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# Differences and inequalities in relation to access to renal replacement therapy in the BRICS countries

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**Abstract** *End-stage renal disease (ESRD) is an important public health problem, especially in developing countries due to the high level of economic resources needed to maintain patients in the different programs that make up renal replacement therapy (RRT). To analyze the differences and inequalities involved in access to RRT in the BRICS countries (Brazil, Russian Federation, India, China and South Africa). This is an applied, descriptive, cross-sectional, quantitative and qualitative study, with documentary analysis and a literature review. The sources of data were from national censuses and scientific publications regarding access to RRT in the BRICS countries. There is unequal access to RRT in all the BRICS countries, as well as the absence of information regarding dialysis and transplants (India), the absence of effective legislation to inhibit the trafficking of organs (India and South Africa) and the use of deceased prisoners as donors for renal transplants (China). The construction of mechanisms to promote the sharing of benefits and solidarity in the field of international cooperation in the area of renal health involves the recognition of bioethical issues related to access to RRT in the BRICS countries.*

**Key words** *Bioethics, Dialysis, Health inequalities, Epidemiology, Kidney transplantation*

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## Introduction

End-stage renal disease (ESRD) is an important public health problem due to its increasing prevalence and the high costs of maintaining patients in existing forms of renal replacement therapy (RRT), i.e. hemodialysis, peritoneal dialysis and renal transplantation[1-3].

This situation is aggravated in developing countries due to the co-existence of a scarcity of resources for investment in health, poor health conditions, recent demographic transition (with progressive population aging and increased incidence of chronic non-communicable diseases) and a high prevalence of contagious, infectious diseases, such as Chagas, malaria, dengue and others)[4-6].

Several studies have demonstrated recurrent failures in terms of ensuring equity of access to RRT worldwide. A systematic review estimated that of the nine million individuals requiring dialysis in 2010, less than a third had access to such treatment, and that more than 90% of these individuals lived in developed countries[7]. Studies have shown a linear correlation between the prevalence of patients with RRT and the gross domestic product (GDP) of nations[6].

Although hypertension and diabetes are the main causes of ESRD, studies have sought to identify other factors that could explain the increased prevalence of ESRD in developing countries[8]. Poverty and other social determinants associated with biological vulnerabilities (such as low birth weight and inadequate nutrition), environmental risks (lack of basic sanitation, a high prevalence of infectious diseases and frequent exposure to pollutants), and inadequate health promotion and treatment systems could explain the epidemic of ESRD in these countries[8].

The acronym BRIC was first coined in 2001 to designate four emerging countries (Brazil, Russia, India and China) with progressive world-wide economic impact. The term was later modified to BRICS after the inclusion of South Africa in the group[9]. These five countries account for about a quarter of the overall GDP worldwide and they also account for about 40% of the world's population. In spite of their potential economic strength and political importance these countries account for 40% of the global burden of diseases and 50% of world poverty, the latter statistic being compounded by inequities in access to health[10].

In recent years there have been reforms in the health systems of these countries which have been intended to improve equity and quality in access to health. Apparently, the goal was to build health systems with broad coverage[11] in order to ensure better health and to maintain a prominent role in building a global health agenda[12]. Studies have sought to understand the possibilities of joint cooperation between these countries in fields such as the production of drugs and vaccines, in the fight against tuberculosis, as well as in the treatment of HIV/AIDS and historically neglected diseases[13-17].

Such forms of cooperation between developing countries, covering aspects of scientific and technological development (in the field of health, in this case), are referred to as South - South cooperation, as opposed to North - South cooperation, i.e. between developed and developing countries[10,18,19].

International analysts point out that the main common denominators among the BRICS countries are economic protagonism, large territorial extensions, and recent socioeconomic transformations. On the other hand, they are heterogeneous countries, both in terms of geographic location and in their historical, political and cultural processes. Such differences explain the different perceptions and responses to bioethical conflicts regarding access to health technologies (in this case, RRT).

This paper analyzes the main bioethical dilemmas associated with the differences and inequalities in terms of access to RRT in BRICS countries.

## Methods

This is a qualitative, cross-sectional, descriptive study based on data collected through documentary analysis and systematic bibliographic research.

