

**ZERO SUM GAME: THE UPS AND DOWNS OF VIOLENT
DEATHS IN BRAZIL – THE NORTHEAST AND THE
SOUTHEAST**

**Kaizô Iwakami Beltrão
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CONTENTS

Abstract	v
Resumo.....	vi
Bio.....	vii
Introduction.....	8
Data and Methodology	13
Results.....	15
External-cause rates for the Brazilian population	15
External causes among young adults: 15 to 24 years.....	23
External causes among young adult males.....	27
Conclusions	31
References.....	34
ANNEX.....	37

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ZERO SUM GAME: THE UPS AND DOWNS OF VIOLENT DEATHS IN BRAZIL – THE NORTHEAST AND THE SOUTHEAST

KAIZÔ I BELTRÃO
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Abstract

This text focuses on the analysis of mortality rates by external causes in Brazil. The analysis covers mortality data from slightly over three decades, from 1979 to 2012, further disaggregating the information by sex and regions. Brazil's 27 states are analytically divided by the Central Statistical Office, IBGE, in five homogeneous Great Regions. For the sake of comparison, besides the crude death rate for the population as a whole, similar statistics are computed for the male population and for the young adult male population – those between 15 and 24 years of age, the group more affected by external causes in general and homicides/assault in particular. Recent years showed that some short lived downward trends were just part of oscillations around a plateau. This plateau was the result of opposing trends among the several regions/states in Brazil. To further enhance the comprehension of the process at a lower ecological unit, we focused on two regions: the Southeast and the Northeast, the two most populated regions in Brazil. The Southeast of Brazil presented the sharpest drop in mortality rates by external causes and homicides/assault. On the other hand, the Northeast presented the largest increase. The analysis is then replicated for all states in the regions. Within each region, states do not show a homogeneous pattern, either.

Keywords: Crude Mortality Rate; Brazil; States; External causes; Homicides/assaults; Young adults males.

Resumo

Este texto analisa as taxas de mortalidade por causas externas no Brasil. A análise inclui a informação de mortalidade de um pouco mais de três décadas, de 1979 a 2012, desagregando os dados por sexo e grande região. Para possibilitar a análise comparativa, as taxas brutas de mortalidade são calculadas também para a população masculina e para adultos jovens do sexo masculino – aqueles entre 15 e 24 anos de idade, o grupo mais afetado por causas externas em geral e por homicídios/agressões em particular. O passado recente mostrou que a aparente queda nas taxas era somente parte de oscilações em torno de um platô. Este platô era o resultado de tendências opostas entre as diferentes regiões/estados do Brasil. Para uma melhor compreensão do processo a uma unidade ecológica mais fina, focalizamos em duas regiões: o Sudeste e o Nordeste, as duas regiões mais populosas do Brasil. O Sudeste apresentou a mais notável queda nas taxas de mortalidade por causas externas e homicídios/agressões. Pelo contrário, o Nordeste apresentou o maior incremento. A análise é replicada para todas as UF nestas regiões. Dentro de cada região, os estados tampouco apresentam um padrão homogêneo.

Palavras chaves: Taxa bruta de mortalidade; Brasil; Estados; Causas externas; Homicídios/agressões; Homens jovens.

Bio

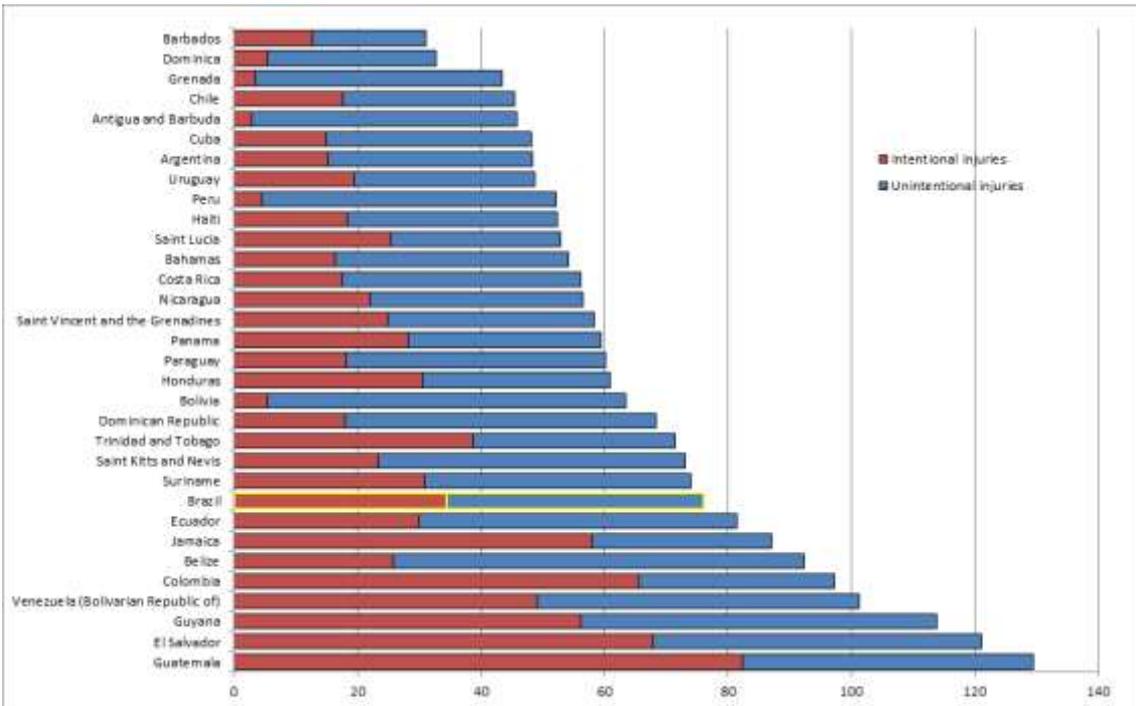
KAIZÔ I. BELTRÃO holds a B. S. Degree in Mechanical Engineering from the Technological Aeronautical Institute (ITA/MAer), a M.Sc. Degree in Applied Math from the Pure and Applied Math Institute (IMPA/CNPq) and a Ph.D. in Statistics from Princeton University. He is presently a Researcher at the Brazilian School of Public and Private Administration/ Getulio Vargas Foundation.

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Introduction

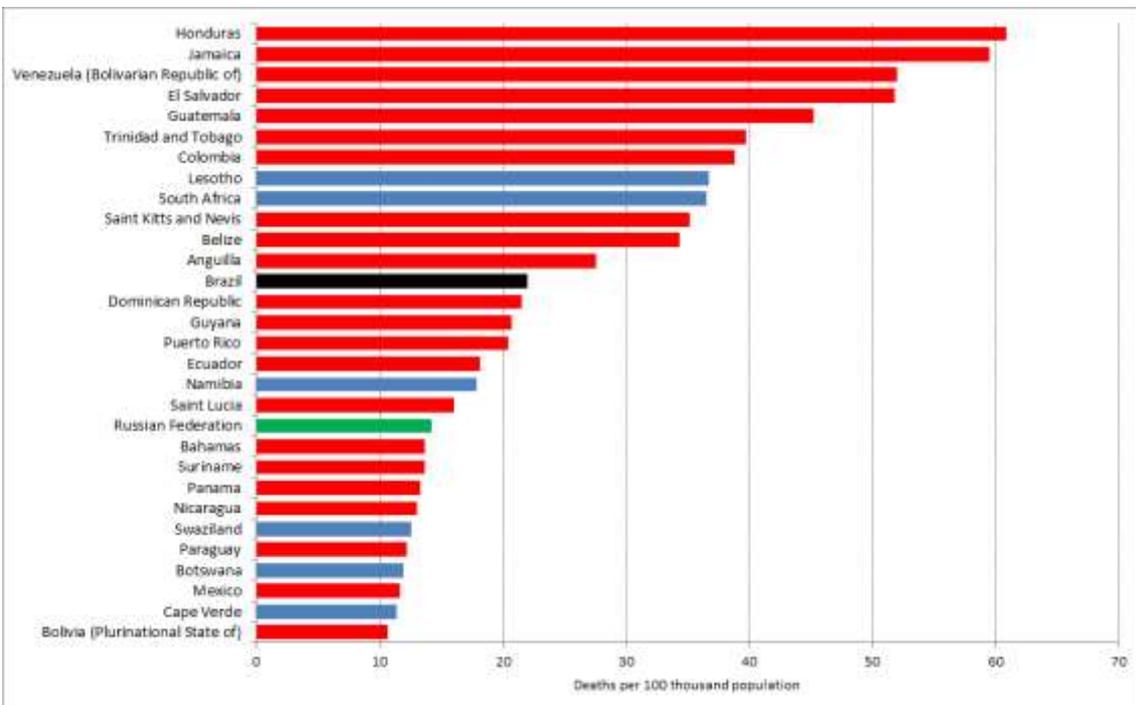
Several statistics referring to the beginning of the first decade of the century indicated a drop in violent deaths in specific areas of Brazil and for the country as a whole: years of life lost (Beltrão and Dellasoppa, 2011a, 2011b), age-specific mortality rates from health registers (Brasil, 2006), intentional violent crime registers (Brasil, 2007), young adult violent deaths (Ferreira, 2005; Waiselfisz, 2011) among others. Some authors included Brazil as part of an international decline in crime rates (see Tseloni et al, 2010). Nonetheless, subsequent years showed that this short lived downward trend was just part of what is now perceived as oscillations around a plateau ending in an upward trend. The plateau for crude mortality rate by external causes for Brazil, of both sexes combined, was around 72.3 deaths per one hundred thousand population (between 1996 and 2012, see Figure 4), while for young adults it increases by one third to 98.8 (between 2001 and 2011) with a steep increase in 2012 to 106.9. For young adult males it increases 80% to 176.5 (roughly the same period, see Figure 7). The latest information, that of 2012, reinforced the impression of an upward trend at the end of the oscillations, reaching, respectively, rates of 78.3, 106.9 and 191.6 for the population as a whole, young adults and young adult males.

It is worth noting, though, that these recent figures place Brazil in the upper third bracket with respect to mortality by external causes among all countries in Latin America (see Figure 1). When considering solely intentional injuries, Brazil is also in the upper third of the rank. On the other hand, homicides/assault, a sub-group of intentional injuries, places Brazil in 11th position in the Americas and 13th in the World (see Figure 2).



Source: WHO, 2011

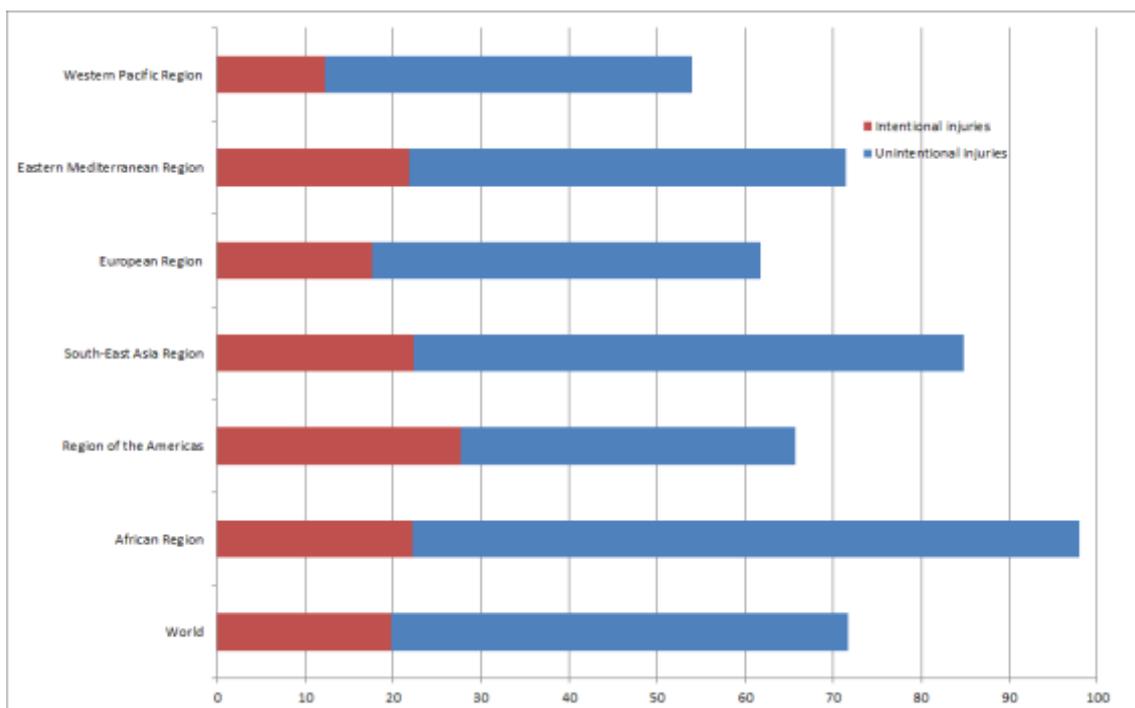
Figure 1. Death rates by injuries broken down by intentionality, countries in Latin America and the Caribbean -2008



SOURCE: UNODC, 2011

Figure 2. Homicide statistics, Criminal Justice sources, latest available year, 2003-2008

The Americas have the highest death rate by intentional injuries among the world regions (see Figure 3). This situation is somehow counterbalanced by deaths by unintentional injuries, for which the Americas present the lowest rate among World regions.



Source: WHO, 2013

Figure 3. Death rates by injuries broken down by intentionality, World regions - 2008

In Brazil, crude mortality rates for the country as a whole have remained basically stable since 1995 (external causes around 72.3 per 100 thousand) or 1998 (homicide/assault around 27.0), ending in an upswing that could or not lead to a steady increase. These plateaus were the result of opposing trends among the several regions/states in Brazil, some showing sharp decreases counterbalanced by sharp increases in other regions/states. As already shown in the literature the ecological unit considered exerts a strong influence on the level and pattern of the variable analyzed (Van Wilsen, 2004). The continental size of the country, more than 3 million square miles, may explain the lack of homogeneous behavior with respect to

cultural and sociopolitical issues. Though these figures for Brazil are high for international standards, as already seen (see Figures 1 and 2), they are smaller than those of several other countries in Latin America, the most violent region in the World.

All these curtailed lives result in huge human, social and economic costs. To better understand the importance and historical variations of these deaths, this text focuses on the analysis of external-cause rates in an extended period, over three decades: 1979/2012 (the latest available information). Data on homicides/assault in Brazil and its regions have already been treated in Beltrão & Dellasoppa (2014).

At a comparative level, it must be noted that there are profound and nontransferable cultural differences among countries, which are synergic to the evolution of these processes: urban ecologies, lifestyles of young adults at risk, social, cultural and economic factors (like macro-level changes in capital investment, distressed communities with residential segregation, racial inequalities and concentration of poverty) and the perception of these inequalities, the access to goods and services (like sneakers, cellphones, internet and social nets) and changes in the economics and trends of the use of illegal drugs. Another influence is the ever changing geographical distribution and power relationships among the organizations dealing with production and distribution of illegal drugs (Moeller and Hesse, 2013). Often, the borderline between deaths caused by wars/guerrillas and homicide is not clear (Souza et al., 2012). All these differences must be taken into account when comparing Brazil patterns with those of other countries.

Common sense links improvement on social indicators to a decline in violence in general and of external causes in particular (or, the inverse situation: worsening of social indicators implying more violence). In the case of Brazil, one can observe an increase in external-cause

rates during the 80s, the so called lost decade, because of economic stagnation. On the other hand, a new pattern begins at the end of the last century, with moderate economic growth and stable crude mortality rates by external causes. Diversely, in this century, homicide rates have been increasing in several Latin American countries in a context of dynamic growth and improvement in social indicators (PNUD, 2013).

This text will deal specifically with deaths by external causes in Brazil. It intends to identify trends and patterns for different ecological units, which may prove useful for future international comparative studies. Specifically, states in the Southeast and in the Northeast are considered: the two extreme cases of increase and decrease trends of death rates. To evaluate the importance of deaths by external causes in the country, we note that in 2012, “External causes” were the third most important Chapter in the International Classification of Diseases, ICD-10¹, following “Diseases of the circulatory system” and “Neoplasms”. External causes represented 12.9% of all deaths. Intentional injuries represented 44.3% of all external causes. The situation was even more concentrated for young adults with corresponding figures of 74.6% (as the most important Chapter) and 66.2%. For young adult males, figures were even higher, respectively, 81.9% and 68.9%.

