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Mortality by skin color/race and urbanity of Brazilian cities

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ABSTRACT

Objective: The skin color/race and urbanity are structural determinants of health. The relationship between these variables produces structure of social stratification that defines inequalities in the experiences of life and death. Thus, this study describes the characteristics of the mortality indicators by skin color/race according level of urbanity and aggregation to the metropolitan region (MR) of 5565 cities in Brazil, controlling for gender and age.

Design: Descriptive study which included the calculation of measures relating to 1,050,546 deaths in the year survey of 2010 by skin color/race White, Black, and Brown according to both sexes, for five age groups and three levels of urbanity of cities in Brazil that were aggregated or not to the MR in the year of study. The risk of death was estimated by calculating premature mortality rate (PMR) at 65 years of age, per 100,000 and age adjusted.

Results: The structure of mortality by skin color/race Black and Brown reflects worse levels of health and excessive premature deaths, with worse situation for men. The Whites, especially women, tend to live longer and in better health than other racial groups. The age-adjusted PMR indicates distinct risk of death by skin color/race, this risk was higher in men than in women and in Blacks than in other racial groups of both sexes. There have been precarious levels of health in the urban space and the MR has intensified these inequalities.

Conclusions: The research pointed out that the racial inequality in the mortality was characterized by interaction of race with other individual and contextual determinants of health. Those Blacks and Browns are the groups most vulnerable to the iniquities associated with occurrence of death, but these differences in the profile and the risk of death depend on the level of urbanity and aggregation MR of Brazilian cities in 2010.

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Mortality; health inequalities; urbanity; race or ethnic group distribution; demographic aging; cities

Introduction

Inequalities in the mortality structure have been widely analyzed in various countries and regions in the world, and these have contributed towards identifying vulnerable social groups and evaluating health and life expectancy levels of populations independently of their stage of socioeconomic development (Nogueira 2008; Vermelho, Costa, and Kale 2008; Szwarcwald et al. 2011a; Kanso 2014).

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In Brazil, studies on mortality have frequently been conducted and have evaluated differences in death profiles and risk as a function of the variables of age, sex, socioeconomic status, and health behaviors associated with these factors (Ripsa 2008; Oliveira-Campos, Cerqueira, and Rodrigues Neto 2011; Kanso 2014). Such studies show relevant variations in the composition of mortality and population groups with marked disadvantage in living conditions and health. However, inequities operating through other structural determinants of health have not yet widely been investigated, but the socioeconomic aspect of health inequities remains as the main focus of interest in these works. It is observed that the studies available when using the level of complexity of the individual tend to investigate the inequities in mortality based mostly on variables that reflect the levels of education, income, and occupation in the labor market (Oliveira-Campos, Cerqueira, and Rodrigues Neto 2011; Szwarcwald et al. 2011a; Belon, Barros, and Marín-León 2012; Kanso 2014). When employing aggregate-level data by spatial or geographic variations in the approaches, the investigations are restricted to the socioeconomic differences within localities belonging to a single city, especially of large Brazilian cities located in the southeastern region of the country, debating the intraurban differences (Macedo et al. 2001; Szwarcwald et al. 2011a; Belon, Barros, and Marín-León 2012). This limits the comprehension of the role of other individual and contextual determinants in mortality at a national scope from different types of population size of Brazilian cities and their levels of urbanity (Squires and Kubrin 2005; Fiorio et al. 2011).

Skin color/race and urbanity are other structural determinants of individual and collective health, which complexly interact with age, sex, and socioeconomic status in defining the health and life conditions and the associated health behaviors (World Health Organization 2007; Nogueira 2008; Fiorio et al. 2011; Sharkey 2013). The close relationship between these variables produces a structure of social stratification that defines an unequal exposure to risk and protection factors and the social, sanitary, and health resources that accumulate over the course of several life cycles and generations and define the inequalities in the experiences of life and death observed among the population groups in different social contexts (Borrell and Hatch 2005; Nogueira 2008; Fiorio et al. 2011; Smedley 2012; Sharkey 2013).

The variable of skin color/race comprises a sociopolitical construct, an important organizational principle of society and inequalities, which is capable of revealing identities and vulnerabilities and which, in different ways, has been used to the present day to create and reproduce racial hierarchies and systematically restrict the opportunities, access to, and distribution of resources and rights of the citizenship to the population groups that depend on the skin color/race (Telles 2004; Sharkey 2013). Over a lifetime, this variable interacts with social position markers and exposes, independently or in combination with other factors, to varying levels of individual and contextual health risks (Telles 2004; Krieger et al. 2014). In this sense, the skin color/race emerges as a multidimensional analytical category that is useful in studying social and health inequalities measured through different indicators in Brazil (Telles 2004; Szwarcwald et al. 2011a; Belon, Barros, and Marín-León 2012; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014).

Studies show that the general conditions of life and health of Blacks in Brazil have always been worse than that of the White population. Browns and Blacks from the period of enslavement have been subjected to the greater burden of tropical diseases, high infant and maternal mortality, low life expectancy, poor health and social

infrastructure in places where they reside, and lack of access to equipment and social institutions such as school, formal work, and health services (Telles 2004; Araújo et al. 2010). This situation has remained even after the abolition of slavery in 1888. The political, economic, and discriminatory forces that generated this social and economic exclusion, exploitation, abandonment, disinvestment, racial stigmatization, and domination have passed and accumulated down through generations and exposed Browns and Blacks to a number of disadvantages that are still observed to this day (Telles 2004; Araújo et al. 2010; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014).

