.28, SD = 0.16, *p* < 0.001; and anxiety: mean = 4.48, SD = 1.30, *p* = <0.001). Bipolar disorder prevalence was highest in America (mean = 0.88, SD = 0.08, *p* < 0.001) whereas depression prevalence was highest in Africa (mean = 4.26, SD = 0.53, *p* < 0.001).

The relation between corruption, NCDs, and risk factor indicators is summarized in Table 2. There was a moderate positive correlation between CPI and cause of death due to NCDs (% of total) (*r* = 0.532), prevalence of schizophrenia (*r* = 0.526), bipolar disorder (*r* = 0.520), and eating disorders (*r* = 0.677).

On the other hand, we found a moderate negative association between the GINI index and cause of death due to NCDs (% of the total) (*r* = –0.571) and smoking prevalence (*r* = –0.502); and between CPI and mortality caused by cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases between the exact ages of 30 and 70 years (%) (*r* = –0.577) and malnutrition prevalence (%) (*r* = –0.602) (Figure 1).

DISCUSSION

The relationship between government characteristics and outcomes in health has been described since Hippocratic times; it was recognized that people with power, property, freedom, and leisure time had better health than those who must work continuously or who could not access certain care (26). This fact has only been taken into account since the industrial revolution, with better health outcomes as a result (27).

Among the characteristics that have been studied in governments is capitalism linked to neoliberalism, generating the reduction of state interventions in economic and social activities, as well as deregulation of markets. Secondary to neoliberalism, there is evidence of a decrease in per capita economic growth in developed countries, like the growth in quality of life and the welfare state. Capitalism is also associated with a higher GINI index, reflecting greater inequality (5). This increase in inequality has been associated with a lack of solidarity and an increase in diseases in the population (28), a fact that has been seen in the distribution of COVID-19 vaccines (29, 30).

Corruption is another issue that has permeated health. The health care sector is one of the largest in the global economy, and corruption in this sector is more dangerous in relation to other traditional sectors of the economy, since it not only limits

TABLE 2. Correlation between corruption and noncommunicable diseases

rho	Malnutrition prevalence (% of the population)	Total smoking prevalence (age > 15)	Diabetes prevalence (% of the population aged 20 to 79)	Mortality due to cardiovascular disease, cancer, diabetes, chronic respiratory diseases between the ages of 30 and 70 years (%)	Total alcohol consumption per capita (liters of pure alcohol, over 15 years)	Deaths due to noncommunicable diseases (% of total)	Suicide (per 100 000 population)	Schizophrenia prevalence	Bipolar disorder prevalence	Eating disorders prevalence	Anxiety prevalence	Depression prevalence
GINI Index	0.481	**−0.502**	−0.044	0.047	−0.194	**−0.571**	−0.240	−0.389	−0.177	−0.239	−0.239	0.107
Corruption Perception Index	**−0.602**	0.165	0.082	**−0.577**	0.467	**0.532**	0.317	**0.526**	**0.520**	**0.677**	0.466	0.014
Country Policy and Institutional Assessment	−0.431	−0.019	0.208	−0.144	0.217	0.349	0.073	0.455	0.030	0.280	0.108	−0.271

Note: Numbers in bold indicate a moderate or high correlation.
Source: Prepared by the authors based on published data mentioned in the text.