The present text comprises four sections: Introduction, Data and Methodology, Results, and Conclusions. The section on Results is further disaggregated into sub-sections dealing with the population as a whole, young adults and young adult males. To have an idea of the under-registration correction impact on mortality rates and their evolution, an Annex displays the correction factors over time for Brazil, Regions and states of the Northeast and Southeast

¹ The ICD is a classification system of morbidity and death causes coordinated by the WHO. It’s periodically revised. It underwent a revision in 1994, ICD-10, adopted by Brazil from 1996 on (Brasil 2010a and 2010b).

regions. The impact on the evolution of mortality rates for selected states (Pernambuco, Espírito Santo and Bahia) is also displayed.

Data and Methodology

Age-specific mortality rates are calculated as the ratio of registered deaths and the population at risk. In Brazil there are two alternative sources for registered deaths: the Civil Registry from the “Instituto Brasileiro de Geografia e Estatística” - IBGE² (2014) and the vital statistics³ from the Brazilian Ministry of Health (Brasil, 2014). Both sources use death certificates as a starting point, but the Civil Registry collects them from the vital registration systems operated at the various local jurisdictions and the Ministry of Health collects them from the Health Department of each Brazilian state. This text uses data from the Ministry of Health with external causes further disaggregated as external causes homicides/assaults and other external causes classified according to the ICD, while the IBGE uses solely a dichotomous classification of “violent/non-violent.”

From the beginning of the mortality statistics collecting system in 1979 up to 1996, the Ministry of Health system used ICD-9 to classify causes of death and in the remaining years, ICD-10. The equivalence between classifications was done following the Pan-American Health Organization recommendations (PAHO, 1999). Disaggregated data by homicide/assault does not exhibit a discontinuity with the changes introduced by the 10th Revision. The same happens for other broad groups of causes (see Beltrão and Dellasoppa, 2011a, 2011b) like external causes and intentional injuries which are under study in this text. For non-census years, population at risk is estimated by linear interpolation of data by sex

² Brazilian Central Statistical Office.

³ SIM: Sistema de Informações sobre Mortalidade (Mortality Information System), Available at www2.datasus.gov.br/DATASUS/index.php?area=0205.

and age groups counted in census years (IBGE 1982, 1996, 2001, 2011). It must be noted that the analysis of the years previous to 1979 is unfeasible since data collection by the Ministry of Health system only started this year.

Ministry of Health data have some quality drawbacks: i) incomplete death coverage; ii) possible misclassification of causes of death as well as the fact that “Deaths due to signs, symptoms and ill-defined conditions are presented in a separate category...” (PAHO, 1999); and iii) the presence of registers with unknown age and/or sex. Due corrections for all these situations as described in Beltrão and Dellasoppa (2011a, 2011b) are used in the present text. No correction was performed to adjust for the first shortcoming. Assuming that death coverage has been changing smoothly (no drastic changes occurred in the period, neither on regulation, nor by public campaigns), the impact would be of an increasing trend. The annex shows correction factors for all regions and for the states of the Northeast and Southeast regions, as well as the impact of the correction factors on mortality rates of selected states. It is worth noting that some states showed no undercoverage⁴. For the disaggregation used in this text, an upper limit⁵ for the second shortcoming was estimated using information contained in Mello Jorge et al. (2002a, 2002b). Beltrão and Dellasoppa (2011a, 2011b), analyzing information up to 2010, verified that completeness of age and sex information on death registers was, with almost no exception among the Great Regions⁶ and states, higher

⁴ Estimates for the state of São Paulo indicated full coverage for 1991, 2000 and 2010. For 1980, coverage was 99/98% (respectively for males and females).

⁵ There is some regional discrepancy with a greater proportion of ill-defined causes of death in the North and Northeast, but not enough to jeopardize our analysis.

⁶ Brazil's 27 states are divided into 5 allegedly homogeneous regions denominated Grandes Regiões (Great Regions), namely: North (with the states of Rondônia, Acre, Amazonas, Roraima, Pará, Amapá and Tocantins), Northeast (Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahia), Southeast (Minas Gerais, Espírito Santo, Rio de Janeiro and São Paulo), South (Paraná, Santa Catarina and Rio Grande do Sul) and Midwest (Mato Grosso do Sul, Mato Grosso, Goiás and the Federal District).

than 98%. This figure is 96% for deaths by “External causes” and 95% for deaths by homicide. Following the procedure defined in Beltrão and Dellasoppa (2011a, 2011b) deaths with unknown sex and age were proportionally distributed, in that order, according to the known distribution. Proportional mortality by ill-defined causes, while ICD-9 was under use, fluctuates around 6%. With the implementation of ICD-10 in 1996, there was a slight increase in these proportions, up to around 7%.

Crude mortality rates by external causes for each sex were estimated for the years between 1979 and 2012, both for all age groups and for the young adult population (between 15 and 24 years of age). Similar statistics were also calculated for both sexes combined. Dealing with each sex separately helps to control possible errors (statistics for young adult females not shown in the text). Besides the estimates for the country as a whole, separate estimates were computed for each Great Region and, separately, for all the states in the Northeast and Southeast regions. It is worth noting that, because of the relative population size, estimates for Brazil as a whole are less volatile than those for Great Regions, which in turn are less volatile than those for individual states.

Results

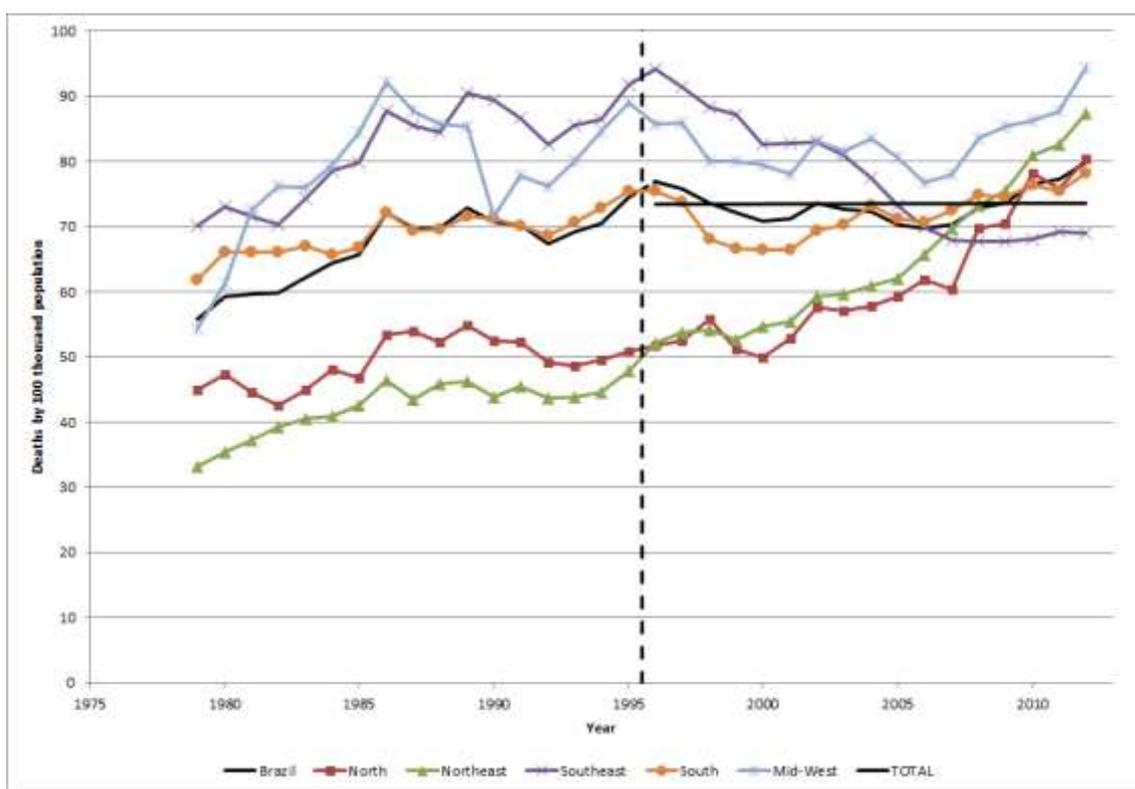
External-cause rates for the Brazilian population

To observe the recent stabilization at such high levels in context, it is adequate to weigh this stabilization against the evolution in a more extended period for which mortality information by cause is available: 1979/2012. Crude mortality rates by external causes (deaths per 100 thousand population) for Brazil as a whole and its Great Regions between 1979 and 2012 are displayed in Figure 4. Figure 5 displays the corresponding index rates with 1979 equal to 1. For Brazil as a whole (black line), the rate exhibited an upward trend (with oscillations)

from 1979 to 1995, followed by fluctuating but stable high rates between 1995 and 2012⁷. Between 1995 and 2012, one could consider that values are oscillating around 72.3 deaths per one hundred thousand⁸. Aggregated results can be misleading: different regions do not have to evolve in tandem. When considering Brazil's Great Regions, the situation is more complex, without common trends: the mortality rate by external causes in the Southeast Region (violet line) increases from 1979 up to 1996 when it reaches its maximum value, then drops until 2007, when rates stabilize around 68.3 deaths per 100 thousand, a figure very close to the value at the beginning. All other regions show an upward trend with heterogeneous oscillations from 1979 on, reaching, in all of the Great Regions, values larger than that of the Southeast: North (80.4), Northeast (87.5), South (78.1) and Midwest (94.4). Changes are of different magnitude among the regions. The increase in the other regions was proportionally higher than the decrease in the Southeast, but because of the much larger population of the Southeast the final result for Brazil is the relative stability of the national mortality rate by external causes observed since 1996. The population in the Southeast encompassed 43.5% of the total population in 1979. This proportion has been somewhat stable over time with figures of 42.0% in 2012.

⁷ In this text we are not taking into account the under-registration of external causes. For an evaluation of the effect of death coverage by state in Brazil, see the Annex and also Beltrão and Dellasoppa (2011a). The correction for under-registration in the case of a group of death causes is also affected by the proportion of ill-defined deaths in the population. The proportion of both under-registration and ill-defined deaths have been diminishing with time, although they impact external-cause rates in opposite directions. Rates were calculated as the ratio of registered deaths (Brasil, 2014) and the exposed population, interpolated from Census data (IBGE, 1982, 1996, 2001 and 2011). The population for the years after the latest Census was extrapolated under an exponential hypothesis.

⁸ This is not simply a statistical fluctuation. Given the size of the Brazilian population (around 2 hundred million), the confidence interval is far beyond the one digit precision used in this text.



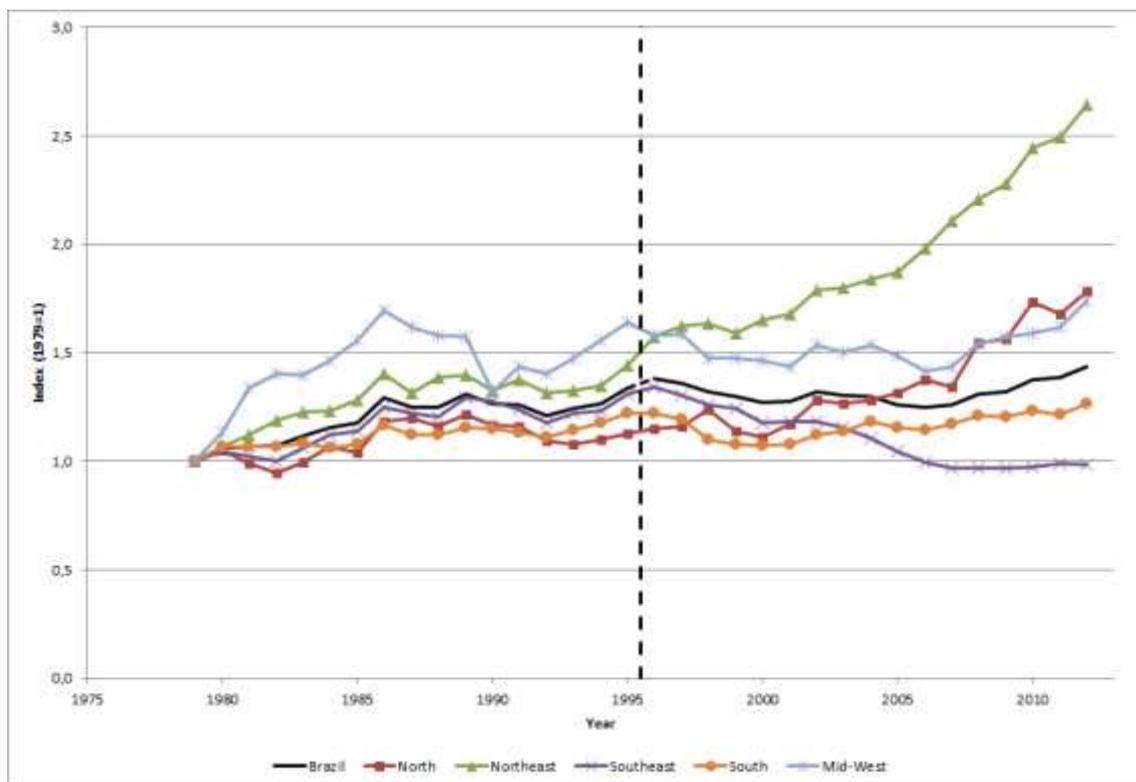
Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 4 – Cause-specific mortality rate by external causes, Brazil and Great Regions, 1979-2012

Figure 5 displays the evolution of the external-cause index for Brazil and its Great Regions considering the index value in 1979 equal to 1. The most striking feature is a large increase of the crude mortality rates by external causes in the period: Brazil's rate increased by almost 40% in the first 17 years. Rates are roughly stable from 1996 on, with a possible upswing in the last two years. The five regions present a rather homogeneous upward behavior until the year 1996, when three different trends develop. The Northeast presents the highest increase among all Great regions: slightly more than 150%. The Midwest follows the national stabilization closely but at a higher level up to 2006 when a steady increase appears, reaching a value roughly 74.0% larger than in 1979. The Northeast presents the largest increase: 164.2%. The North region exhibits another important increase up to 2012, 78.5%. The South

shows a modest increase of 26.4%. On the other hand, the Southeast which had increased 34.4% until 1996, shows a decline from then on, reaching a net decrease (compared to 1979) of 3% in 2007 and stabilizing from then on.