Accumulated empirical evidence have revealed that, even in the twenty-first century, Browns and Blacks in Brazil are overrepresented among the poor, those with low levels of schooling, underemployed, those staying in the absence of fairness, those in precarious material situations of life, and those with high health needs when compared to the White population (Telles 2004; Araújo et al. 2010; Szwarcwald et al. 2011a; Oliveira, Thomaz, and Silva 2014). Thereby, even after controlling for income or educational level differences, non-Whites of both sexes have worse health indicators in comparison to Whites of the same groups. This condition indicates the concentration of complex social and health problems in Brown and Black populations of the country and suggests that the permanence of experience of race-based discrimination in other realms of life is related to racial inequality that is still evident (Szwarcwald et al. 2011a; Belon, Barros, and Marín-León 2012; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014).

In turn, urbanity represents the degree of urbanization of a certain area at a given moment, shows the set of physical and social attributes that distinguish the cities from each other, and explains an important portion of health inequalities, because it is considered as one of the major modifiers of the health and living conditions of this century, given the inequities that occur or are worsened when associated with this situation (World Health Organization 2007; Caiaffa et al. 2008; Nogueira 2008; Harpham 2009) and the accumulation of health problems and needs in these social spaces they become increasingly complex (Veiga 2002; Borrell and Hatch 2005; Harpham 2009).

In Brazil, this urbanization is characterized by having occurred in a short time and with intense displacement of populations to cities, emergence of new cities of different population sizes and densities, growth or aggregation of these cities with each other, composing a complex and expansive metropolitan country, and predominance of population living in the slum sector or city fringe, irregular areas, and precarious social infrastructure regardless of the geographic region of the country (Monte-Mór 2005; Caiaffa et al. 2008). These phenomena produced profound modifications of daily life of the people and the places in which they live. These transformations have made cities complex social structures characterized by the stratification of society, segregation of their spaces, and heterogeneity of urban space across the cities. This condition produces uneven population groups at risk and accumulation of vulnerabilities that manifest them in the social and health measures, such as those of mortality (Monte-Mór 2005; Caiaffa et al. 2008; Harpham 2009).

The interaction between race and the physical and social attributes of the place where the people live seems to model the experience of death observed in certain racial groups once the more vulnerable racial groups suffer the negative concentration of these individual and contextual factors (Borrell and Hatch 2005; Inagami et al. 2006; Nogueira 2008; Smedley 2012; Krieger et al. 2014; Singh and Siahpush 2014). Both in Brazil and in other countries, excess mortality, increased premature mortality, and lower life expectancy

among non-Whites of both sexes have been observed in contexts that concentrate on poverty, unemployment, violence, drugs market, poor provision of social service infrastructure equipment, basic sanitation, leisure, recreation, and health. This clustering of the negative socioeconomic, political, and environmental aspects has important implications for the life chances of those racial groups, as they reflect on racial inequities that explain the high mortality levels studied (Macedo et al. 2001; Nogueira 2008; Araújo et al. 2010; Szwarcwald et al. 2011a; Belon, Barros, and Marín-León 2012; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014; Krieger et al. 2014; Singh and Siahpush 2014).

However, epidemiological studies conducted in Brazil until this moment have not evaluated the way in which inequalities of mortality attributed to race, according to age, sex, and socioeconomic status, depend on the level of urbanity in Brazilian municipalities, along with the way in which the properties of these municipalities, in metropolitan areas or not, are associated with race in the configuration of racial profiles and risk of death. Hence, the expansion of the scope of analyses on these social determinants of health will make it possible to understand the other dimensions of stratification of the inequalities studied and provide additional explanations about them, especially those related to the cities of different size populations present in the five geographic regions of Brazil (Borrell and Hatch 2005; Monte-Mór 2005; Fiorio et al. 2011; Smedley 2012).

Therefore, the present study aimed to describe the characteristics of mortality relating to skin color/race, according to age, sex, and the municipality in which the deceased individual lived, in Brazil in 2010.

Methods

The present study is a descriptive study on mortality indicators that occurred in Brazil during the census year of 2010, from the death data recorded in the Mortality Information System (MIS; Sistema de Informações sobre Mortalidade), which is made available online by the Ministry of Health through the Computing Department of the Brazilian National Health System (SUS; DATASUS).

The MIS is one of the strategic components of the Brazilian National Health System for it is present in all municipal departments of health in Brazil, but the percentage of coverage of death records in the MIS and the adequacy of the information contained therein still show variability across and within regions and across cities of the country (Ripsa 2008; Szwarcwald et al. 2011b). However, in recent years, it has improved the percentage of coverage and quality of the information on the MIS and decreased the differences across the many social contexts of the country. Leading researchers in the death theme have proposed that, due to the recent advances in the expansion of coverage and completeness of MIS data, the record of variables related to death in Brazil may allow accuracy and reliability similar to those observed in other long tradition of countries in the preparation of health statistics (Ripsa 2008; Vermelho, Costa, and Kale 2008; Szwarcwald et al. 2011b).

The analysis unit used was the deaths that occurred during the census year of 2010 that were registered in the municipality of residence of the individual who died. In that year, there were 5565 municipalities in Brazil. The variables used in this study were skin color/race, sex, age, and municipality of residence of the individual who died. Death data were gathered according to categories of skin color/race (white, brown, black, yellow,

indigenous, and undeclared) and according to the Brazilian municipalities in 2010. The overall number of deaths for which data were gathered was 1,136,947, among which the municipality of residence of the individual who died was recorded in 1,131,286 cases. Among these, information on skin color/race was recorded in 93.7% of the death certificates. Whites, Browns, and Blacks accounted for 1,050,546 of these deaths. The yellow skin color category (6161) and indigenous category (2918) were not considered in the analyses because their frequencies were lower than 1% of all of the deaths with information on skin color/race and because these categories were not the focus of interest of the present study. Both sexes were considered, and age was categorized into five groups (0–4, 5–14, 15–24, 25–64, and ≥65 years old).