FIGURE 1. Correlation between corruption and noncommunicable diseases
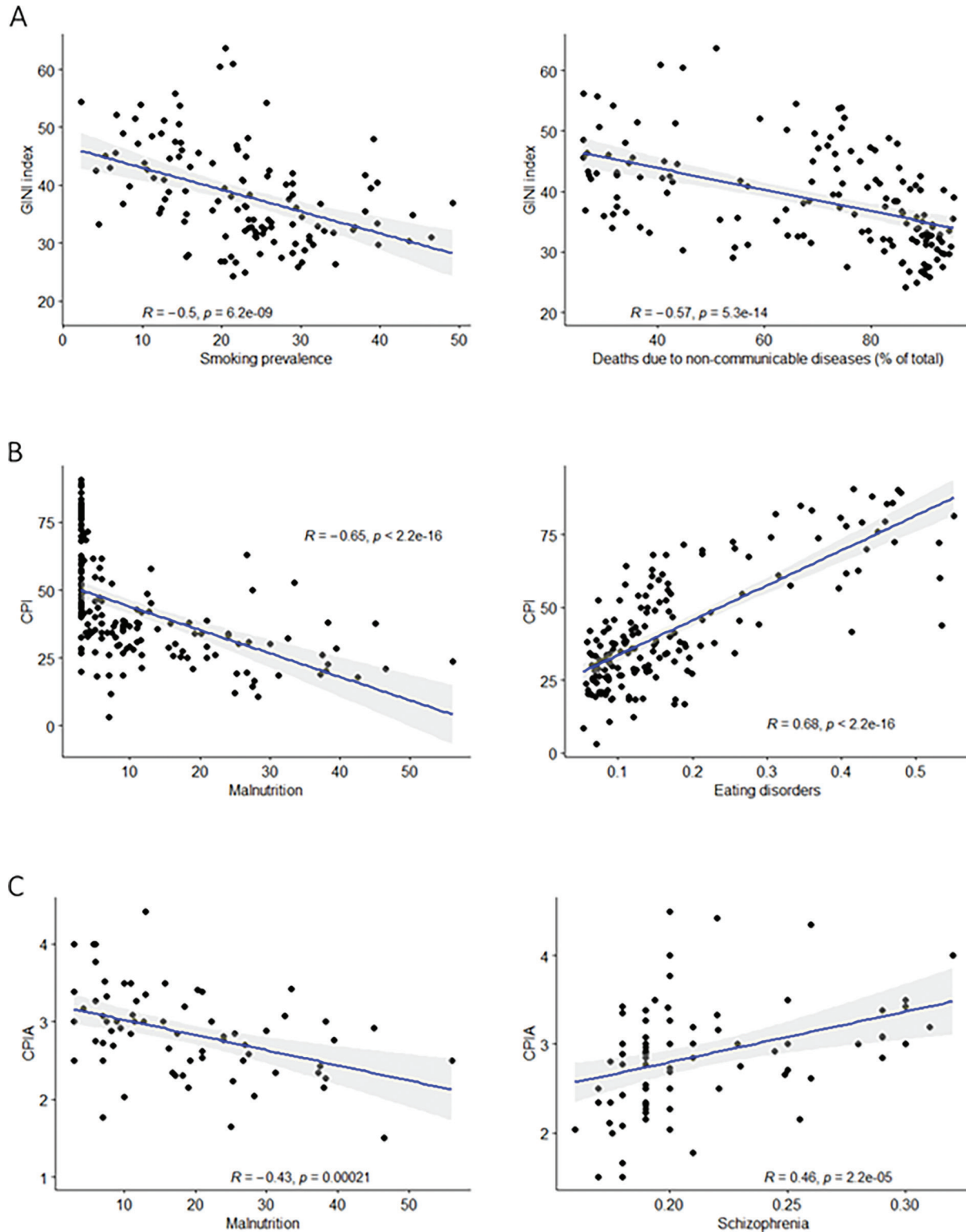
A. Correlation of GINI index with smoking prevalence and deaths due to noncommunicable diseases (% of total).
B. Correlation of Corruption Perception Index (CPI) with prevalence of malnutrition and eating disorders.
C. Correlation of Country Policy and Institutional Assessment (CPIA) with prevalence of malnutrition and schizophrenia.
Source: Prepared by the authors based on published data mentioned in the text.

economic development but also human development, putting at risk the health of the population.

In addition, corruption is evaluated by the CPIA to define the possible effectiveness of international aid, affecting health assistance programs worldwide. This foreign aid has been important throughout history; for example, in the eradication of smallpox. In 2013, the Transparency International report indicated a broad perception of corruption in health systems across many countries. As a consequence, in rich countries corruption tends to make health care more expensive, while in poor countries it undermines it, in both cases generating a higher level of inequality, both within a country and between countries—hence the term "the cancer of corruption" (3).