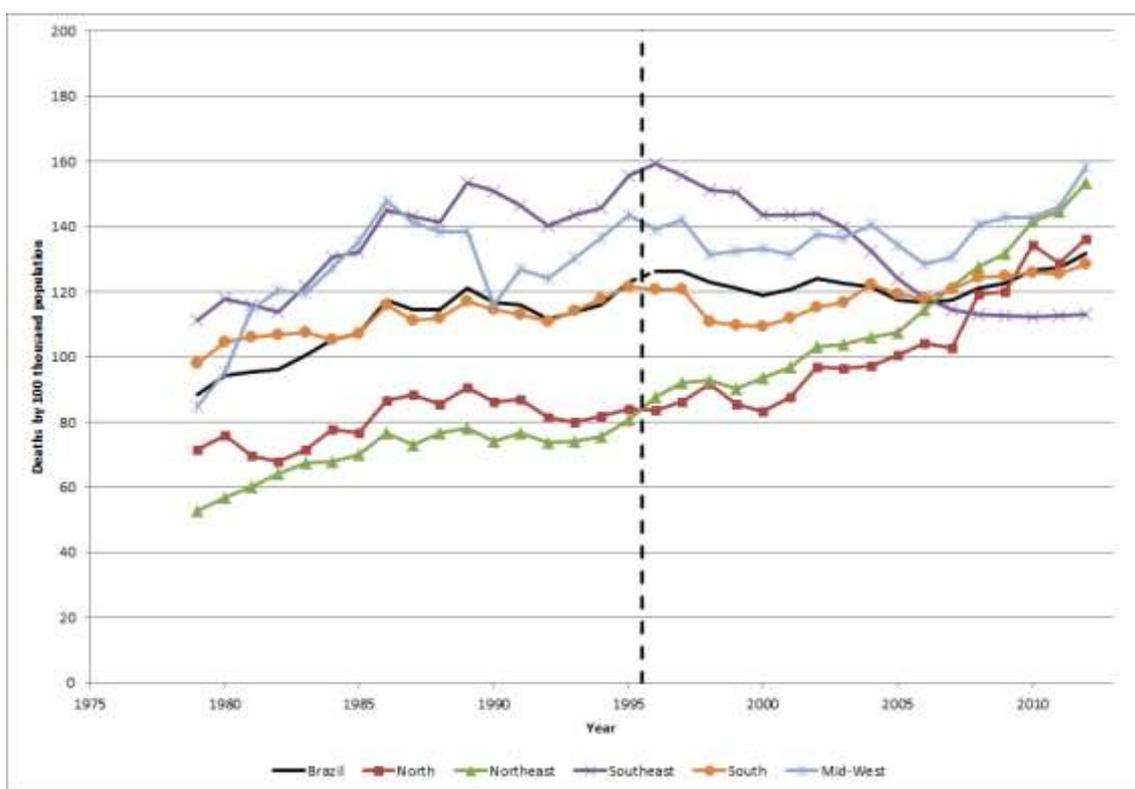


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 5 – Cause-specific mortality rate by external causes. Index (1979=1), Brazil and Great Regions, 1979-2012

Crude mortality rates by external causes (deaths per 100 thousand population) of the male population for Brazil as a whole and its Great Regions between 1979 and 2012 are displayed in Figure 6. Patterns are similar to those observed for the population as a whole (Figure 4), but slightly less dispersed with higher values (62.4% higher in 2012 for Brazil): for Brazil, an upward trend up to 1997, followed by stable rates up to 2012, with a possible upswing at the end; and no common trends for the Regions, with the Southeast standing out with a decrease after 1996 and reaching levels similar to the beginning in 2012.

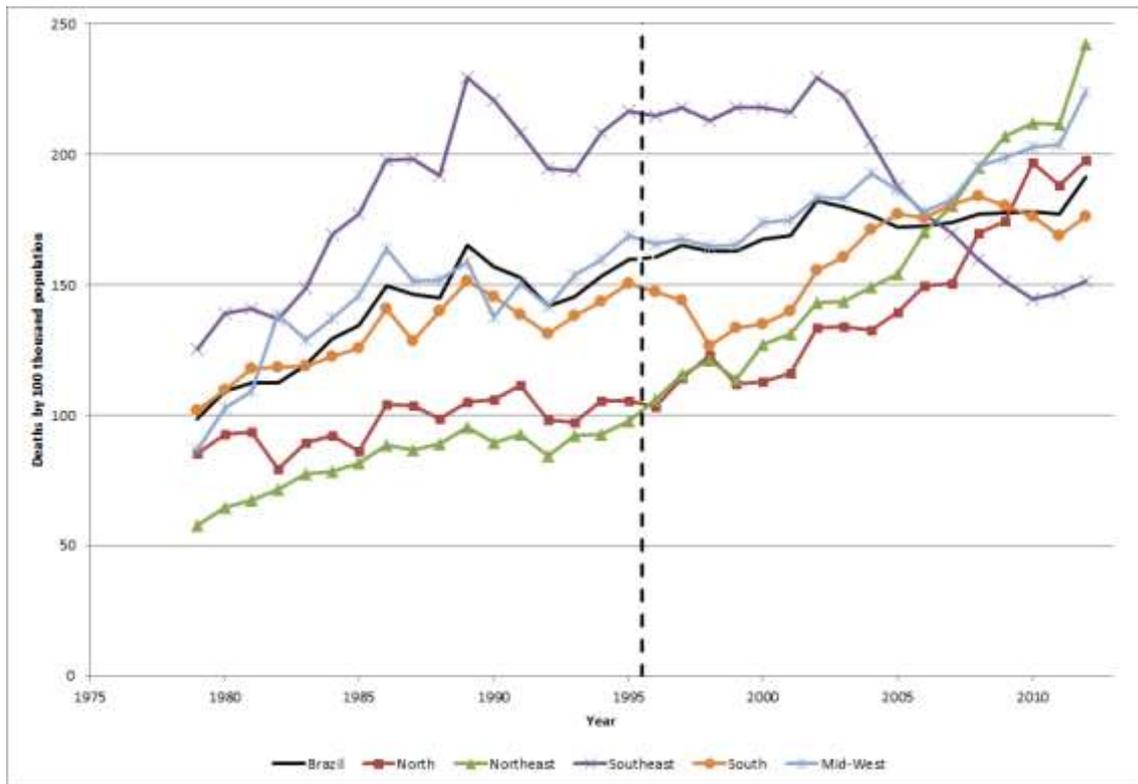


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 6 – Cause-specific mortality rate by external causes, Males, Brazil and Great Regions, 1979-2012

Crude mortality rates by external causes (deaths per 100 thousand population) of the young adult male population for Brazil as a whole and its Great Regions between 1979 and 2012 are displayed in Figure 7. Patterns are similar to those observed for the male population (Figure 6), but with higher values (50.5% higher in 2012 for Brazil), with the exception of the Southeast: for Brazil, an upward trend up to 2002, followed by stable rates up to 2012, with a possible upswing at the end. The Southeast displays a strong upward trend up to 1987, followed by a plateau up to 2002, and a steep decrease but falling short, in 2012, of the initial level by 20.1%.



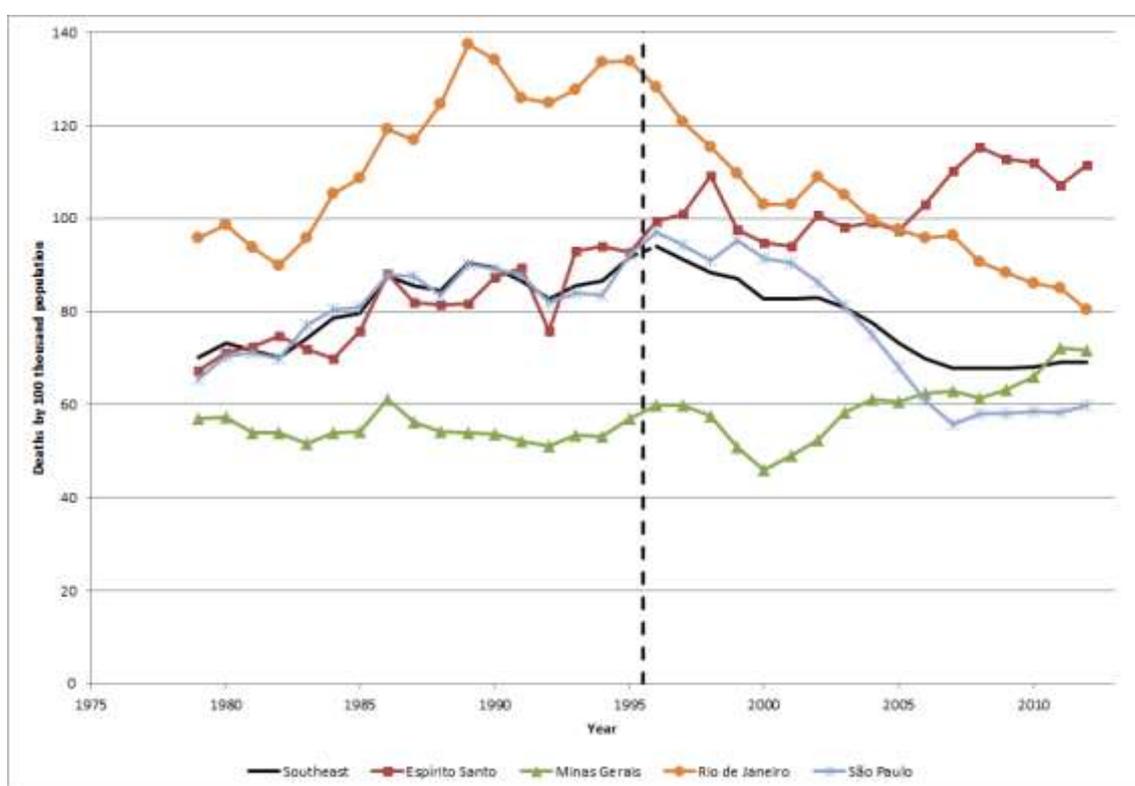
Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 7 – Cause-specific mortality rate by external causes. Young adult Males (15-24), Brazil and Great Regions, 1979-2012

Figure 8 shows crude mortality rates by external causes (deaths per 100 thousand population) for the Southeast Region and its states between 1979 and 2012. In the Southeast also, the decline (1996-2007) and the subsequent stabilization (2007-2012) is the compound result of individual state behaviors. Similar to what happened to the country as a whole, one can observe contradictory trends among these states, some even with net increases. The downward trend in the state of Rio de Janeiro was the first one to occur. It begins in 1989, with a temporary reversal between 1992 and 1995, then continuing the decline up to 2012, when the external-cause rate for the state is 16.4% higher than the regional rate. The mortality rate by external causes for São Paulo increases up to 1996, then decreases to reach a plateau between 2007 and 2012, with the lowest state value for the region, about 14%

below the regional rate. The other two states, Minas Gerais and Espírito Santo present different behaviors: Minas Gerais displays, among the states of the region, the largest stable period, from the first year of data collection up to 1998, followed by a drop to 2000 and an increase up to 2012 (with rates one fourth larger than the initial values). On the other hand, Espírito Santo, which presented in 1979 a rate very close to that of the Southeast, experienced a very large increase, with values oscillating around 110 deaths per 100 thousand population by the end of the period.



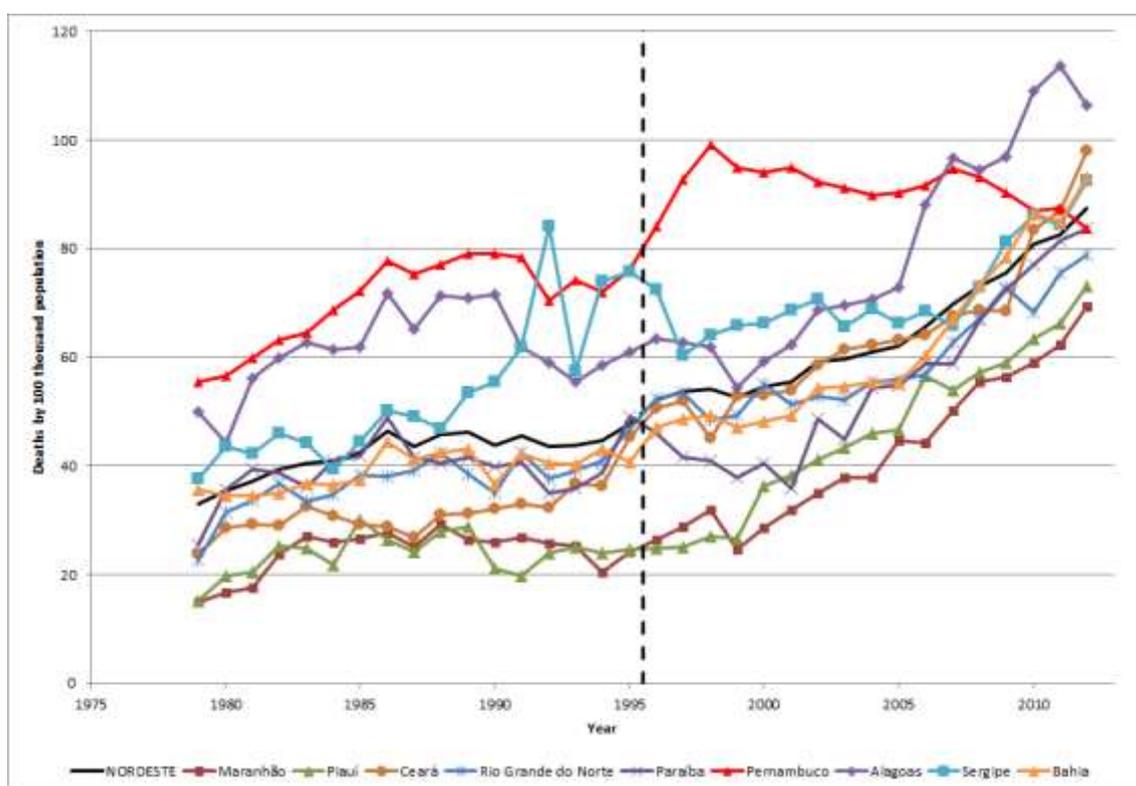
Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 8 – Cause-specific mortality rate by external causes, Southeast Region and corresponding states, 1979-2012

Figure 9 shows crude mortality rates by external causes (deaths per 100 thousand population) for the Northeast Region and its states between 1979 and 2012. In the Northeast also, the steady increase between 1979 and 2012 is the compound result of individual state behaviors.

Total increase in the period amounted to 164%. States in the lower range at the beginning of the period (e.g. Ceará and Bahia) show a steeper slope, reaching, at the end of the period, states (Pernambuco and Alagoas) that started already in the higher bracket. It is worth mentioning that Pernambuco, though starting with the highest rate, reaches a plateau in 1997 which lasted 10 years and then starts a descent, ending with a value below that of the region. On the other hand, Alagoas, which started with rates similar to that of Pernambuco, is slow to pick up speed, but after 1999 starts a steep increase, reaching the highest rate among all the states in the Northeast, in 2012.



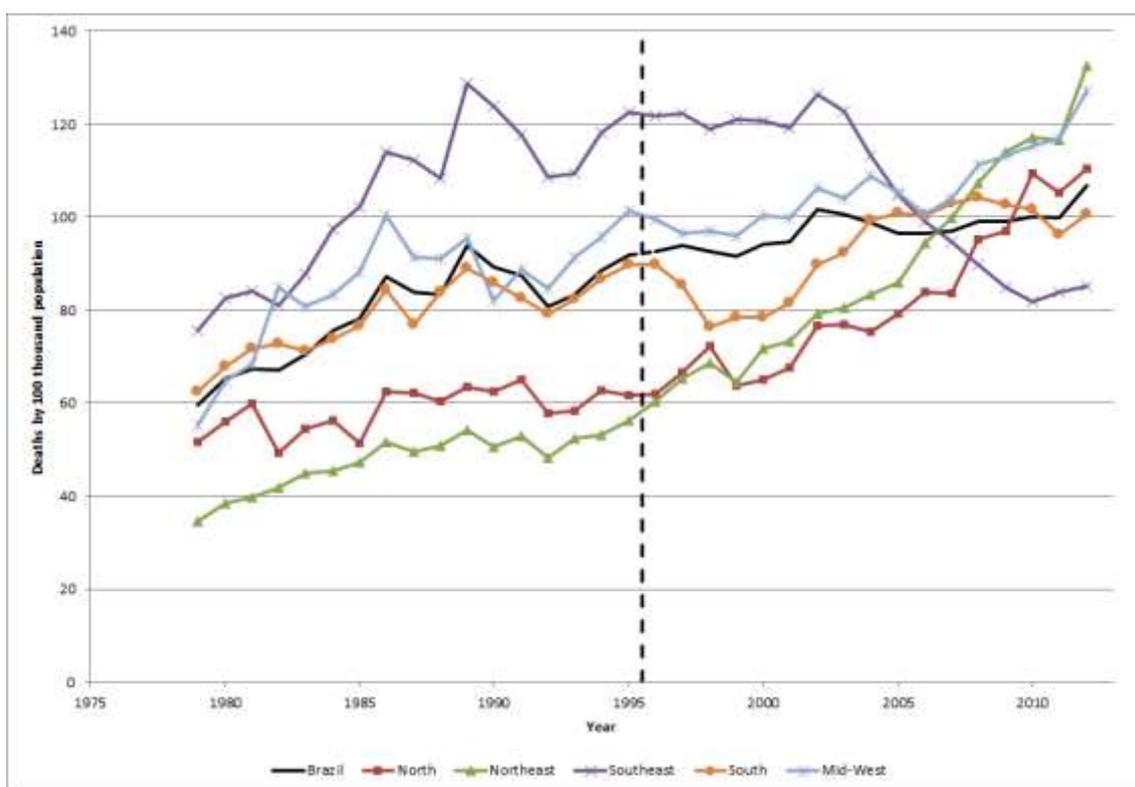
Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 9 – Cause-specific mortality rate by external causes, Northeast Region and corresponding states, 1979-2012

External causes among young adults: 15 to 24 years

In Brazil, as in most Latin America countries (PNUD, 2013), young adults are the most affected by intentional injuries, both as perpetrators as well as victims. External causes in general present a similar situation. Young adult deaths represent around a fourth of all external causes during the period under analysis. Figure 10 shows the cause-specific mortality rate by external causes of young adults for Brazil as a whole and Great Regions from 1979 to 2012. Figure 11 shows the corresponding index with 1979=1. For Brazil and regions, patterns for young adults are quite similar to those observed for all ages, but encompassing a larger dynamic range and much higher values for the rates. It is also worth mentioning the presence of a plateau for the Southeast between 1989 and 2003. In the last stretch, between 2002 and 2012, while rates for Brazil remain almost stable (since 2002), trends for each region follow different patterns, similar to those observed for the total population: the Southeast presents a strong declining trend with an upswing at the end, against strong increasing trends for the Northeast, North and Midwest regions. The plateau starting in 2005 for the South may be interpreted as a 6-year belated result with respect to the Southeast.