In Brazil, recording death information is a medical assignment, and it is recommended that the professional asks the skin color/race of the deceased from the one responsible for the death information and should never allow the racial attribute be decided by the doctor from his or her observation. Racial information of the deceased is the result of the classification by another person, whereas, in the decennial census, the population is a self-declaration of color/race (Laurenti et al. 2005; Ripsa 2008; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014). The inclusion of skin color/race on death certificates was only introduced recently, in the usual manner, for deaths that occurred from 1996 (Laurenti et al. 2005; Ripsa 2008). Therefore, there is still concern about ignoring this variable because it can generate possible limitations in understanding the true epidemiological pattern of mortality by skin race/color in the country, as recording this attribute is not yet at present uniform across regions and states in the country. However, in the 2000s, the declaration of this variable has dramatically improved, falling from the almost 150% absence of this record between 2000 and 2010, reaching record levels that have enabled consistent analyses at local, regional, and national levels of these data (Ripsa 2008; Vermelho, Costa, and Kale 2008; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014).

The municipalities of residence of the individuals who died were classified according to the combination of the following characteristics: population size, demographic density (DD), and whether they belonged to a metropolitan region (MR). In accordance with the criteria available in Veiga (2002), who elected the municipality as a territorial unit of analysis to capture the intensity of use of rural and urban space from the human action on the ecosystem, the first two characteristics were combined to classify the Brazilian municipalities according to their level of urbanity into three groups: rural, 'rurban,' and urban. Brazilian municipalities with <50,000 inhabitants and DD ≤80 inhabitants/km^2 were classified as rural. In turn, municipalities with populations between 50,000 and 100,000 inhabitants, or with DD >80 inhabitants/km^2 (even if the population size was <50,000 inhabitants), were deemed to present an intermediate level of urbanization and thus were characterized as rural/urban (i.e. 'rurban'). Finally, those with population higher than 100,000 inhabitants were considered urban by presenting a typical pattern of urbanization and of artificialization of the ecosystem due to human action with the formation of the built spaces (Veiga 2002).

The quality of aggregation into an MR was taken into consideration when the municipalities were located in MR, integrated development regions (IDR), and urban agglomerations. The defining characteristics of these locations are described in publications from the Brazilian Institute for Geography and Statistics (IBGE 2011).

Thus, for the purposes of statistical analysis, the municipalities were aggregated into six categories: rural within MR, rural outside MR, 'rurban' within MR, 'rurban' outside MR, urban within MR, and urban outside MR. For this study, mortality rates and ratios were calculated. Proportional mortality was measured as the proportion of deaths according to white, brown, and black skin color/race in relation to the total number of deaths according to sex, age group, level of urbanity, and aggregation to an MR. Next, proportional mortality was calculated according to skin color/race and sex for each of the five age groups evaluated, specifically for sex according to the level of urbanity and aggregation to an MR. Age curves for proportional mortality according to skin color/race and sex were calculated, specifically for the level of urbanity and aggregation to an MR. Finally, all deaths that occurred before age 65 years were aggregated and divided by the total number of deaths according to skin color/race and the level of urbanity and aggregation to an MR to calculate the premature proportional mortality below age 65 years. In turn, the risk of death was estimated by calculating the premature mortality rate (PMR) at age 65 years. These rates were calculated according to skin color/race and sex, specifically according to the level of urbanity and aggregation to an MR. These rates were multiplied per 100,000 and age adjusted by the direct method using the total population age structure of Brazil in the census year of 2010 as the standard.

The analysis of the proportional distribution of deaths is useful when you want to check the relative share of certain characteristics in the mortality structure, allowing to discriminate and assess variations in population levels of health from the relativity of death data (Laurenti et al. 2005; Vermelho, Costa, and Kale 2008). In addition, the use of proportional mortality is accepted only when the coverage of deaths is high, as has been seen in Brazil in the last years (Szwarcwald et al. 2011b). Moreover, the PMR has been increasingly used in epidemiological studies conducted in several countries in the analysis of population levels of health to check the risk of death before the old stage of life. Another reason for using that rate is that it avoids differences in the survival structure among some social groups or places that affect the understanding of mortality even after adjustment for age (Ripsa 2008; Szwarcwald et al. 2011a).

The analyses were performed using the SPSS 21.0® statistical package (SPSS, Inc., Chicago, IL, USA) and Excel for Windows® 2013.

This study was elaborated based on aggregated databases on death that are available online. These did not include confidential information regarding personal or home identification. All the work was performed in accordance with Resolution No. 466 of the National Health Council [Conselho Nacional de Saúde (CNS)] of 12 December 2012.