Corruption also affects the quality of care in health systems and the longevity of a population. Corruption is also associated with the Human Development Index (HDI), with several studies having pointed out the relationship between increased life expectancy and NCDs, proposing the challenge of accelerating the care of these diseases, favored by the international context articulated between government, health agents, and communities (3, 31, 32).

The association with some cancers has also been shown, pointing out an inverse correlation with the HDI, mainly with diseases such as gastric, intestinal, cervical, colorectal, and kidney cancer. These characteristics suggest that cancers related to infectious etiology are more frequent in people with poor economic resources. In addition, the lack of adherence to treatment, barriers in access to health services, poor insurance conditions, the costs of care, and poor availability of technology result in a delayed diagnosis and stage migration in the classification of cancers.

On the other hand, suicide, sedentary lifestyle, and drug use, as well as breast and ovarian cancer showed direct correlations with the HDI (33). Durkheim argues that suicide varies inversely with the degree of social groups' integration and refers to possible causes such as social disorganization, loss of social objectives, and the individual's inability to adapt to social upheavals (33, 34).

Regarding mental health, Gillanders argues that being a victim of corruption—for example, having to pay a bribe—can have a negative impact on health, being reflected mainly in depressive symptoms through multiple mechanisms. First, acting as a contextual stressor, as corruption implies that access to social resources does not work properly; in other words, it represents a scenario where damage or loss can occur for individuals (9). On the other hand, Ross and Mirowsky point out that corruption decreases optimism and increases impotence, mental states associated with depressive symptoms (10, 35).

Additionally, corruption can trigger feelings of anger, hostility, frustration, and anxiety due to the injustice of the environment, generating inconsistency and frustration in relation to what people expect from their health system; this in turn can lead to people distancing themselves from the system, increasing the burden of chronic diseases (9).

Another important factor in chronic diseases is the increase in the burden of disease they generate (36, 37). In this regard, the World Stroke Organization, seeing the increase in the incidence and burden of stroke disease, has recently provided guidance and tools to support countries to review their health system and improve care for people with stroke. Additionally, the Organization proposes more options for primary prevention in order to modify risk factors (38).

In addition, in many cases, conditions could be better treated and large numbers of deaths could be prevented if social inequities were reduced. Marmot studied the gradient of lethality due to heart disease in professionals of different levels and found that the greater the authority the professional had, the lower the lethality. This difference between individuals also applies between countries (28, 37).

Therefore, Lundberg proposes a more comprehensive approach to each government, as beyond the differences in resources that a welfare state can give to its citizens, it is important how they are used; a fact that, as stated previously, is affected by corruption. He suggests to focus on policies, as these demonstrate the political purposes that will ultimately generate more durable resources for the population's benefit (39). Otherwise, other authors propose to define priorities in each context and address this topic from different disciplines (40).

Even though the population of different continents is quite different, especially considering the demographic and epidemiological transition, which is not homogeneous around the globe, results such as malnutrition, smoking, and alcohol consumption are not age-related and were found to differ between countries. Additionally, we found that mortality due to NCDs was higher in Asia, and deaths due to NCDs as a percentage of total deaths was higher in Europe. These two results must be discussed within the context of these two continents, which have a higher proportion of older adults compared with South America or Africa. In fact, this result can be due to the higher proportion of deaths due to preventable causes in other continents. We propose this should be discussed additionally and that further research is needed.

Our study has several limitations. This is an ecological study, using data that have already been collected, and there is no way verify that the information was collected without bias. It is important to mention that corruption and availability of information are also related; therefore, it is imperative to acknowledge that corruption of the collection and availability of the information can also bias the results. There might be potential for systematic differences in the collection of the information between countries. Additionally, the CPI is a subjective index, which depends on the memory of the respondents and so is vulnerable to memory bias. Consequently, we found a significant opportunity for research on this topic while controlling the limitations that we have acknowledged.

This study suggests that there is a correlation between corruption and NCDs and their risk factors. This proposes that the high prevalence of NCDs could relate to political practices that negatively impact the population. Further research should study the weight of these associations, to take actions on the way corruption is impacting on the health of societies and to implement regulatory measures to avoid corruption in our health systems.