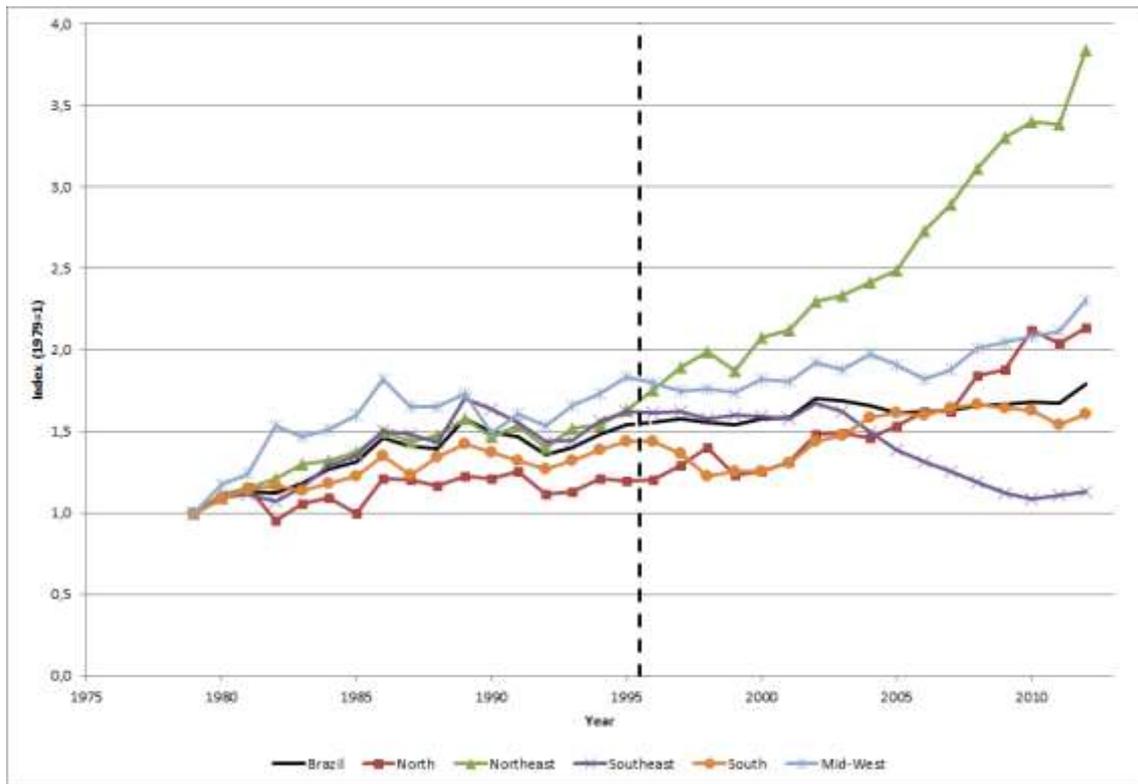


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 10 – Cause-specific mortality rate by external causes of Young adults (15-24), Brazil and Great Regions, 1979-2012

Figure 11 displays the evolution of the external causes index for Brazil and its Great Regions considering the index value in 1979 equals 1 and the population of young adults. In Figure 11, the most striking features are the increase for the Northeast (almost fourfold) and the plateau followed by a decrease in the Southeast. Brazil's rate stabilizes at a level 70% higher than in 1979. The ratio between mortality rates for the young adults in the last and the first year is larger, for all Great Regions, than the one observed for all ages (see Figure 4): North (2.1), Northeast (3.8), Southeast (1.1), South (1.6) and Midwest (2.3).

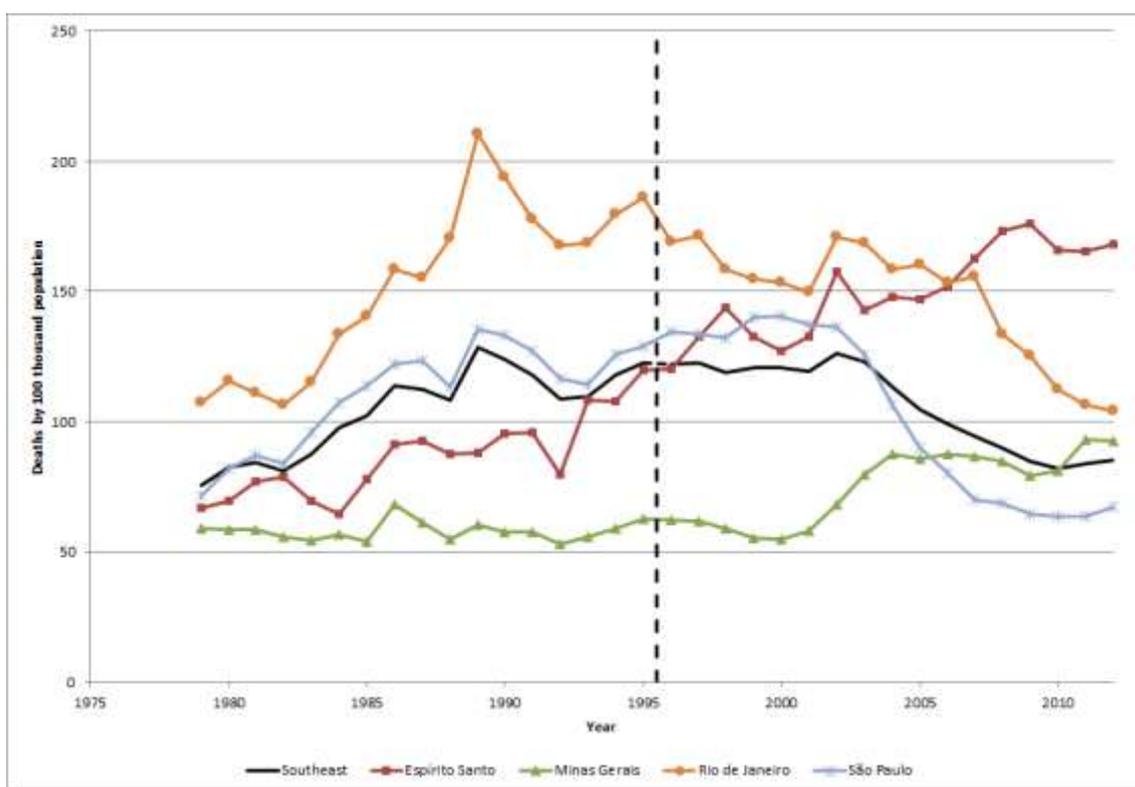


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 11 – Cause-specific mortality rate by external causes of Young adults (15-24), Index (1979=1), Brazil and Great Regions, 1979-2012

Figure 12 shows the same information as Figure 10 but for the Southeast region and the corresponding states. Again, one observes a similar pattern at higher values than those observed for all ages (Figure 8). The plateaus for the Southeast region and for the state of São Paulo are mirrored at slightly higher values. The decreasing trend for Rio de Janeiro State starts also in 1989. Espírito Santo rates present an increasing trend up to 2009, reaching 176.2 deaths per 100 thousand, a 150% increase from 1979. Minas Gerais shows a more stable plateau until 2000 followed by an increase up to 2004 to another plateau.

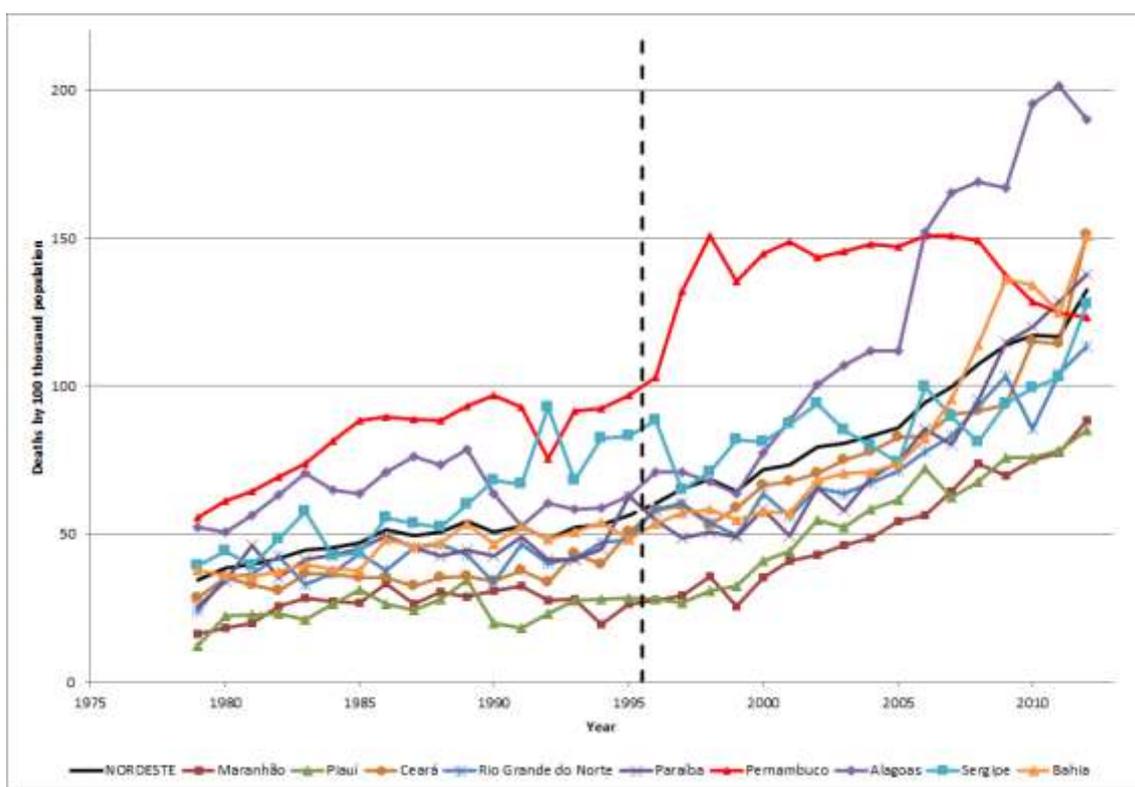


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 12 – Cause-specific mortality rate by external causes of Young adults (15-24), Southeast Region and corresponding states, 1979-2012

Figure 13 shows the same information as the previous one but for the Northeast region and the corresponding states. Again, one observes a similar pattern at higher values than those observed for all ages (Figure 9). Total increase in the period amounted to 284%. For young adults also, states in the lower range at the beginning of the period (e.g. Ceará and Bahia) show a steeper slope, reaching levels similar to those presented by states which already started in the higher bracket (Pernambuco and Alagoas). For this population age-bracket also, Alagoas surpasses Pernambuco after 2006.



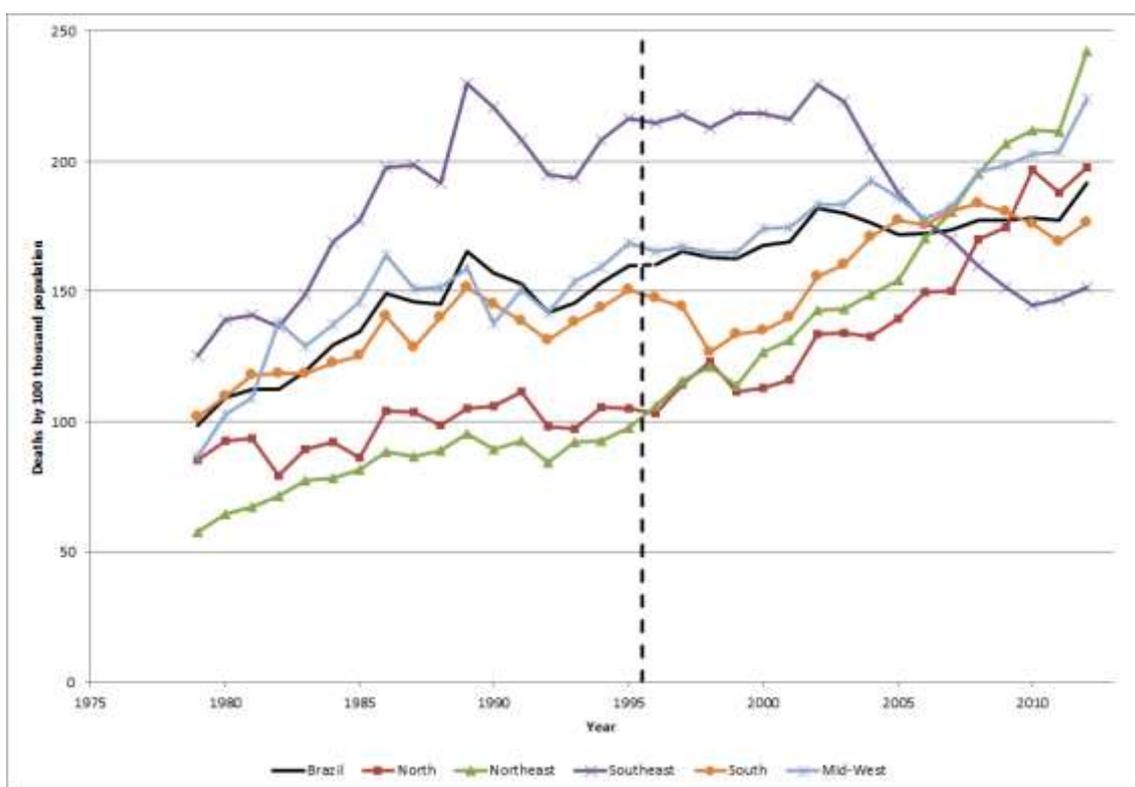
Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 13 – Cause-specific mortality rate by external causes of Young adults (15-24), Northeast Region and corresponding states, 1979-2012

External causes among young adult males

Young adult males present the highest mortality rate by external causes among all combinations of age groups and sex. Figure 14 shows cause-specific mortality rate by external causes of young adult males (15-24) for Brazil and Great Regions in the 1979-2012 period, and the plateau since 2003 with a level three-fourths larger than the value observed for both sexes combined: 177 deaths per 100 thousand. For this group, the plateau is also the result of divergent trends, though similar to the ones observed for the population as a whole: decreasing for the Southeast, increasing for the North, Northeast and Midwest and a plateau for the South. For young adult males this result for the South could also be interpreted as a belated plateau with respect to the Southeast.