Results

In 2010, among the deaths that occurred in Brazil for which information about skin color/race and municipality of residence was available, 56.8% were White, 35.2% Brown, and 8.0% Black. This distribution was similar to the racial composition of the Brazilian population in 2010, which was predominantly White (48.4%) against the Browns (43.8) and Blacks (7.7%). Deaths among individuals of white skin color/race predominated in both sexes, and women accounted for a higher proportion (60.7%). Deaths among individuals of brown (38.0%) and black (8.2%) skin color/race were more frequent among men. In the three youngest age groups, deaths of individuals of brown skin color/race predominated

(≥49.8%). The percentages increased as the age group increased, until age 24 years, and reduced from age 25 years onwards, such that the lowest proportion was in the age group ≥65 years (28.5%). Deaths among Whites only predominated from age 25 years onwards, especially in the oldest age group (64.4%). In the three levels of urbanity and condition of aggregation to an MR, deaths among individuals of white skin color/race predominated. However, in municipalities within an MR, the increase in the level of urbanity was accompanied by a reduction in the proportion of deaths of Whites and increases among the Browns and Blacks. In turn, the opposite occurred in municipalities outside the MRs, and the percentages reached the highest values for Browns and Blacks in non-urbanized contexts (Table 1).

Regarding the five age groups, deaths of individuals of white skin color/race were more frequent among women, but deaths of individuals of brown and black skin color/race were predominantly among men, with higher percentages in the youngest three age groups, and were lower from age 25 years onwards, when the proportion of Whites predominated in both sexes. The highest proportion of deaths of individuals of white skin color/race occurred in the age group ≥65 years; for those of black skin color/race, it was in the previous age group. For those of brown skin color/race, it was in the age group between 15 and 24 years among men (58.4%) and between 5 and 14 years among women (50.5%; Figure 1).

At all levels of urbanity and conditions of aggregation to an MR among the municipalities studied, deaths of individuals of white skin color/race predominated. However, within MRs, the percentages decreased as the level of urbanity increased, and increased outside the MRs, in both sexes. Deaths of individuals of brown and black skin color/race occurred more frequently among men in all the contexts evaluated and these percentages increased as the level of urbanity in an MR increased but decreased when outside the MRs. Among women, the proportion of deaths of individuals of brown skin color/race

Table 1. Absolute and relative distribution (%) of deaths by skin color/race according to sex, age and level of urbanity and aggregation to the MR in Brazil in 2010[a].

	Whites		Browns		Blacks	
	N	%	*N*	%	*N*	%
Variables/categories	596,613	56.8	370,292	35.2	83,641	8.0
Sex						
Male	322,993	53.8	227,842	38.0	48,857	8.2
Female	273,620	60.7	142,450	31.6	34,784	7.7
Age bracket (years)						
0–4	19,210	47.2	20,277	49.8	1232	3.0
5–14	3748	41.4	4744	52.5	548	6.1
15–24	15,553	35.5	24,740	56.5	3466	8.0
25–64	188,933	49.3	156,731	40.9	37,698	9.8
≥65	369,169	64.4	163,800	28.5	40,697	7.1
Level of urbanity[b] and aggregation to the MR[c]						
Rural in MR	13,423	61.8	6995	32.2	1292	6.0
'Rurbano' in MR	28,020	60.5	15,257	33.0	3029	6.5
Urban in MR	258,066	57.5	152,326	34.0	38,319	8.5
Rural off MR	131,486	52.1	101,093	40.1	19,618	7.8
'Rurbano' off MR	73,197	54.3	51,370	38.1	10,206	7.6
Urban off MR	92,421	62.9	43,251	29.5	11,177	7.6

[a]Ignore the deaths color/race yellow and indigenous and no color/race information and county of residence of death.
[b]Rural = municipalities with <50,000 and density ≤80 inhabitants/km^2; 'rurban' = municipalities with a population between 50,000 and 100,000 or density of >80 inhabitants/km^2; urban = municipalities with >100,000 inhabitants.
[c]RM = Municipalities belonging to the metropolitan areas, the IDR or in conurbations.

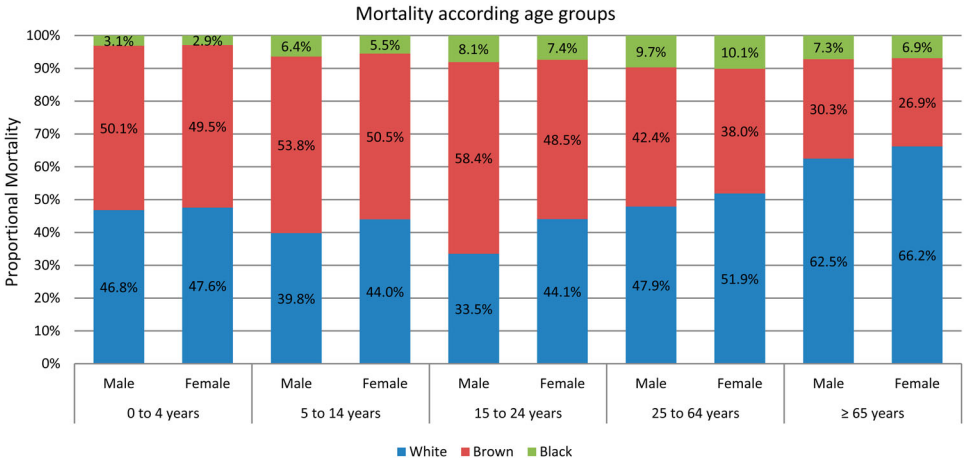

Figure 1. Proportional distribution of deaths by skin color/race by sex and by specific age groups in Brazil in 2010.

decreased as the level of urbanity increased under both conditions of aggregation to an MR; for Black women, it only increased within the MR. In general, the highest proportions for individuals of brown and black skin color/race of both sexes occurred outside the MRs at all levels of urbanity (Figure 2).