The identification of information from the specialized literature was performed through research via the Scielo, Google Academic and Pubmed – Medline websites, using the keywords 'end-stage renal disease' and 'renal replacement therapy'. The data related to each BRICS member country were searched. Subsequently, a thematic screening was carried out, identifying articles that dealt with bioethical aspects related to access to RRT in the BRICS countries.

The documentary research aimed to identify information and nephrological data about national censuses regarding dialysis and renal transplantation. This was done because data

Ciência & Saúde Coletiva, 22(7):2175-2185, 2017

on dialysis and kidney transplantation in some countries (such as India and China) were not included in the international comparisons chapter of the US census of dialysis, the United States Renal Data System (USRDS), which is a benchmark in the comparison Of RRT data worldwide[20].

The data regarding the BRICS countries in relation to the variables of GDP, life expectancy at birth, and percentage of GDP/health expenditure were obtained through the World Bank website[21]. Data on the global HDI of these countries were taken from the United Nations Development Program website[22]. The base year chosen for the collection of such data was 2012. The choice of 2012 was intended to allow a more distanced analysis of the data, in addition to the fact that several important publications on the nephrological and bioethical issues in access to RRT in the BRICS countries were published around that time.

## Results and Discussion

The comparative data regarding the variables HDI (values and ranking), GDP (values and ranking), life expectancy at birth, and percentage of GDP expenditure in health are shown in Table 1.

The comparative data regarding the nephrological information on the differences and inequalities in access to RRT in the BRICS countries, as well as the main bioethical issues involved, are shown in Chart 1.

### 1. Brazil

Brazil is the largest country in South America and compared to the other BRICS countries it has the second best HDI (behind Russia), GDP and life expectancy (behind China). Brazil occupies first place in the prevalence of patients in RRT and the proportion of GDP invested in health (Table 1).

Brazil is a prominent country in the global nephrological scenario, with one of the largest populations in a chronic ambulatory dialysis program in the world[23]; it has one of the largest gross numbers of renal transplants per year[24].

Brazil has one of the largest public health systems in the world, known as the Unified Health System (SUS), which provides access to health in a universal, free and unrestricted manner to its citizens[25].

One of the data sources for the analysis of the situation regarding dialysis is the Brazilian Dialysis Census (CBD), which was instituted more than ten years ago by the Brazilian Society of Nephrology (SBN)[26]. According to data from the CBD, in 2013 the main form of RRT was hemodialysis, which was responsible for the treatment of more than 90% of patients with ESRD. This form of treatment is carried out in hospitals, philanthropic entities and in private clinics that have agreements with the SUS, which are present in all the states throughout Brazil. More than 100,000 patients are reg4ularly on a chronic dialysis program, and about 90% of all patients have their treatment funded by the SUS[26].

Data from the USRDS has revealed an average prevalence in terms of ESRD of 771 patients/pmp (per million population)[20]. The main causes of ESRD are hypertension, diabetes and glomerulonephritis. It is estimated that one-third of dialysis patients are waiting for renal transplantation[26].

Data regarding kidney transplants are regularly compiled by the Brazilian Association of Organ and Tissue Transplants (ABTO). Brazil has one of the largest public transplant programs in the world, which is funded by the SUS and coordinated and regulated by the National Transplant System (SNT)[27].

**Table 1**. Comparison between the BRICS countries in relation to economic and social variables (base year, 2012).

| Country | Global HDI | HDI ranking | GDP (millions of dollars) | GDP ranking | Life expectancy at birth (years) | Expenditure on health (% GDP) |
|---|---|---|---|---|---|---|
| Brazil | 0.744 | 79 | 2,245,673 | 7 | 73.6 | 9.3 |
| Russia | 0.778 | 57 | 2,096,777 | 8 | 70.5 | 6.3 |
| India | 0.568 | 135 | 1,876,797 | 10 | 66.2 | 4 |
| China | 0.719 | 91 | 9,240,270 | 2 | 75.2 | 5.4 |
| South Africa | 0.658 | 118 | 350,63 | 33 | 56.1 | 8.8 |

Source: World Development Indicators[21] and United Nations Development Program[22].