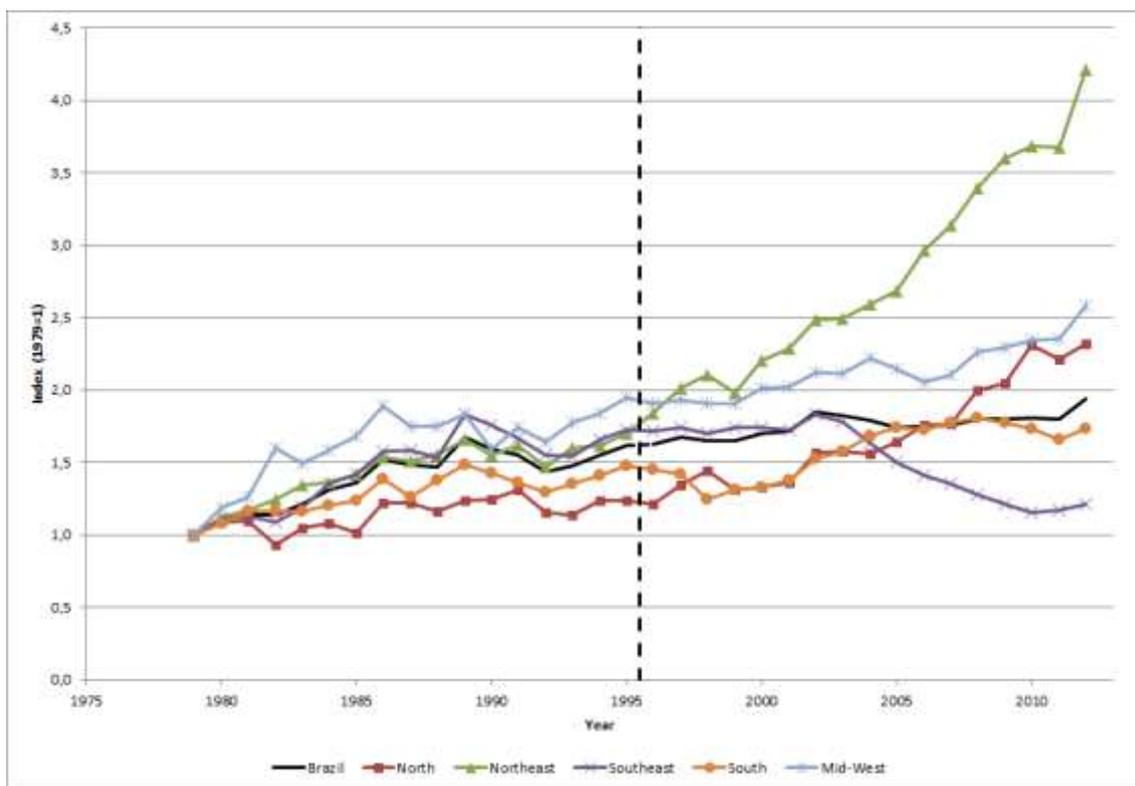


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 14 – Cause-specific mortality rate by external causes of Young adult males (15-24), Brazil and Great Regions, 1979-2012

Figure 15 displays the evolution of the external-cause index for Brazil and its Great Regions considering the index value in 1979 equals 1 and the population of young adult males. In Figure 15, similarly to what was seen in Figure 11 (Young adult population), striking features are the increase for the Northeast (more than fourfold) and the plateau (roughly between 1989 and 2003) followed by a decrease in the Southeast. Brazil's rate stabilizes at a level 80% larger than in 1979. The ratio between mortality rates for the young adults in the last and the first year is even larger, for all Great Regions, than those observed for all ages (see Figure 4) and for young adults (see Figure 11): North (2.3), Northeast (4.2), Southeast (1.2), South (1.7) and Midwest (2.6).

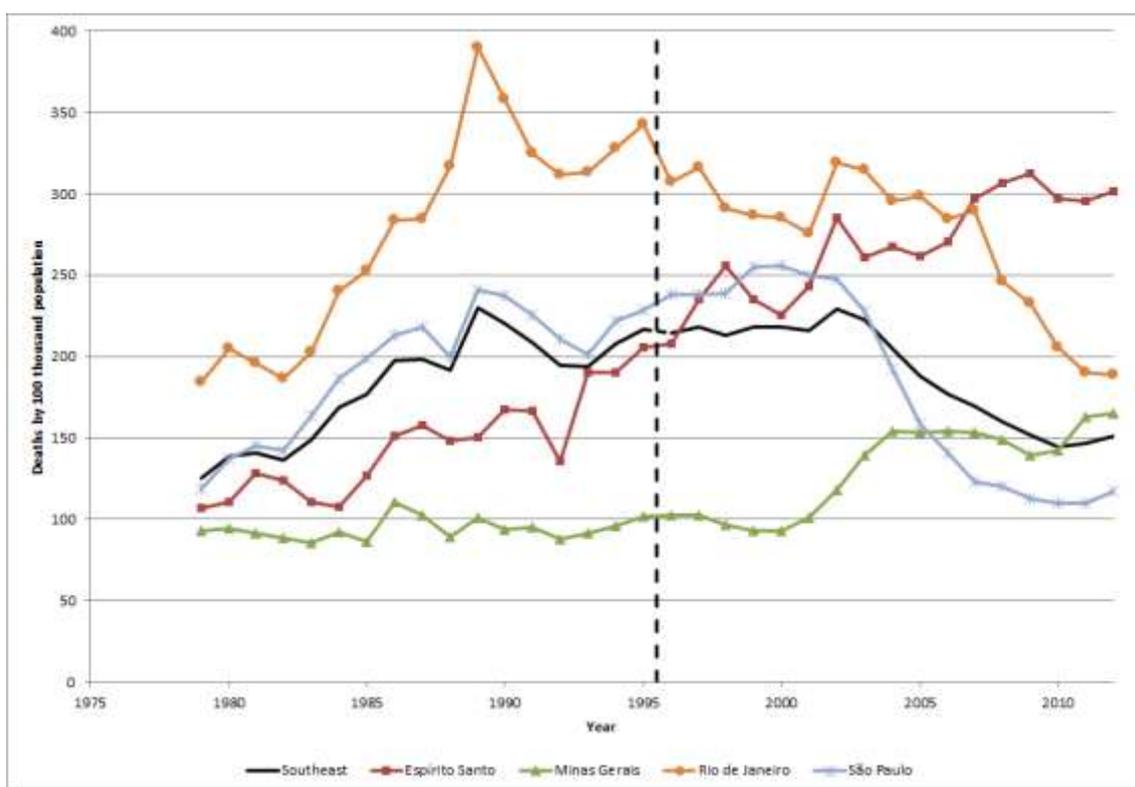


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 15 – Cause-specific mortality rate by external causes of Young adult males (15-24), Index (1979=1), Brazil and Great Regions, 1979-2012

Figure 16 shows the same information of Figure 14 but disaggregated by the corresponding states of the Southeast region. Again, one observes a similar pattern at much higher values than those observed for all ages (Figure 8) and higher values than those observed for young adults of both sexes (Figure 12).

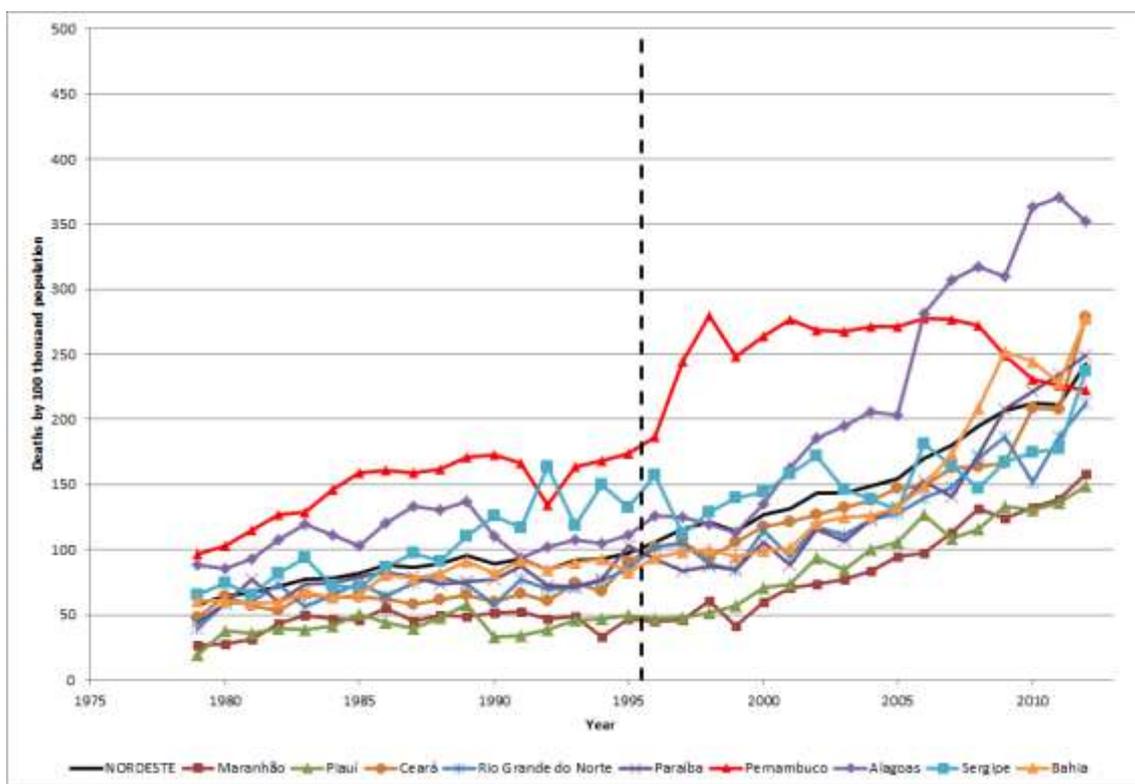


Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 16 – Cause-specific mortality rate by external causes of Young adult males (15-24), Southeast Region and corresponding states, 1979-2012

Figure 17 shows cause-specific mortality rate by external causes of young adult males for the Northeast and corresponding states. Again, one observes a similar pattern at much higher values than those observed for all ages (Figure 9) and higher values than those observed for young adults of both sexes (Figure 13).



Source: authors' calculation (see Note 2)

Note: Rates calculated without correction for coverage

Figure 17 – Cause-specific mortality rate by external causes of Young adult males (15-24), Northeast Region and corresponding states, 1979-2012

Conclusions

As already mentioned, Brazil shares with several other Latin American countries a high level of death rates by external causes. This is the outcome of the evolution of the intentional and unintentional injury death rates during the three last decades. These mortality rates by external causes are a dominant issue in Brazil, particularly concerning crime and traffic accidents. From 55.7 deaths per 100,000 population in 1979, it increases to a plateau with values oscillating around 72.3 from 1996 on. The corresponding figure for young adults is basically one-third higher, 98.8 (but beginning slightly later – 2001), almost doubling for young adult males to 176.5 (also beginning in 2000).

The plateau for Brazil as a whole results from markedly different behaviors of two groups of Great Regions: a strong drop in the Southeast starting in 1996 reaching a lower plateau of 68.3 in 2007; and a major increase in the remaining regions (North, Northeast, South and slightly later for the Midwest). Concomitant with the diversity of cultural and sociopolitical characteristics of the states, within some Great Regions they can also exhibit markedly different behaviors with respect to the mortality rate by external causes. In the case of the Southeast, to compound the downward trend, one can recognize two distinct patterns since 1996 in the four states: a steady drop in the states of Rio de Janeiro and São Paulo (the latter reaching a plateau in 2007); a steady increase in the case of Espírito Santo and Minas Gerais (the latter starting only in 2000). In the case of the Northeast, all the states, but Pernambuco contribute to the ascending trend. Pernambuco reaches a plateau in 1997 with the highest rate of the region at the time, and after 10 years of stability starts a descent.

The most striking feature when considering the evolution of the crude mortality rate by external causes for Brazil is the large increase observed in the period: Brazil's rate increased by almost 40% in the first 17 years under study and has been roughly stable since 1996. The five regions present a rather homogeneous upward behavior until the year 1996 and diverge from then on. The Midwest follows the national stabilization closely up to 2006 when a steady increase appears, reaching in 2012, a value roughly 74.0% larger than in 1979. The North, Northeast and South regions also exhibit increases up to 2012, 78.5%, 164.2% and 26.4% respectively. On the other hand, the Southeast which had increased its rate by 34.4% up to 1996, shows a decline from then on, reaching a net decrease (compared to 1979) of a 3% in 2007 and stabilizing from then on. The increase in the other regions was proportionally higher than the decrease in the Southeast, but because of the much larger population of the

Southeast the final result for Brazil is the relative stability of the national mortality rate by external causes observed since 1996.

References

- Albuquerque, Fernando Roberto P. de C.; Senna, Janaína Reis Xavier. Tábuas de mortalidade por sexo e grupos de idade: grandes regiões e unidades da federação: 1980, 1991 e 2000. Rio de Janeiro: IBGE, 2005.
- Beltrão KI and Dellasoppa EE (2011a) *Anos de vida perdidos e hiato de gênero : Brasil e grandes regiões – 1980/2005*. Texto para Discussão - Escola Nacional de Ciências Estatísticas no. 31. Rio de Janeiro : Escola Nacional de Ciências Estatísticas.
- Beltrão KI and Dellasoppa EE (2011b) El designio de los hombres: años de vida perdidos en Brasil y en las grandes regiones, 1980-2005 *Estudios Demográficos y Urbanos* 26(2): 299-343.
- Beltrão KI and Dellasoppa EE (2014) *Oscillations around a plateau: deaths by homicide in Brazil – 1979-2011*. Paper presented at 14th Annual Conference of the ESC held in Prague, September 10–13, 2014, European Society of Criminology.
- Brasil. Ministério da Justiça. Secretaria Nacional de Segurança Pública. Departamento de Pesquisa, *Análise da Informação e Formação de Pessoal em Segurança Pública. Análise das Ocorrências Registradas pelas Polícias Civis (Janeiro de 2004 a Dezembro de 2005)*. Setembro / 2006. Available at: <<http://www.observatorioseguranca.org/pdf/Mapacrimes.pdf>> viewed August 2nd, 2011.
- Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde – SVS. *Redução de Homicídios no Brasil*. 2007 In: Georgetown University. Center for Latin American Studies (CLAS). Political Database of the Americas (PDBA). Available at <<http://pdba.georgetown.edu/Security/citizensecurity/brazil/documents/rh.pdf>> viewed August 2nd, 2011.
- Brasil (2010a) *Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde (CID-9)*. tabnet.datasus.gov.br/cgi/sim/obtcid9br.htm.
- Brasil (2010b) *Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde (CID-10)*. www2.datasus.gov.br/DATASUS/index.php?area=040203.
- Brasil. Ministério da Saúde. Datasus (2014) Tabulador de estatísticas vitais. Available at: tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obtuf.def. (accessed 10 November 2014).
- Ferreira H (2005) O crescimento dos homicídios de crianças e adolescentes no Brasil: 1980 a 2003. *Políticas sociais - acompanhamento e análise* 11: 178-185.
- IBGE (1982) *Censo Demográfico 1980*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE (1996) *Censo Demográfico 1991*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.