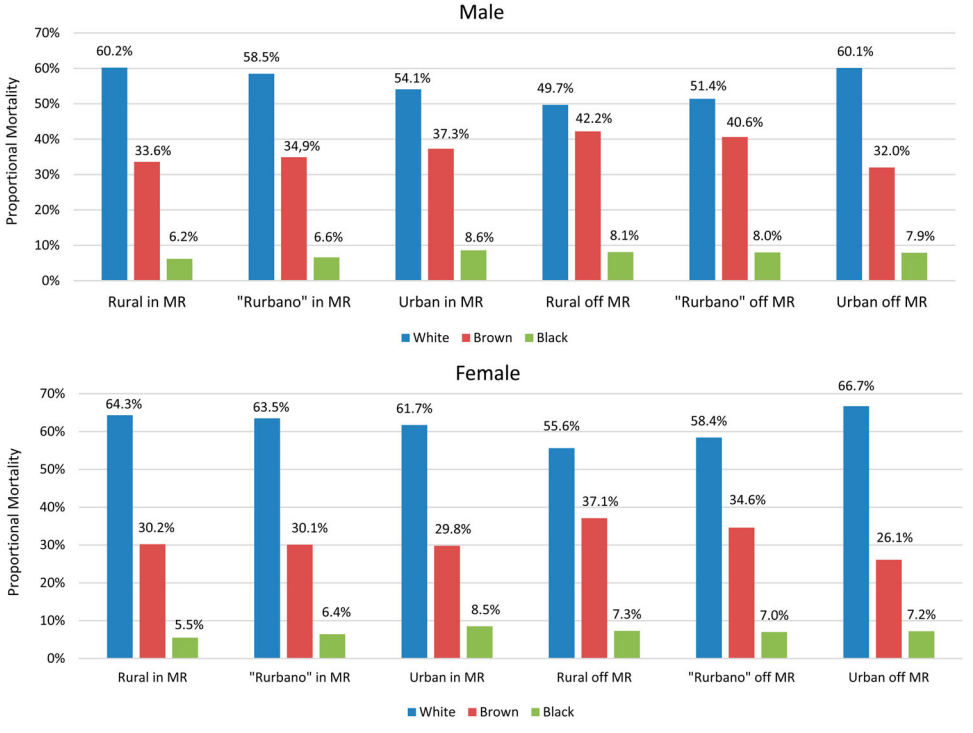

Figure 2. Proportional distribution of deaths by skin color/race according to gender and level of urbanity and aggregation to the metropolitan area in Brazil in 2010.

The age curves for proportional mortality according to skin color/race revealed that, in all the contexts evaluated, there was a worse relative structure of deaths for Browns and Blacks than for Whites, of both sexes, but with differences regarding the age group. In the adult phase, between ages 15 and 64 years, in both sexes, the highest proportions of deaths were found among Blacks and Browns but with highest numbers of deaths among Brown and Black men. In turn, in the elderly phase (age ≥65 years), deaths of individuals of white skin color/race predominated and the highest number of deaths was, in this case, among women, whereas deaths among Black men presented a lower frequency. In the rural municipalities, whether or not they were aggregated to an MR, deaths among elderly individuals predominated in all racial groups and in both sexes. However, at all other levels of urbanity, the curves for Brown and Black men presented the highest frequency between ages 25 and 64 years. These percentages increased with the level of urbanity, such that they were higher within the MR than outside it (Figure 3).

Premature proportional mortality, before age 65 years, was systematically higher among Browns and Blacks than among Whites in all levels of urbanity and conditions of aggregation to an MR. These groups presented growing frequencies of premature deaths due to the increase in the level of urbanization under both conditions of aggregation to an MR (Figure 4).

The age-adjusted PMR indicates a distinct risk of death by skin color/race according to gender and specific level of urbanity and aggregation to an MR of Brazilian cities. In general, rates increased with the increased level of urbanity and were even higher in cities aggregated to an MR. The risk of premature death was higher in men than in women and in Blacks than in other racial groups of both sexes (Table 2).

Discussion

The results revealed major inequalities in the composition of mortality according to skin color/race in relation to age, sex, and level of urbanity and aggregation to an MR among Brazilian municipalities in 2010. These inequalities reflect a set of structural disadvantages and aspects of social organization within cities that influence the patterns of behavior and ways of life and work, generating uneven exposure to risk and protection factors among Brazilian racial groups within the different contexts of the study, thereby influencing their life-course trajectories and disproportionate risk of death.

Table 2. Age-standardized PMRs <65 years averages, per 100,000 inhabitants, by skin color/race according to sex and specific levels of urbanity and aggregation to the MR of Brazilian cities in 2010.

	Male			Female		
Level of urbanity[a] and aggregation to the MR[b]	Whites	Browns	Blacks	Whites	Browns	Blacks
Rural in MR	327.84	246.17	455.58	172.17	105.71	294.83
'Rurbano' in MR	332.23	313.06	479.91	165.42	140.07	265.74
Urban in MR	349.04	362.34	467.57	179.69	158.17	270.03
Rural off MR	302.00	281.99	480.48	166.45	133.31	257.95
'Rurbano' off MR	301.96	340.49	530.41	169.53	147.90	268.08
Urban off MR	340.81	341.12	546.92	175.61	155.30	295.30
Brazil	306.91	291.15	486.05	167.65	134.78	262.80

Notes: Rates adjusted by age using standard to Brazil's population in the 2010 census.
[a]Rural = municipalities with <50,000 and density ≤80 inhabitants/km^2; 'rurban' = municipalities with a population between 50,000 and 100,000 or density of >80 inhabitants/km^2; urban = municipalities with >100,000 inhabitants.
[b]RM = Municipalities belonging to the metropolitan areas, the IDR or in conurbations.