Further research is recommended, taking in account other ways to measure corruption, considering availability of health care, country-specific inequalities, and population pyramids, which might influence the prevalence and incidence of different NCDs.

Conflict of interest. None declared

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La corrupción y su relación con la prevalencia y mortalidad por enfermedades no transmisibles y sus factores de riesgo: una perspectiva mundial

RESUMEN

Objetivo. Describir la relación entre los indicadores de corrupción y las estadísticas sobre enfermedades no transmisibles y sus factores de riesgo por continente.

Métodos. Se realizó un estudio ecológico para examinar la relación del coeficiente de Gini, la Evaluación de las políticas e instituciones nacionales y el índice de percepción de la corrupción con las enfermedades no transmisibles, utilizando la prueba de correlación de rangos de Spearman.

Resultados. Existe una correlación positiva moderada entre el índice de percepción de la corrupción y la causa de muerte debida a enfermedades no transmisibles y sus factores de riesgo (r = 0,532), la prevalencia de esquizofrenia (r = 0,526), el trastorno bipolar (r = 0,520) y los trastornos alimentarios (r = 0,677). Existe una asociación negativa moderada entre el índice de Gini y la causa de muerte por enfermedades no transmisibles (r = -0,571) y la prevalencia del tabaquismo (r = -0,502), y entre el índice de percepción de la corrupción y la mortalidad por enfermedades cardiovasculares, cáncer, diabetes o enfermedades respiratorias crónicas entre las edades exactas de 30 y 70 años (r = -0,577) y la prevalencia de la desnutrición (r = -0,602).

Conclusiones. En este estudio se encontró correlación entre la corrupción y las enfermedades no transmisibles y sus factores de riesgo. Estos hallazgos sugieren que la alta prevalencia de enfermedades no transmisibles y sus factores de riesgo podrían estar relacionados con prácticas políticas que impactan negativamente en la población. Se requieren investigaciones adicionales para estudiar el peso de estas asociaciones y tomar medidas sobre la forma en que la corrupción está impactando en la salud de las sociedades.

Palabras clave   Corrupción; enfermedades no transmisibles; enfermedad crónica; estrategias de salud globales; atención a la salud; política.

Corrupção e a sua relação com a prevalência e morte devido a doenças não transmissíveis e seus factores de risco: uma perspectiva global

RESUMO

Objetivo. Descrever a relação entre os indicadores de corrupção e as estatísticas sobre doenças não transmissíveis e os seus factores de risco por continente.

Métodos. Foi realizado um estudo ecológico para examinar a relação do coeficiente Gini, a Avaliação das políticas e instituições nacionais, e o Índice de percepção da corrupção com doenças não transmissíveis, utilizando o teste de correlação de postos do Spearman.

Resultados. Existe uma correlação positiva moderada entre o Índice de percepção da corrupção e a causa de morte devido a doenças não transmissíveis e seus factores de risco (r = 0,532), prevalência de esquizofrenia (r = 0,526), desordem bipolar (r = 0,520), e desordens alimentares (r = 0,677). Existe uma associação negativa moderada entre o índice Gini e a causa de morte devido a doenças não transmissíveis (r = -0,571) e a prevalência de tabagismo (r = -0,502), e entre o Índice de percepção da corrupção e a mortalidade causada por doenças cardiovasculares, cancro, diabetes, ou doenças respiratórias crónicas entre as idades exactas de 30 e 70 anos (r = -0,577) e a prevalência de desnutrição (r = -0,602).

Conclusões. Este estudo indica uma correlação entre a corrupção e as doenças não transmissíveis e os seus factores de risco. Isto sugere que a elevada prevalência de doenças não transmissíveis e de factores de risco pode estar relacionada com práticas políticas que afectam negativamente a população. São necessárias mais pesquisas para estudar o peso dessas associações e para tomar medidas sobre como a corrupção está impactando a saúde das sociedades.

Palavras-chave

Corrupção; doenças não transmissíveis; doença crónica; estratégias de saúde globais; atenção à saúde; política.