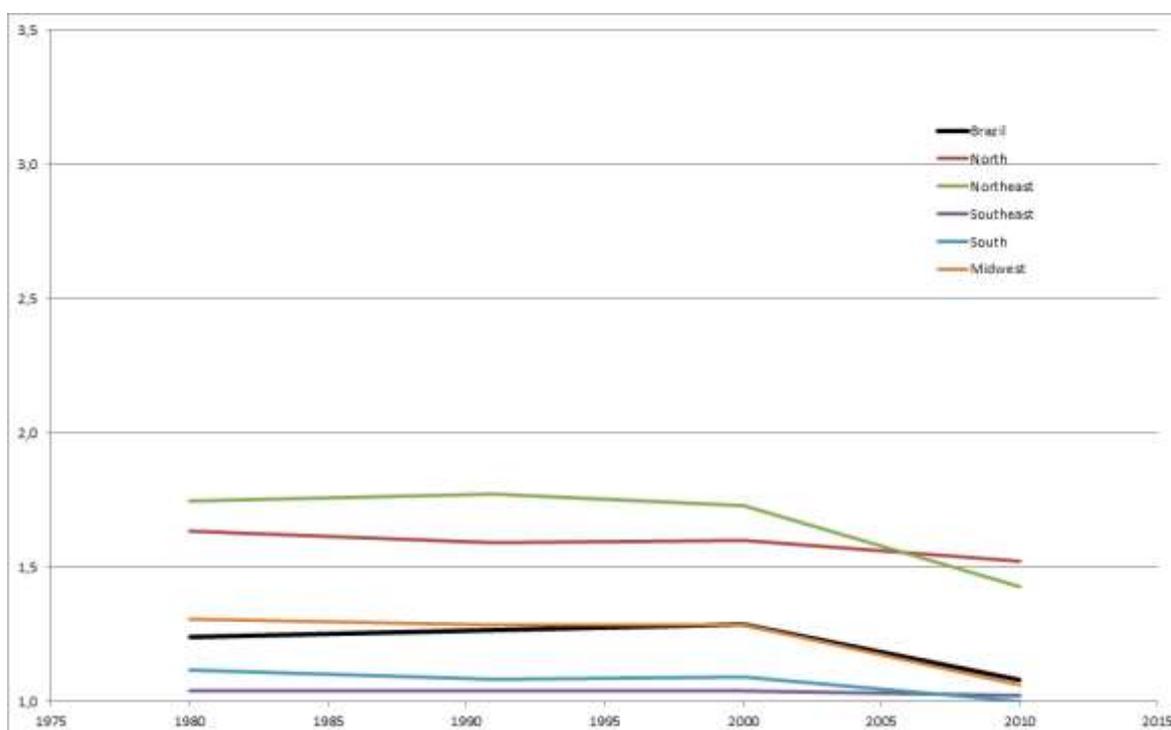
- IBGE (2001) *Censo Demográfico 2000*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE (2011) *Censo Demográfico 2010*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE (2013) *Tábuas Abreviadas de Mortalidade por Sexo e Idade Brasil, Grandes Regiões e Unidades da Federação 2010*. Estudos e Pesquisas - Informação Demográfica e Socioeconômica - número 30. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE (2014) Registro Civil. Available at: http://downloads.ibge.gov.br/downloads_estatisticas.htm (accessed 14 November 2014).
- Mello Jorge MHP, Gotlieb SLD and Laurenti R (2002a) “O sistema de informações sobre mortalidade: problemas e propostas para seu enfrentamento. II – mortes por causas naturais,” *Revista Brasileira de Epidemiologia*, 5(2): 197-211.
- Mello Jorge MHP, Gotlieb SLD and Laurenti R (2002b) “O sistema de informações sobre mortalidade: problemas e propostas para seu enfrentamento. II – mortes por causas externas,” *Revista Brasileira de Epidemiologia*, 5(2): 212-222.
- Moeller K and Hesse M (2013) Drug market disruption and systemic violence: Cannabis markets in Copenhagen. *European Journal of Criminology*, 10(2): 206–221.
- PAHO (1999) Epidemiology: New PAHO List 6/67 for Tabulation of ICD-10 Mortality Data. *Epidemiological Bulletin* 20(3): 4-9.
- PNUD (2013) *Informe Regional de Desarrollo Humano 2013-2014. Seguridad ciudadana con rostro humano: diagnóstico y propuestas para América Latina*. November. New York: PNUD.
- Souza ER et al. (2012) Estudo multicêntrico da mortalidade por homicídios em países da América Latina. *Ciênc. saúde coletiva [online]* 17(12): 3183-3193. Available at: www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-81232012001200004&lng=en&nrm=iso. (accessed 23 January 2013).
- Tseloni A, Mailley J, Farrell G and Tilley N (2010) Exploring the international decline in crime rates. *European Journal of Criminology* 7(5): 375-394.
- UNODC (2011) *Homicide Statistics, Criminal Justice Sources - Latest available year (2003-2008)*. Available at: www.unodc.org/unodc/en/data-and-analysis/homicide.html. (accessed 14 November 2012).
- Van Wilsem J (2004) Criminal Victimization in Cross-National Perspective - An Analysis of Rates of Theft, Violence and Vandalism across 27 Countries. *European Journal of Criminology*, 1(1): 89–109.
- Waiselfisz JJ (2011) *Mapa da Violência 2011 - Os Jovens do Brasil*. Instituto Sangari and Ministério da Justiça. Available at: www.mapadaviolencia.org.br/pdf2011/MapaViolencia2011.pdf. (accessed 14 November 2012)

- WHO - World Health Organization. (2011) Department of Measurement and Health Information. *Table 3. Age-standardized death rates per 100,000 by cause, sex and Member State, 2008 (a, m)*. Available at :
http://www.who.int/gho/mortality_burden_disease/global_burden_disease_death_estimates_sex_2008.xls?ua=1 (Accessed 05/03/2014)
- WHO - World Health Organization. (2013) *Global health estimates summary tables: deaths by cause, age and sex, by WHO Region*. Available at
http://www.who.int/healthinfo/global_burden_disease/en . (Accessed 05/03/2014)

ANNEX

To evaluate the under-registration correction impact on mortality rates and their evolution, this Annex displays the correction factors over time for Brazil, Regions and states of the Northeast and Southeast regions. These are the areas under scrutiny in the text. The impact on the evolution of mortality rates for selected states (Pernambuco, Espírito Santo and Bahia) are also displayed for comparison purposes. These are the states with the largest dynamic ranges with respect to mortality rates by external causes.

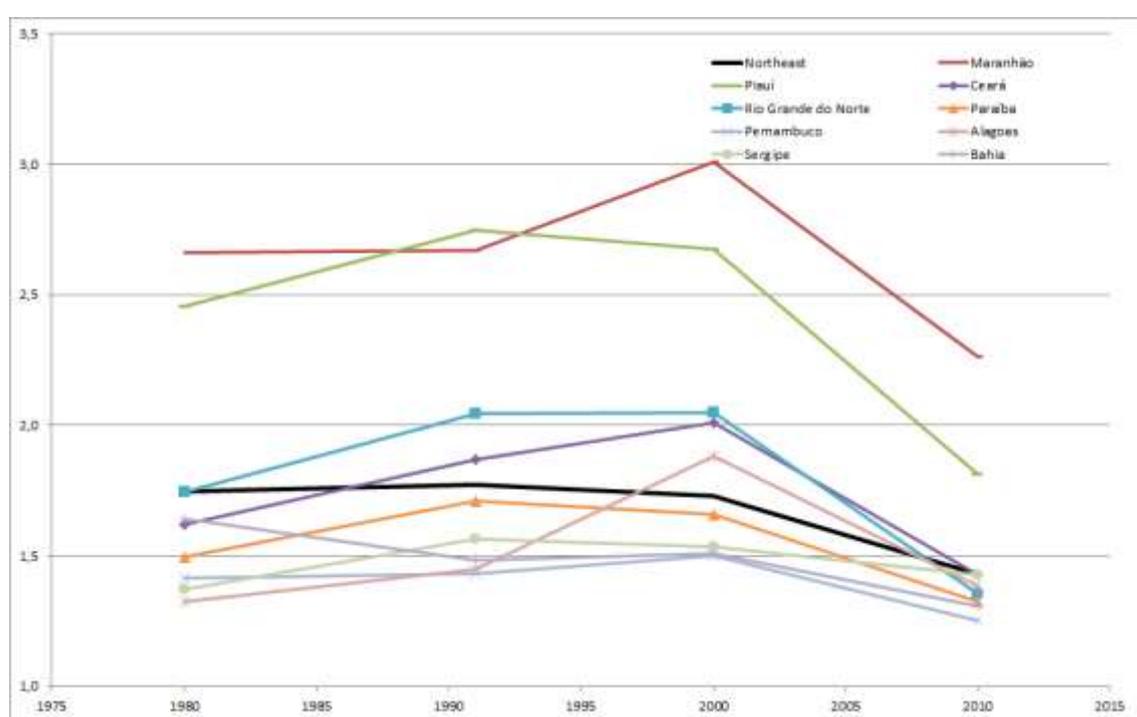
Figure A1 presents the death-registration coverage correction factors for Brazil as a whole and Regions for census years between 1980 and 2010. North and Northeast present the highest values, with more than 50% correction. The South and Southeast present the lowest values, the latter with no correction in 2010. The Midwest presents values very similar to Brazil as a whole.



Source: Albuquerque & Senna (2005); IBGE (2013)

Figure A1 – Death-registration coverage correction factors – Brazil and Regions – 1980/2010

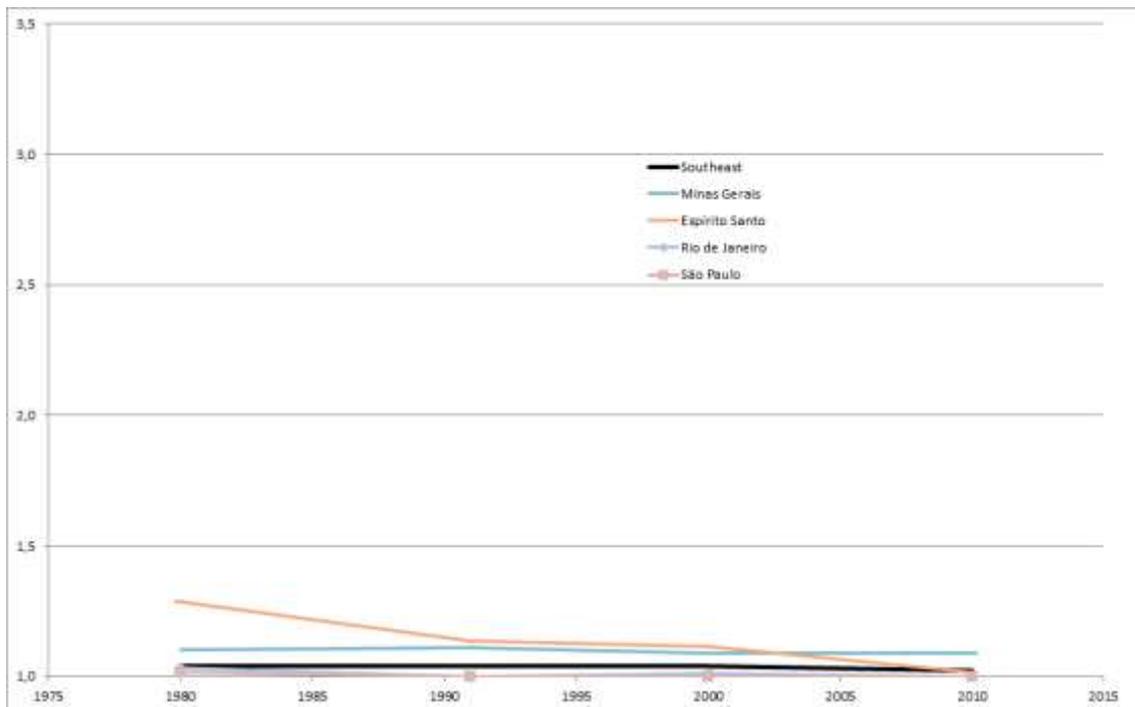
Figure A2 presents the death-registration coverage correction factors for the Northeast and corresponding states for census years between 1980 and 2010. The correction factor for the region improves with time, but the states themselves show several divergent patterns. Factors are clustered in two groups: Piauí and Maranhão present higher values, around 2.5, and the other states are grouped around the regional average. Factors for all the states deteriorate in the first decade and improve in the last decade.



Source: Albuquerque & Senna (2005); IBGE (2013)

Figure A2 – Death-registration coverage correction factors – Northeast and states – 1980/2010

Figure A3 presents the death-registration coverage correction factors for the Southeast and corresponding states for census years between 1980 and 2010. The correction factor for the region is very close to 1.0 from the beginning. Minas Gerais presents slightly larger factors. Espírito Santo, with the largest factor in 1980, improves to a situation better than the regional average in 2010. São Paulo and Rio de Janeiro present factors even closer to 1.0 than the regional average.



Source: Albuquerque & Senna (2005); IBGE (2013)

Figure A3 – Death-registration coverage correction factors – Southeast and states – 1980/2010

Figure A4 presents mortality rates for the state of Pernambuco, one with the largest dynamic range, disaggregated by sex and broad group of causes, for the population as a whole from 1979 to 2012. For each sex, on the left, one can find mortality estimates without the correction for under-registration and on the right, estimates with the due correction. The correction factor for Pernambuco (see Figure A2) following an initial rise, is smaller at the end of the period than at the beginning. Therefore, for both sexes, the decline presented by deaths by natural causes seems larger with the application of the correction factor. Actually, in the last stretch, without the correction there is an apparent stability. On the other hand, the ascending trend of external causes for the male population up to 1997, seems smaller with the correction factor. The last stretch, corresponding to a decrease, seems steeper. Mortality by external causes for females, presents an increasing trend when data without correction is

used. But, the application of the correction factor, changes the result after 1997, into a decreasing trend.

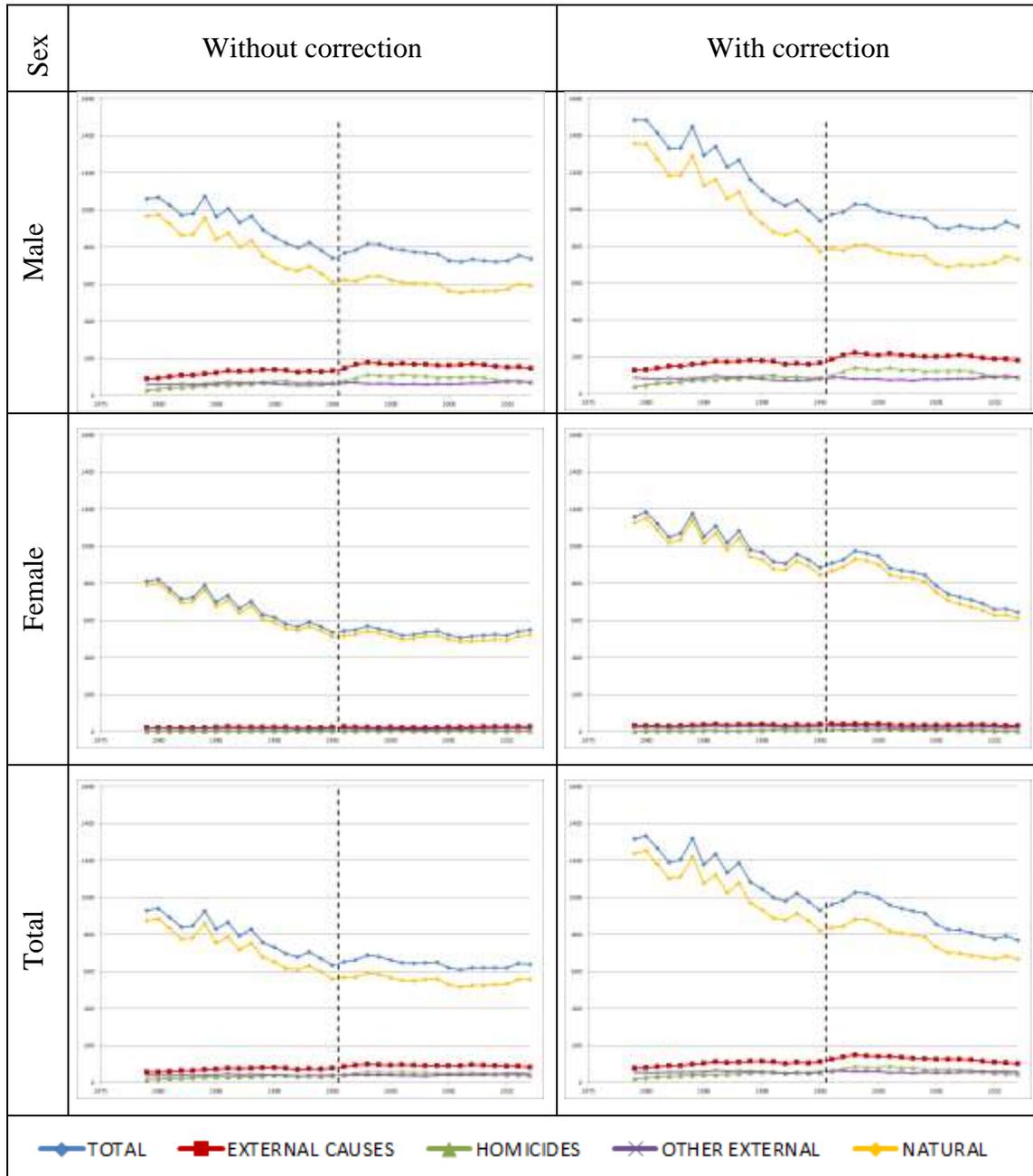


Figure A4 – Mortality rates by broad group of causes and sex – Pernambuco - 1979/2012

Since the level of the mortality rates are so different for each broad cause of death, it is somehow hard to recognize trends. Figure A5 presents mortality rate index (1979=1) for the state of Pernambuco also disaggregated by sex and broad group of causes, allowing a better perception of the change in trends with and without the correction. For males, the correction on external causes results in a similar pattern at lower values along the whole interval. For females, a similar pattern at slightly higher values appears up to 2000, when an opposite increasing trend develops for the corrected values up to the end of the interval. For deaths by homicides, the dynamic range is reduced with the application of the correction factor for males and amplified for females.