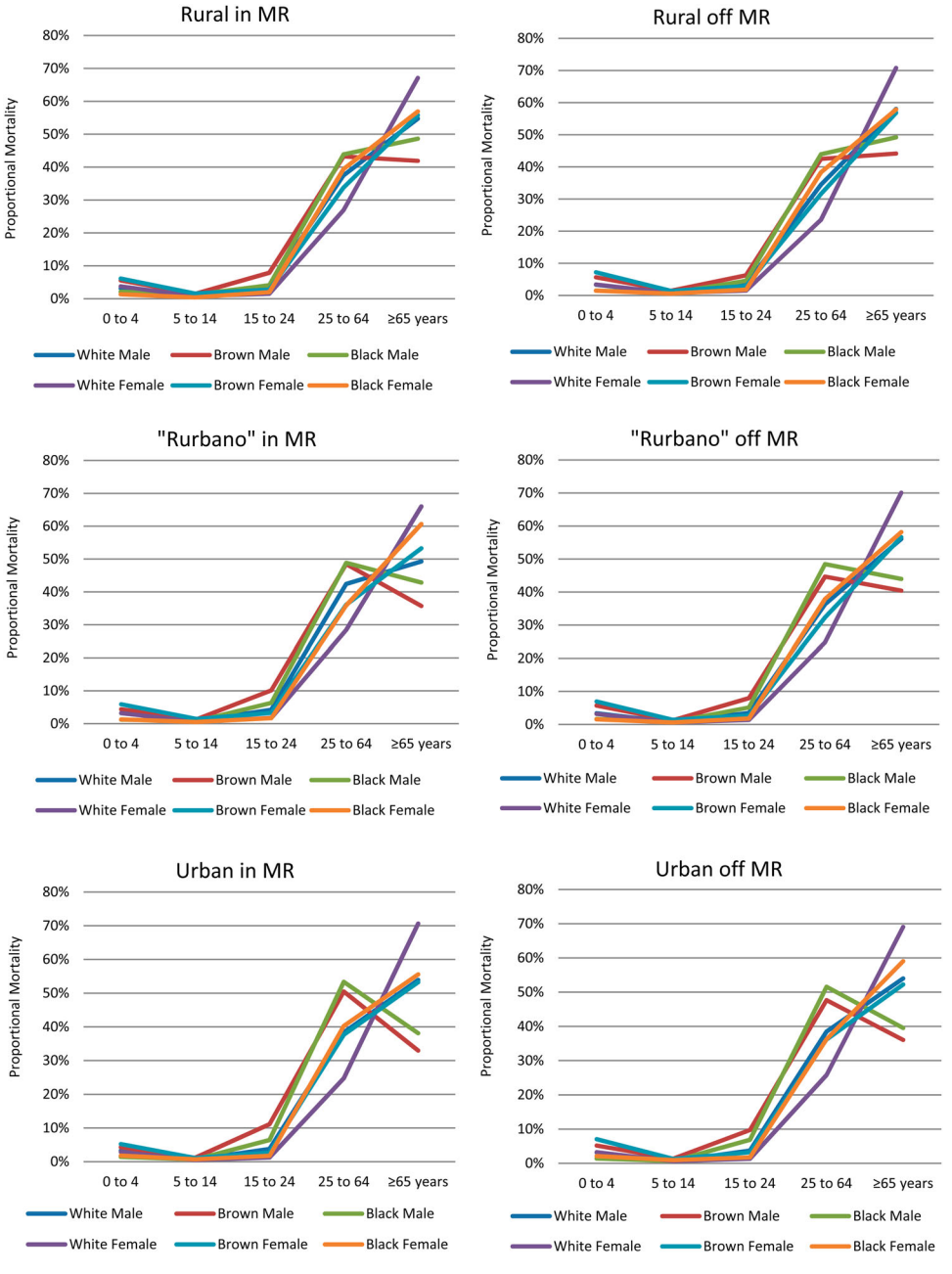

Figure 3. Proportional mortality curves for skin color/race by sex and by specific level of urbanity and aggregation to the metropolitan area in Brazil in 2010.

Similar to other studies, the results suggest that racial disparities in mortality rates can be attributed to the interaction of individual and contextual factors that create changes in lifestyles, health, and socioeconomic and cultural status depending on the availability of health and social services or other stressors related to life in areas with high concentrations of poverty and institutional weakness (Araújo et al. 2010; Szwarcwald et al. 2011a; Belon,

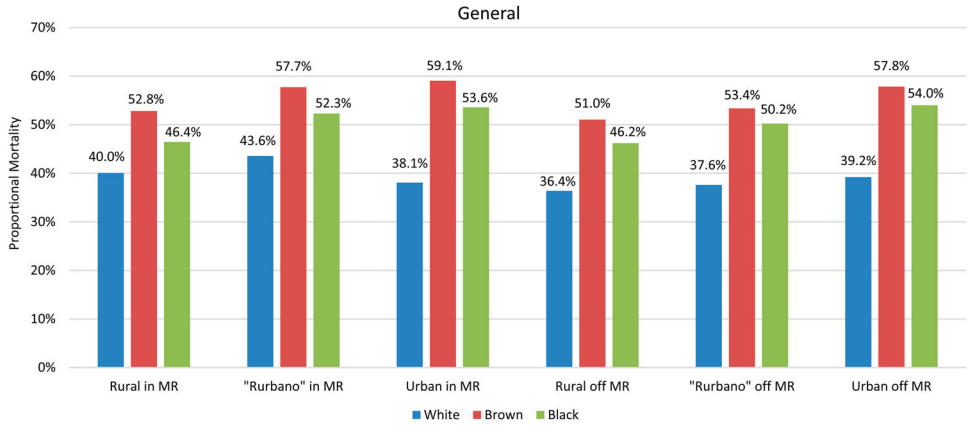

Figure 4. Proportional distribution of premature deaths <65 years for skin color/race according to the level of urbanity and aggregation to the metropolitan area in Brazil in 2010.