**Chart 1**. Comparative table showing nephrological data and bioethical issues associated with access to RRT in the BRICS countries.

| Variables | Brazil | Russia | India | China | South Africa |
|---|---|---|---|---|---|
| **Existence of a Nephrology Society** | Brazilian Society of Nephrology | Russian Dialysis Society | Indian Society of Nephrology | Chinese Society of Nephrology | South African Dialysisnd Transplant Registry |
| **Existence of a regular census or registration of dialysis and kidney transplantation** | yes | yes | no | yes | no |
| **Estimated prevalence of patients receiving RRT** | 771/pmp | 241/pmp | 800/pmp | 79.1/pmp | 167/pmp |
| **Principal causes of ESRD** | Hypertension | - | Glomerulonephritis | Glomerulonephritis | Hypertension |
| **Predominant type of renal transplant (deceased donor or corpse)** | Deceased | Deceased | Live | Deceased | Deceased |
| **Renal transplant rate** | 26/pmp | 6.8/pmp | - | 5,000 transplants/ year | 9.2 / pmp |
| **Principal bioethical issues** | Regional disparities regarding access to dialysis and renal transplantation | Regional disparities regarding access to dialysis and renal transplantation<br><br>Low rate of renal transplantation.<br><br>Difficult to find unofficial data in the literature | Lack of state funding and high cost of medication (e.g. immunosuppressants)<br><br>High number of inter vivo and non-related renal transplants<br><br>Gender discrepancies between donors and recipients<br><br>Evidence of commercialization of organs | Regional disparities regarding access to dialysis and renal transplantation<br><br>Use of renal transplants from deceased donors without consent | Prioritization of dialysis only for patients with a chance of renal transplantation<br><br>Evidence of 'transplant tourism' regarding organs |

Chart produced by the authors based on references[20,26-70].

Data from 2011 showed that Brazil was the second largest country in the world in terms of the gross number of kidney transplants, only behind the United States, with a predominance of kidney transplants from deceased donors[28].

Historically, issues related to RRT in Brazil have resulted in important bioethical dilemmas. The expansion of dialysis services during the 1980s was not accompanied by specific legislation that regulated the peculiarities surrounding hemodialysis treatment. This culminated in 1996 in what became known as the 'Caruaru tragedy', where the presence of cyanobacterial (algae) contamination in the reservoir of a hemodialysis clinic resulted in the death of more than fifty people due to hepatic insufficiency[29]. This situation led to changes in federal legislation in order to safeguard the safety of patients with ESRD.

In matters related to renal transplantation, the passing of Law 9434/97 and Decree 2268/97 regarding 'presumed donation' (i.e. every Brazilian was considered to be a potential donor of organs unless they manifested a desire to the contrary), which was intended to increase the number of kidney transplants, resulted in the opposite effect. The legislation was amended by an interim measure, confirmed by Law 10211 of 2001, in which the organs of the deceased indi-

Ciência & Saúde Coletiva, 22(7):2175-2185, 2017

vidual were assigned to their family, which made the decision-making autonomous of the potential donor while they were alive[27].

Currently, the donation of organs from deceased donors is only permitted after family consent, and transplants from living donors are only allowed after consent from relatives with a fourth degree of kinship and also from compatible spouses. The transplantation of unrelated living donors is only permitted following a judicial procedure, with a view to curbing trafficking in organs[27].

The current moral dilemmas in Brazil are centered on issues related to inequity and justice in the access to RRT. The total prevalence of patients in dialysis/pmp in Brazil is low when compared to some Latin American countries[6]. This reinforces the perception of the existence of under-diagnosis and of difficulties in access to treatment. In addition, studies have shown inequality in the distribution of clinics throughout Brazil, with a strong correlation between the proportion of clinics/pmp and the values of state GDP[30]. A recent study showed a linear correlation between dialysis centers and municipal human development index (HDI-M) values[31].

Regarding bioethical issues related to kidney transplantation, despite the high gross number of transplants in Brazil, corrected data for the Brazilian population (26 renal transplants/pmp in 2011) put the country in the modest place of 33rd in relation to renal transplants and behind Latin American countries such as Uruguay and Argentina[28]. Economic and regional disparities in relation to transplantation issues have also been verified, with a higher rate of transplantation in regions of the country with the highest levels of income[27,32].