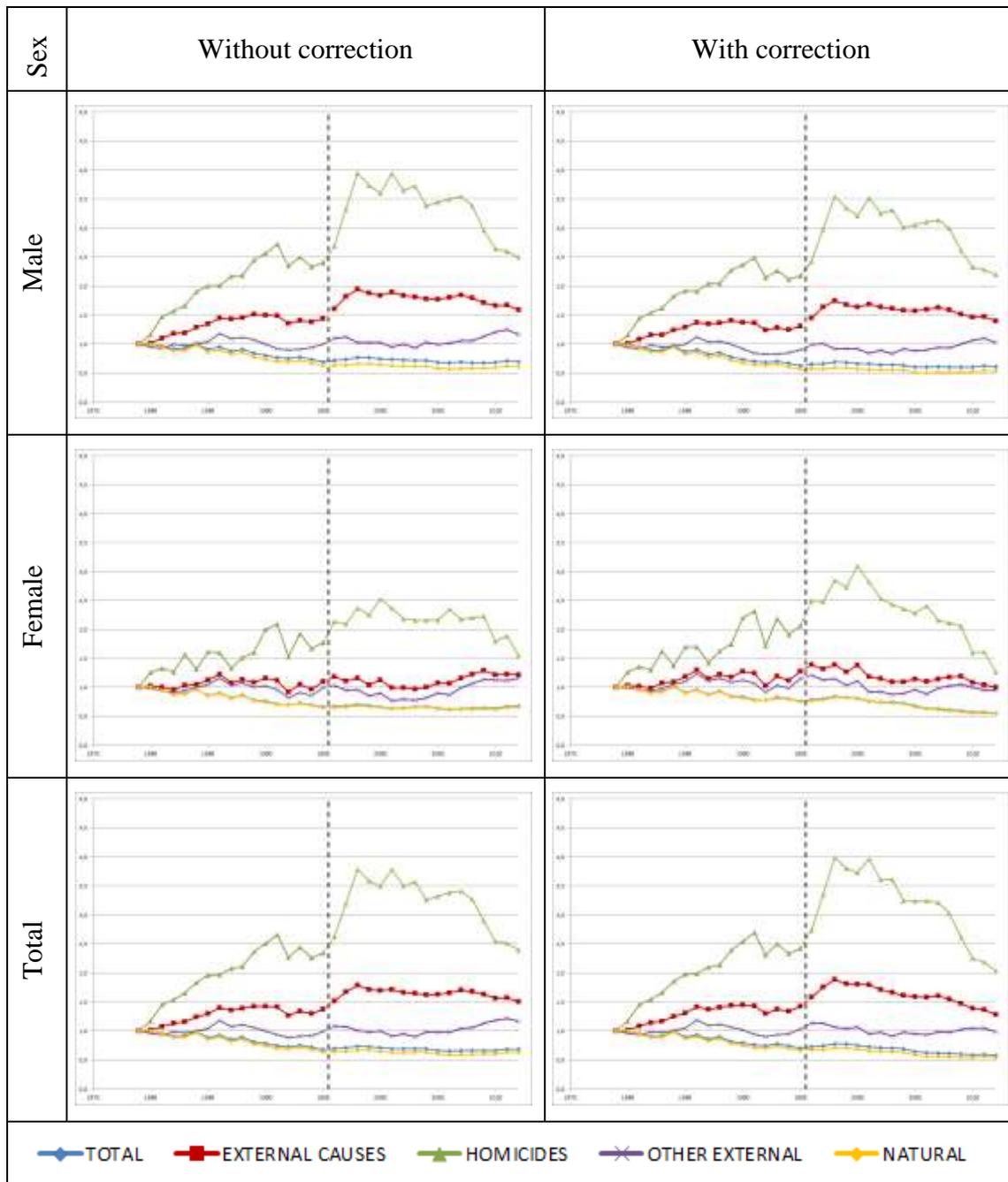


Figure A5 – Mortality rates index (1979=1) by broad group of causes and sex – Pernambuco - 1979/2012

Figure A6 presents mortality rates for the state of Pernambuco disaggregated by sex and broad group of causes, but differently to what was presented in Figure A4, it concerns only

the young adult population. For both sexes, as it was the case for the population as a whole, the decline presented by deaths by natural causes for young adults seems steeper with the application of the correction factor. For males, as can be observed in figure A7, patterns with and without correction are very similar for all broad groups of causes, presenting regularly higher values when correction is applied. Driven by homicides, external and all causes present an increasing trend up to 1996, an upward discontinuity, a plateau up to 2007, followed by a decrease. Natural causes presents a decrease in both cases, a steeper one when the correction factor is applied. For females, the downward trend on rates by natural and all causes seems steeper with the application of the correction factor. The dynamic range for deaths by homicides is wider for data with the correction factor.

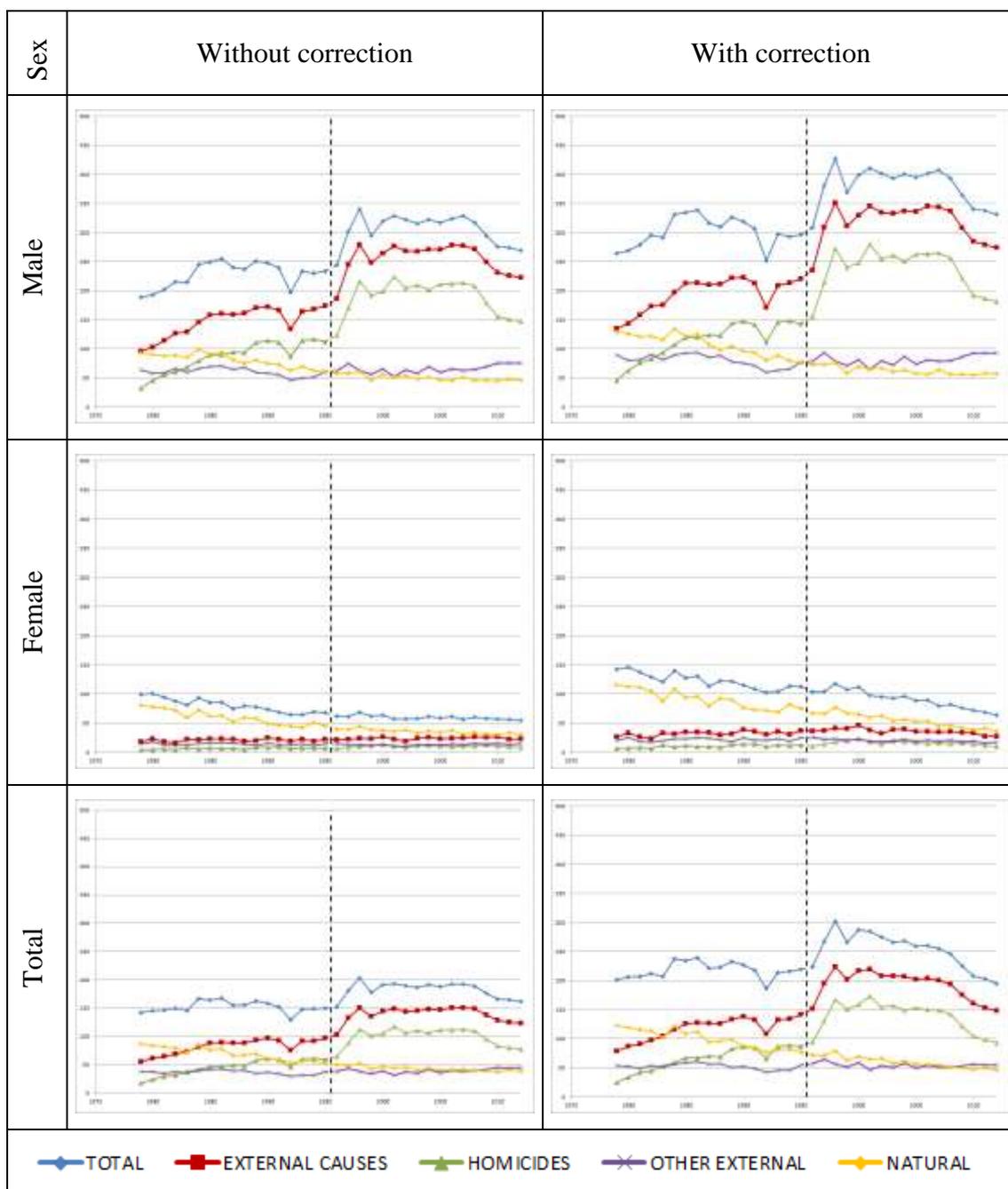


Figure A6 – Mortality rates by broad group of causes and sex – Young adults - Pernambuco - 1979/2012

Figure A7 presents mortality rate index (1979=1) for the young adult population of the state of Pernambuco also disaggregated by sex and broad group of causes. For males, the correction of external causes results in a similar pattern at lower values along the whole

interval (an increase up to 1996, an upward discontinuity, a plateau up to 2007, and a decrease). This is also true for homicides and all causes. For females, the correction yields a similar pattern at slightly higher values up to 2000, when an opposite increasing trend develops for the corrected values up to the end of the interval. For deaths by homicides, the dynamic range is reduced with the application of the correction factor for males and amplified for females. Natural and all causes present a steeper decrease with the correction.

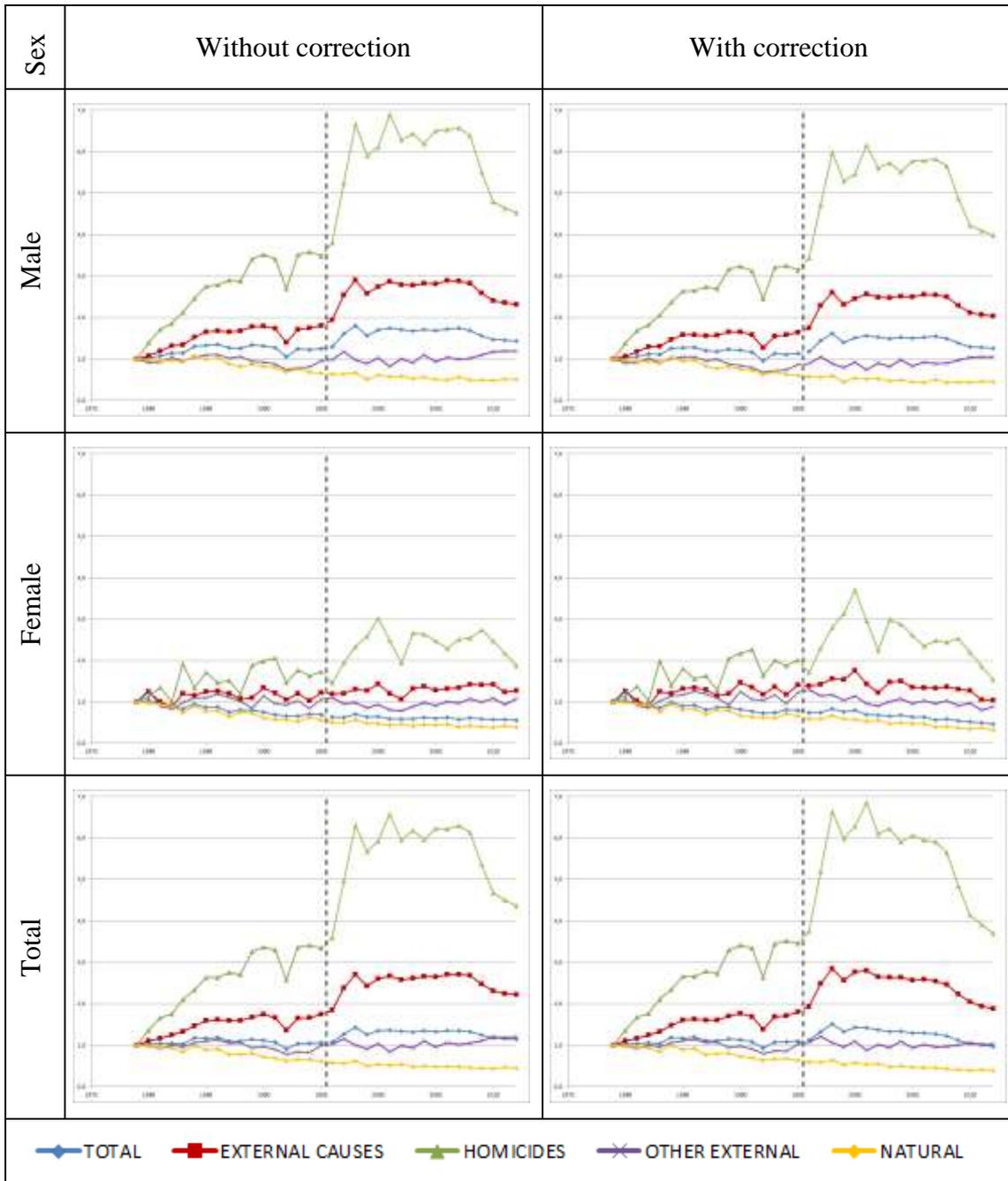


Figure A7 – Mortality rates index (1979=1) by broad group of causes and sex – Young adults - Pernambuco - 1979/2012

Figure A8 presents mortality rates for the state of Espírito Santo disaggregated by sex and broad group of causes, for the population as a whole from 1979 to 2012. For each sex, on the left, one can find mortality estimates without the correction for under-registration and on the right, estimates with the due correction. It is worth mentioning that Espírito Santo is the only state in the Southeast region with a major variation on the correction factor. The correction factor for the state (see Figure A3) at the end of the period is smaller than at the beginning, decreasing over time. Therefore, for both sexes, separately and combined, the decline presented by deaths by natural causes is only noticeable with the application of the correction factor. Without the correction, there is an apparent stability for males and both sexes combined. For females, the trend is characterized by a slight increase. On the other hand, the ascending trend of external causes for the male population seems less steep with the correction factor. Mortality by external causes for females, presents an increasing trend when data without correction is used. The trend is less steep with the application of the correction factor. The impact of the correction factor is similar to that already observed for the state of Pernambuco.