Barros, and Marín-León 2012). However, it presents as a novelty the urbanity levels of Brazilian municipalities, aggregated or not to an MR, as the factor that sets these contextual differences, making, similar to other countries, more robust the definition of the influence of place on health to use population and demographic criteria to define the differences between urban and rural in Brazil.

In this study, the racial inequalities were characterized by the fact that deaths among individuals of brown and black skin color/race were more frequent among young men, with mortality curves typical of low health levels. In turn, deaths of individuals of white skin color/race were more frequent among elderly women, with mortality curves reflecting high health levels and higher life expectancy. These racial differences in mortality according to sex suggest, as observed in other studies, that sex has a role in the ranking of racial inequalities in health (Ovadia 2003; Nogueira 2008) and that the factors that create and reproduce inequities among Brown, Black, and White men operate more intensely than among women from the same racial groups (Ovadia 2003; Telles 2004). Previous studies that used mortality data showed a higher expectancy of full and healthy life among women than among men, and the increase in the level of socioeconomic status of the place of residence contributes to the increase of this negative difference for men, even among Blacks and Browns (Szwarcwald et al. 2011a; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014).

Understanding mortality according to skin color/race in relation to the level of urbanity and aggregation to an MR among Brazilian municipalities made it possible at the population level to ascertain the importance of the contextual attribute in defining racial inequalities in health. The superposition and accumulation of risks to health within the mortality gradient from rural to urban, which is unfavorable to Browns and Blacks in MRs, especially for men, suggests that these groups do not benefit from the urban context and that the population density and the socioeconomic and infrastructure characteristics of MRs intensify the effect of urbanity on mortality. Therefore, as observed in studies conducted in other countries, Browns and Blacks are the population groups that are most exposed to the multiple forms of structural disadvantages that exist in

metropolitan and urbanized areas (Borrell and Hatch 2005; Squires and Kubrin 2005; Sharkey 2013).

Studies have indicated that the higher levels of mortality presented by the Brown and Black racial groups may result from the fact that these groups are more intensely exposed to risks associated with the precariousness of the social, material, and sanitary infrastructure, which produces infectious and parasitic diseases and deficiencies; risks from the behaviors and lifestyles that are associated with occurrences of chronic and degenerative diseases, social isolation, and mental and emotional diseases; and risks associated with deaths due to accidents and violence and to unequal access to and use of health actions and care (Borrell and Hatch 2005; Finch et al. 2008; Nogueira 2008; Harpham 2009; Fiorio et al. 2011; Smedley 2012). Thus, this complex concentration of effects of social determinants of health on Browns and Blacks exposes them to multiple risks of daily loss of quality of life and high numbers of premature deaths (Borrell and Hatch 2005; Singh and Siahpush 2014).

The results from the present study showed that race interacted at different levels with other social determinants, which structure social relationships within health, and indicated that, in Brazil, Browns and Blacks die earlier, while they are still young, especially among men and Black women, than do Whites. The results also indicated that, in this last group, death is postponed until more advanced age groups, especially in the elderly phase of life. This indicates that Whites tend to live longer and under better health conditions than the other racial groups (Fiorio et al. 2011; Oliveira, Thomaz, and Silva 2014).

Among countries that share a history of slavery, in Brazil, socioeconomic and health disparities experienced by Blacks and Browns throughout the life cycles and generations are significantly more intense than those observed among non-Whites from other countries, and in Brazil, Blacks have social and health measures even worse than the Browns (Telles 2004; Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014; Krieger et al. 2014; Oliveira, Thomaz, and Silva 2014). In Brazil, a major explanation for socioeconomic disparities associated with African ancestry is the cumulative effect of the lack of social, economic, and health policies designed to support the newly freed slaves and their descendants since the abolition of slavery in 1888 up to the last decades of the twentieth century (Telles 2004; Oliveira, Thomaz, and Silva 2014). As a consequence, Browns and Blacks are more likely to have lower income, education, and health levels (Araújo et al. 2010).

In the United States, higher levels of premature mortality, before age 65 years, was also observed among Blacks, in comparison to Whites, over an analysis period of approximately 50 years (1960–2009) (Krieger et al. 2014), and the temporal persistence of racial inequalities produces a racial composition of the elderly population of the country that is preponderantly White (Oliveira-Campos, Cerqueira, and Rodrigues Neto 2011; Krieger et al. 2014; Oliveira, Thomaz, and Silva 2014). A recent study using population-based survey data also indicated that Whites predominated in the elderly population of Brazil and had better socioeconomic and health indicators than those of the Brown and Black elderly population (Oliveira, Thomaz, and Silva 2014).

These racial inequalities also reveal the effects of the most frequent risks to health in the early stages of life, which produce premature deaths (Smedley 2012; Krieger et al. 2014; Oliveira, Thomaz, and Silva 2014). Analyses on the causes of mortality have suggested that deaths during the young and adult phases of life, with high levels of death among

Brown and Black men and women and poor result from violent causes and traffic accidents (Borrell and Hatch 2005; Araújo et al. 2010; Fiorio et al. 2011; Kanso 2014).