**2. South Africa**

South Africa is located in the region known as sub-Saharan Africa, on the southern tip of the African continent. Africa is the second largest continent in the world: sub-Saharan Africa occupies about 80% of this territory[33] and is home to approximately 70% of the world's least developed countries[5].

In comparison with the other BRICS countries, South Africa has the second highest percentage of GDP investment in health (second to Brazil), modest HDI values (only ahead of India), with the lowest life expectancy among all the BRICS countries. Unlike the other BRICS countries, South Africa is not among the ten largest economies in the world and it has the lowest GDP of all of the BRICS countries (Table 1).

Official data regarding dialysis and renal transplantation in South Africa can be obtained through the South African Dialysis and Transplant Registry. However, according to Naicker[4], such data should be interpreted with caution since it reflects the accessibility to RRT rather than the actual prevalence of ESRD. In fact, the vast majority of African countries do not have records of dialysis and transplantation, which makes it difficult to create an integrated African census[34].

The main causes of ESRD are hypertension, glomerulonephritis, and diabetes[4,33,35]. It is estimated that hypertension affects a quarter of the South African adult population and that the prevalence of chronic kidney disease is three to four times higher than in developed countries[4,33]. Glomerular diseases are more prevalent and aggressive than in Western countries in view of the correlation with the high prevalence of infectious, parasitic and viral diseases (such as HIV)[5,35,36].

There has been a significant decline in life expectancy in sub-Saharan Africa due to war, crime and violence, which has been aggravated by precarious economic and social conditions after such events[33]. In this context, the profile of patients receiving dialysis in Africa are young individuals with glomerulonephritis or hypertension, whereas in developed countries the patients are older, with the main cause of ESRD being diabetes[33].

According to data from the USRDS, the prevalence of patients with ESRD is 167/pmp[20], with hemodialysis predominating as the form of RRT[4,33]. The kidney transplant rate is around 9.2/pmp, with South Africa being one of the few countries in sub-Saharan Africa where renal transplants are performed, and the only one in which deceased donor transplants are performed[5]. Given that RRT treatment is preferably performed in urban centers, in many parts of Sub-Saharan Africa there are simply no nephrologist physicians.

According to Naicker[33], a large part of RRT funding throughout Africa is private, with governments in a few African countries (including South Africa) providing care for a small number of patients and with prioritization for those patients who are eligible patients for kidney transplantation[33]. In many African countries, chronic outpatient dialysis is unsustainable; most patients are unable to afford the cost of their own treatment after the initial months[33].

From the point of view of the history of bioethics, the first heart transplant of a deceased donor occurred in South Africa in 1967. In the absence of a definitive criterion for brain death, this event led to discussions about the establishment of criteria to provide more ethical deceased donor transplantation programs[37].

Currently, in addition to the intense inequalities that exist in sub-Saharan Africa regarding access to all forms of RRT, another bioethical dilemma is present; despite the fact that it is prohibited by law, 'transplant tourism', especially of kidneys, occurs[38,39]. In 2003, the South African Parliament reviewed its National Health Law, inserting a specific chapter dealing with the use of human blood and blood products, tissues and gametes.

### 3. India

Located in southwest Asia, India is one of the most populous regions in the world and has a population of more than 2 billion[40]. Among the BRICS countries, in comparative terms India has the lowest HDI values, the lowest percentage of investment in health, and the second worst life expectancy at birth (66 years), only ahead of South Africa (56 years) (Table 1).

Despite a growing understanding of the important aspects of morbidity and mortality associated with ESRD and the efforts of the Indian Society of Nephrology, there is no unified dialysis and renal transplant census in India[41].

The estimated incidence of ESRD is between 150-200 individuals/pmp and a prevalence of 800 individuals/pmp[42-45]. The predominant form of RRT is hemodialysis[40,45-47]. The main causes of EDD are glomerulonephritis, diabetes and undetermined causes affecting young middle aged males[40,42-44].

Studies have demonstrated efforts to increase access to dialysis and early diagnosis[45,48]. However, less than one-third of the patients who are referred have access to some type of RRT, and hemodialysis treatment is frequently interrupted in the first months due to the inability to pay for the treatment[43]. There are few nephrologists and hospitals that offer dialysis and transplantation, especially in the poorer regions, and the quality of hemodialysis is questionable because of the frequent re-use of cellulose acetate capillaries (of lower quality) and the lack of use of important medications (such as erythropoietin). These actions are taken in order to minimize the costs of dialysis but they generate greater morbidity and mortality, inadequate rehabilitation and worse quality of life for patients with ESRD[46]. Less than 10% of patients with ESRD undergo kidney transplantation. Transplants from related living donors predominate, with gender discrepancies between donors (2/3 female) and recipients (3/4 males)[43]. Approximately 30% of kidney transplants are from unrelated living donors[43], with only 1-2% corresponding to deceased donors due to the lack of public policies aimed at post-mortem donation[43,44,46].

After renal transplantation, the use of immunosuppressive drugs (such as cyclosporin) is generally discontinued because of the economic inability of patients to acquire this medication[43,44]. This causes a consequent loss of renal graft, as well as the non-coverage of the treatment-related costs of treatment for cortico-resistant rejections and cytomegalovirus infections[46]. Several studies have reported the sale of kidneys for the purpose of living transplants as a standard practice in India, accounting for up to 70% of living kidney transplants[44,46].

According to Garrafa[49], the argument that the donation of a kidney is an act of kindness and that the financial incentive for such an act is morally justifiable began in the late 1980s, and the expression 'reward donors' was coined in the scientific community[49]. One of the great ethical questions is precisely the conflict over economic incentives to altruistic donation in the face of the growing need for organs[50] and the applicability of the principles of justice and autonomy in a context of significant economic and social exclusion[51]. In a compelling article, Jha[52] questions the argument about fairness of benefits between donors and recipients in a regulated market for the purchase of organs, highlighting the role of the Authorizing Committee of the Indian Organ Transplant Act and demonstrating that in most countries where payment for transplants occurs (such as India, Iran, Pakistan and the Philippines) there is a low score in the Corruption Perceptions Index, which is compiled by the organization Transparency International[52-54].

### 4. China

China is situated in the eastern part of the Asian continent and is the third largest country in the world in terms of territory, with a population of over one billion. Compared to the other BRICS countries, China has the highest GDP and life expectancy at birth, with the third best HDI (surpassed by Russia and Brazil) and the penul-

Ciência & Saúde Coletiva, 22(7):2175-2185, 2017

timate in terms of the percentage of GDP investment in health (surpassing only India) (Table 1).

Studies have shown a progressive increase in the incidence of chronic non-communicable diseases, such as obesity and diabetes, in addition to population aging, which has led to a growth in cases of ESRD[55]. The main causes of ESRD are glomerulonephritis, diabetes and hypertension[56-59]. Data sources can be obtained through the Chinese Society of Blood Purification and the Chinese Society of Nephrology[55,56], and there are also regional censuses[57,58].

Despite a prevalence of ESRD of 79.1 patients/pmp in mainland China (lower than many other regions in Asia), the annual rate of prevalence of ESRD is estimated at 52.9%[56]. An important inequity in the distribution of dialysis centers throughout the provinces and regions of China has been indicated[55,57,58]. There are also asymmetries in the distribution of nephrologist physicians (with a greater presence near large metropolises such as Beijing and Shanghai)[59] and important disparities between the urban and rural areas in terms of access to dialysis treatment[60].

The predominant form of dialysis treatment is hemodialysis in 80% of cases[61]. In view of the exponential growth of cases of ESRD it is estimated that by 2030 the prevalence rate of ESRD will reach 1505 cases/pmp, with an annual rate of increase in health costs of 6% per year and an increase in the prevalence of renal transplants of around 10%[62]. In this context, the Chinese Society of Nephrology has a growing understanding of the need for early diagnosis and prevention as a way of delaying the emergence of new cases of ESRD[55].