The findings of the present study support the interpretation that the death profile and risk between the sexes is dependent on social and health vulnerabilities and is defined by race and specific for each age group and for the place where people live. This can be seen from the facts that Brown and Black men presented premature deaths and mortality curves typical of precarious levels of health, in comparison to women from the same racial group, and that White women had longer survival than White men. Therefore, the expected change in the distribution of deaths from younger age groups to older age groups (Veiga 2002; Oliveira-Campos, Cerqueira, and Rodrigues Neto 2011; Kanso 2014) still has not occurred for the three racial groups of both sexes. The intensity of this phenomenon remains marked by racial inequality at the three levels of urbanity in aggregation to MRs among Brazilian municipalities.

Our findings suggest that the network of interactions between places and health consists of extensive combination of factors. Social and physical properties of the places in which we live affect the health of individuals and populations, and this dwelling place is shaped not only by socioeconomic status but also by race and ethnicity (Telles 2004; Borrell and Hatch 2005; Sharkey 2013). The variables place, race, class, and relations of domination, subordination, and discrimination are associated with the social planning and organizing, economics, and population from places, explaining the fact that the benefits of community life are not shared equally among populations (Ompad et al. 2007; Harpham 2009; Sharkey 2013).

Our study shows that the level of urbanity has the capacity to reveal the influence of the place on the configuration of racial inequalities of health in Brazil. The results indicate that, in rural places, the worst levels of health tend to be shared in a more similar way by individuals, which suggests that there is lower inequality among the groups evaluated. The disjunction of the mortality curves according to skin color/race, in relation to sex, the magnitude of deaths at age ≥65 years, and age-adjusted PMR, increased as the urbanity increased, thus indicating that racial injustices become more serious and levels of health become more precarious in urban spaces. Similar to studies conducted in other countries, the present study revealed that the highest levels of urbanity, in aggregation to MRs, are associated with higher numbers of deaths and higher risks for the non-White groups and that MRs tend to intensify the inequalities that exist at each level of urbanity while maintaining the differences between sexes (Singh and Siahpush 2014).

These findings reflect the contradictory health situation that occurs in urban scenarios. This is characterized by a socioeconomic and epidemiological paradox present in these places, in which there is a lack of advantage to being in an urban or metropolitan context, in relation to health (Ovadia 2003; Borrell and Hatch 2005; Squires and Kubrin 2005; Harpham 2009).

Thus, our results make it possible to comprehend how the level of urbanity and aggregation to MRs of Brazilian municipalities is associated with race in configuring different racial profiles and risk relating to death. They indicate that the variable of skin color/race influences various levels of exposure to different risks over the course of life according to the context within which individuals live. Despite questions regarding the validity and reliability of race as a determinant of health, the evaluation of mortality profiles shows the multidimensional and sociopolitical nature of race and suggests that the public policies

aimed at reducing inequities in social and racial health in the country must be articulated in the physical and social characteristics of cities that reside populaces.

Limitations

A few limitations of this study need to be described. Among them, the undercounting of deaths can produce an underreporting of this event. However, the rate of undercounting has decreased over the past few years and presents increasingly low importance. Another limitation relates to the information furnished on death certificates, among which skin color/race may be neglected. However, studies have indicated that exclusion of deaths for which the certificate does not record a certain attribute is acceptable and can be done without problems when the magnitude of the absent record is infrequent, as observed in 2010. It should still be considered that there are variations across the cities evaluated in coverage and completeness of the information on skin color/race in death certificates included in the MIS of Brazil, as it is well known that there are significant differences in how variables are completed and its consistency across the Brazilian regions. It should be noted that there is heterogeneity within the different territories that make up the city. Individuals of the same racial group do not necessarily share the same socioeconomic and health disadvantages or benefits within the same city; thereby, the calculated mortality indicators represent aggregate measures and level of average exposure within each city.

Finally, the lowest PMR in Browns may arise from the lack of correspondence between the records of death and population by skin color/race, generating the numerator–denominator bias and the passage of Brown to White category during the race of death classification or the population that diluted racial inequalities in health among Browns and focused on Whites.

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Key messages

(1) The proportional mortality age curves for skin color/race revealed in all levels of urbanity and the aggregate to the MR evaluated worst relative structure deaths to Browns and Blacks compared to Whites in both sexes, but with differences according to the age of life cycle, and that Browns and Blacks die more prematurely, whereas the death of Whites is more frequent in the elderly phase of life.
(2) The analysis of the age-adjusted PMR indicated a distinct risk of death by skin color/race according to gender and specific level of urbanity and aggregation to an MR of

Brazilian cities. The highest rates were observed in cities considered urban in all racial groups of both sexes. Blacks had the worst rates, with excess mortality of Black men compared to Black women.

(3) Inequalities in mortality measures reflect the interaction of the race with the place where you live. This interaction appears to model the death experience to the structure an unequal exposure to risk and protection factors among Brazilian racial groups within the different contexts of the study.

(4) The study presents the ability level of urbanity and aggregation to an MR in revealing the influence of place on setting racial inequalities in health in Brazil. The level of urbanity not only represents an important dimension of stratification but also may serve as an important pathway by which the economic circumstances, social organization, sanitary infrastructure, health services, and cultural norms and practices seem to contribute to the racial inequalities in the structure of mortality. This contextual unit can be used to monitor the inequalities across the different Brazilians cities.

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