A renal transplantation rate of 5000 cases/year, predominantly from deceased donors, has been estimated[59]. These organs often come from prisoners who are executed (among them political dissidents and human rights activists), and therein lies one of the major ethical problems in relation to the Chinese kidney transplant program. Some scientific articles and the Chinese government relativize this situation, focusing on the apparent normality of the system and the utilitarian pro-societal benefit of these organs[63], which converges with the morality of Confucian ethics[64]. However, there is little transparency in the data from the Chinese kidney transplant program, with consequent violations of human rights, bioethical principles of autonomy and justice, and all the ethical recommendations of the World Health Association (WHO), the World Medical Association and the Declaration of Istanbul[65-68].

**5. Russia**

Russia, or the Russian Federation, is a transcontinental nation that occupies a vast territory in Europe and Asia. Compared with the other BRICS countries, Russia has the best HDI values, the third-best life expectancy at birth (behind China and Brazil) and the third- highest percentage of GDP investment in health (behind Brazil and South Africa) (Table 1).

Russia is a full member of the ERA-EDTA (European Renal Association – European Dialysis and Transplant Association, an association that compiles national and regional data from more than 30 European countries with the aim of outlining the situation regarding ESRD in Europe[69]. The Russian Dialysis Society is responsible for this data, which can be accessed via the ERA-EDTA website (www.era-edta.org) or directly (through the website www.nephro.ru).

Data from the USRDS show a prevalence of patients with ESRD of around 241/pmp[20]. It was verified that there was a renal transplantation rate of around 6.8 patients/pmp in 2011, with a predominance of deceased donors.

It is difficult to obtain articles about the status of dialysis and transplantation in the Russian Federation apart from the official data. Values for both the prevalence of ESRD and rates of renal transplantation are lower than in several European countries[69], which may, in the context of the analysis carried out in the other BRICS countries, be an indication of inequity in access to RRT. In a letter to the European journal, Nephrology, Dialysis and Transplantation in 1998, Khan et al.[70] cautioned about the difficulties facing the Russian universal healthcare model, especially after the collapse of the Union of Soviet Socialist Republics (USSR) and the repercussions of that event on attempts to obtain data about RRT. In a 1995 article, Boesken et al.[71] also discuss the difficulties of maintaining RRT programs in a 'hostile economic environment'.

Some authors have argued that one of the reasons why the Russian Federation does not play a more influential role within the BRICS in building a global health agenda is that it is traditionally more concerned with internal domestic problems[9]. This would partially explain the difficulties in obtaining scientific data beyond the official data.

## Final Considerations

As has been discussed, ESRD represents a major public health problem in view of its increasing prevalence worldwide. This situation is particularly aggravated in emerging countries, such as the BRICS, due to rapid demographic transitions associated with continuing economic, health and social inequities.

Solutions to combat such an epidemic are complex. According to White[72], expanding access to conservative treatment, as well as the local production of inputs (such as capillaries and dialysis lines, which are commonly imported), the use of non-governmental funding sources, and cost-containment planning could minimize the economic impact of ESRD. Garcia-Garcia[73] argues that the large-scale expansion of deceased donor programs could also be an option.

The construction of a South-South type-cooperation could, in this context, play an important role, since these countries share several similarities regarding inequities in access to RRT. This cooperation would follow the bioethical vision expressed in the Universal Declaration of Bioethics and Human Rights (UDBHR) through Article 13 (which deals with the need for solidarity and international cooperation among nations) and Article 14 (which states that the promotion of health and social development should be central objectives for governments)[74].

In a well-argued article, Cunha and Garrafa[75] state that the bioethical principle of 'vulnerability' can have different meanings in different countries; from a simple 'deprivation of autonomy' (in the bioethical view that is often expressed in the United States) to a social connotation (which is often the bioethical view in South America)[75,76]. This would explain the diverse ways in which such countries try to deal with the issue of ESRD based on the prevailing bioethical vision in each country.

Thus, the construction of interdisciplinary bridges of understanding[77], as well as investment in the creation of legislation that results in greater technological integration and shared access to new medicines and therapies, could help to solve some difficulties in accessing RRT.

## Collaborations

FHRP Ferraz created the idea of the article and wrote the first version, CIS Rodrigues reviewed the section regarding dialysis and bioethics, GC Gatto reviewed the section concerning transplantation, and NM Sá created the idea of the article and revised the final content.

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