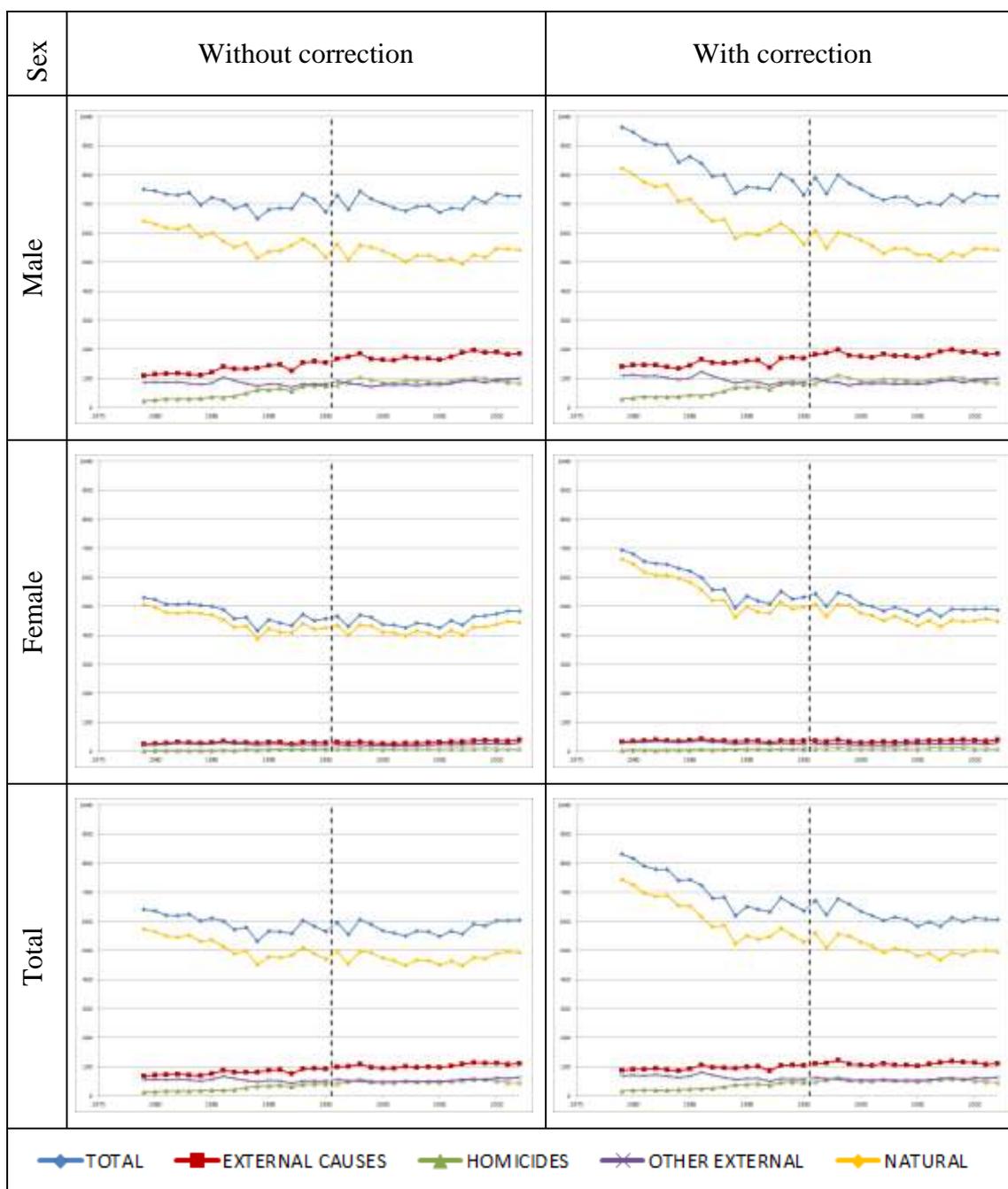


Figure A8 – Mortality rates by broad group of causes and sex – Espírito Santo - 1979/2012

Since the levels of the mortality rates are so different for each broad cause of death, it is somehow hard to recognize trends. Figure A9 presents mortality rate index (1979=1) for the

state of Espírito Santo also disaggregated by sex and broad group of causes, allowing a better perception of the change in trends with and without the correction. For males, the correction of external causes results in a similar pattern at lower values along the whole interval: an increasing trend in the early years, but with the rate of increase slowing down to reach a plateau with wide oscillations from 1995 onwards. For females, a similar pattern is noticeable up to 1995, but after a short fall, the upward trend resumes when the correction factor is not applied. A saw-saw effect appears when the correction factor is applied. For deaths by homicides, the dynamic range is reduced with the application of the correction factor for both sexes.

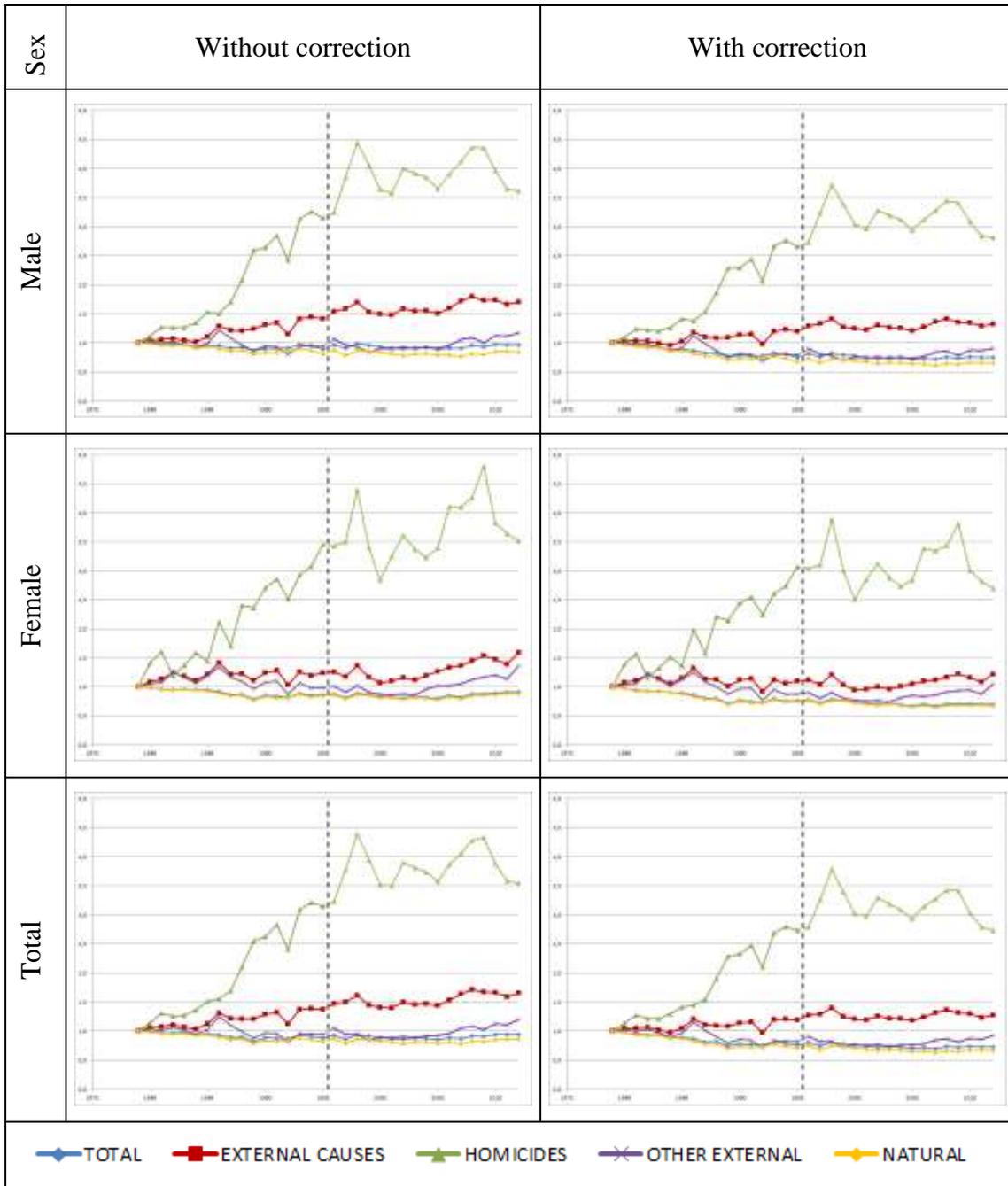


Figure A9 – Mortality rates index (1979=1) by broad group of causes and sex – Espírito Santo - 1979/2012

Figure A10 presents mortality rates for young adults of the state of Espírito Santo disaggregated by sex and broad group of causes. For both sexes the decline in deaths by natural causes for young adults seems greater with the application of the correction factor. For males, as can be observed in the Figure, patterns with and without correction are very similar for all broad groups of causes, presenting, at least in early years, higher values when correction is applied. For the male population, driven by homicides, external and all causes present an increasing trend up to the end of the period. For the female population, the upward trend in homicides has a visible impact only on death by external causes, not on all causes. The dynamic range for deaths by homicides is narrower for data with the correction factor.

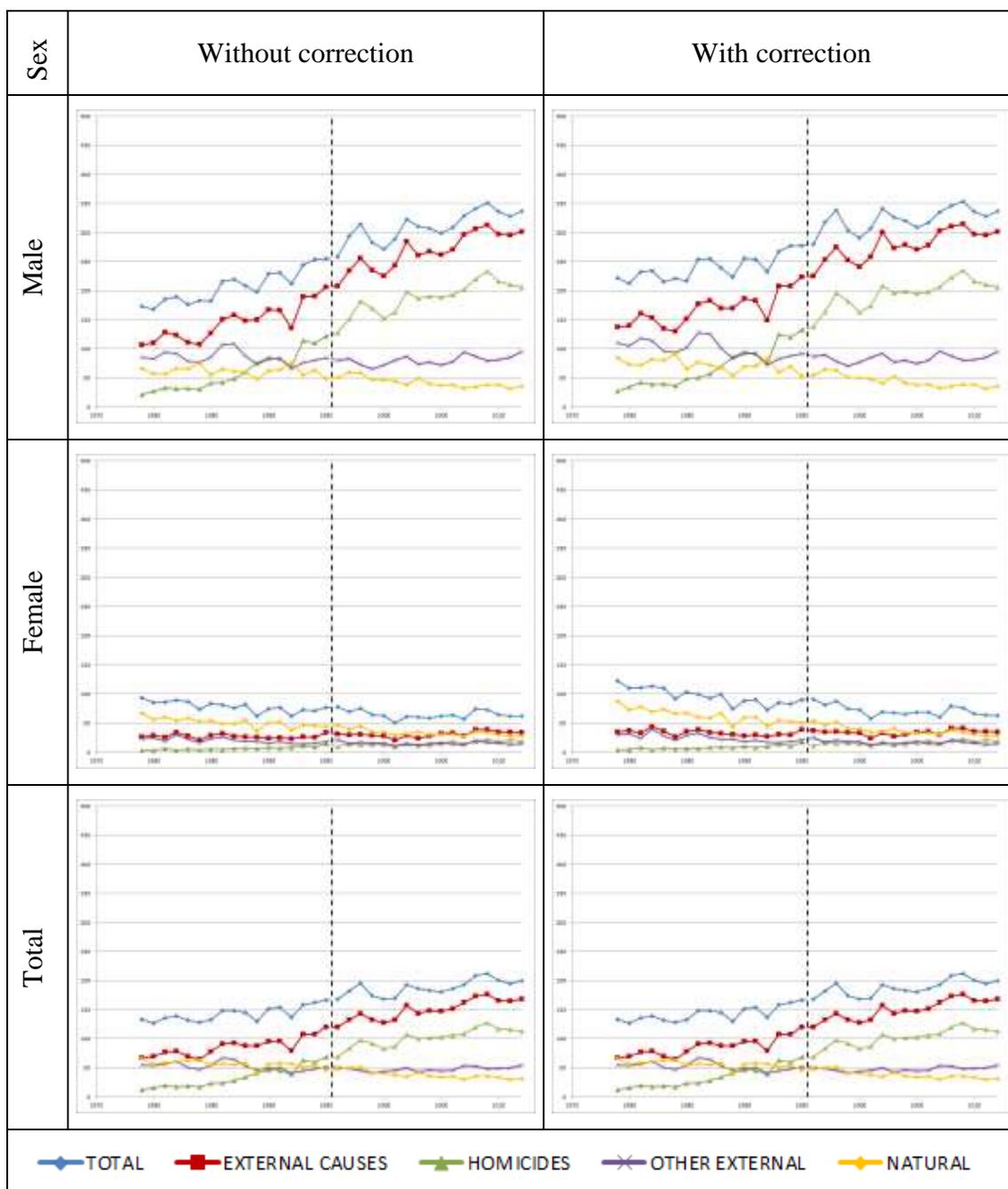


Figure A10 – Mortality rates by broad group of causes and sex – Young adults - Espírito Santo - 1979/2012

Figure A11 presents mortality rate index (1979=1) for the young adult population of the state of Espírito Santo also disaggregated by sex and broad group of causes. For males, the application of the correction factor, narrows the dynamic range of all increasing curves. The

only decreasing trend, mortality by natural causes, gets steeper with the factor. For females, the impact is similar, narrowing the increasing trends (homicides and external causes) and making the decreasing trends steeper (natural, other external and total).

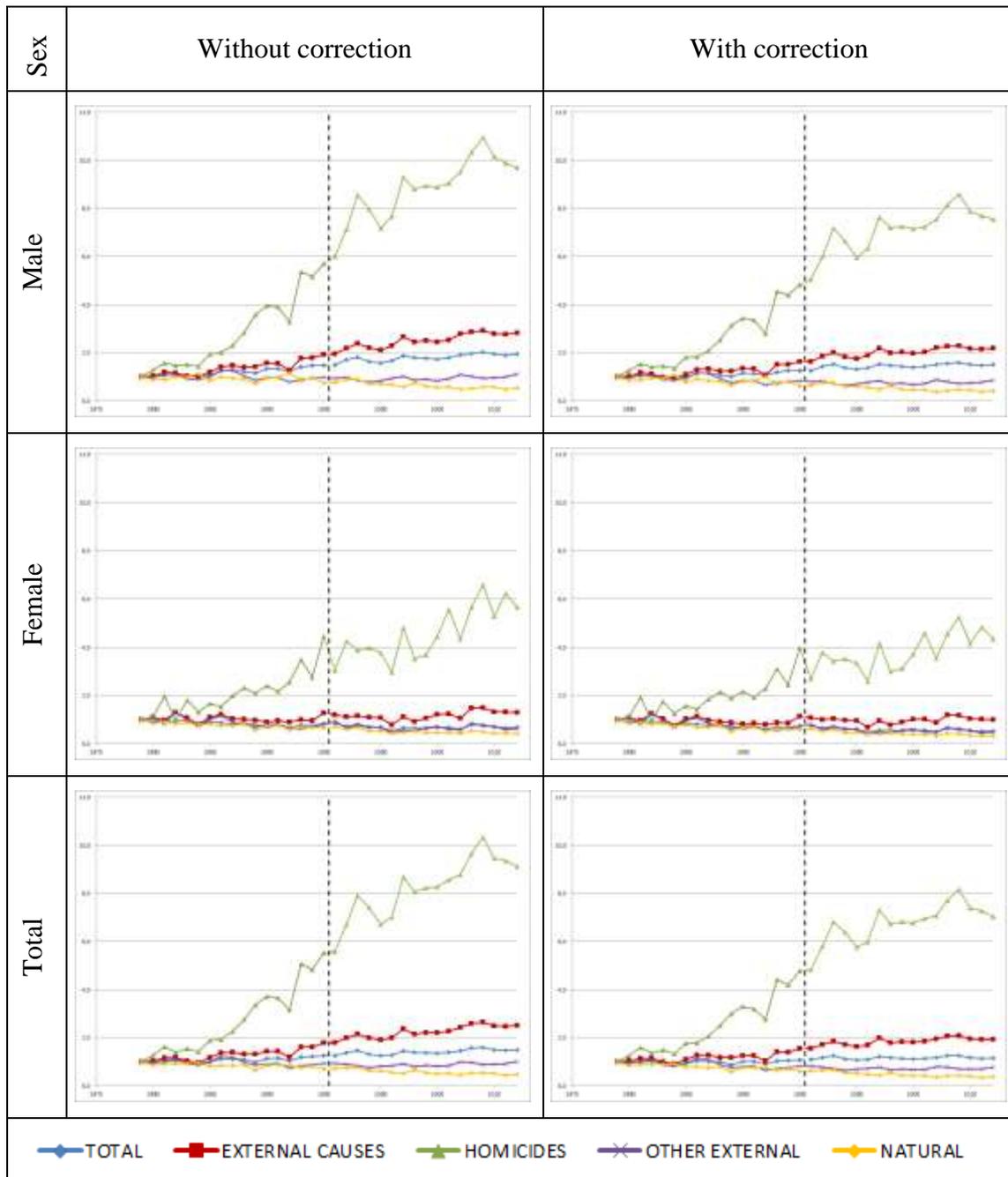


Figure A11 – Mortality rates index (1979=1) by broad group of causes and sex – Young adults - Espírito Santo - 1979/2012

Figure A12 presents mortality rates for the state of Bahia, disaggregated by sex and broad group of causes, for the population as a whole from 1979 to 2012. The correction factor for Bahia (see Figure A2) at the end of the period is smaller than at the beginning, following a pattern similar to the region as a whole, but at a lower level. For all causes, male mortality follows a U-shaped curve, shallower without the correction factor. For natural causes, male mortality without correction follows the shallow U-shaped curve observed for all causes. When the correction factor is applied, the right side of the curve after 1997 flattens out into a plateau. For females, without correction, a shallow U-shaped curve is the pattern for both total and natural causes. When the correction factor is applied, the right side of both curves flatten out into a plateau. All the increasing trends, when the correction factor is applied, have their dynamic ranges narrowed.

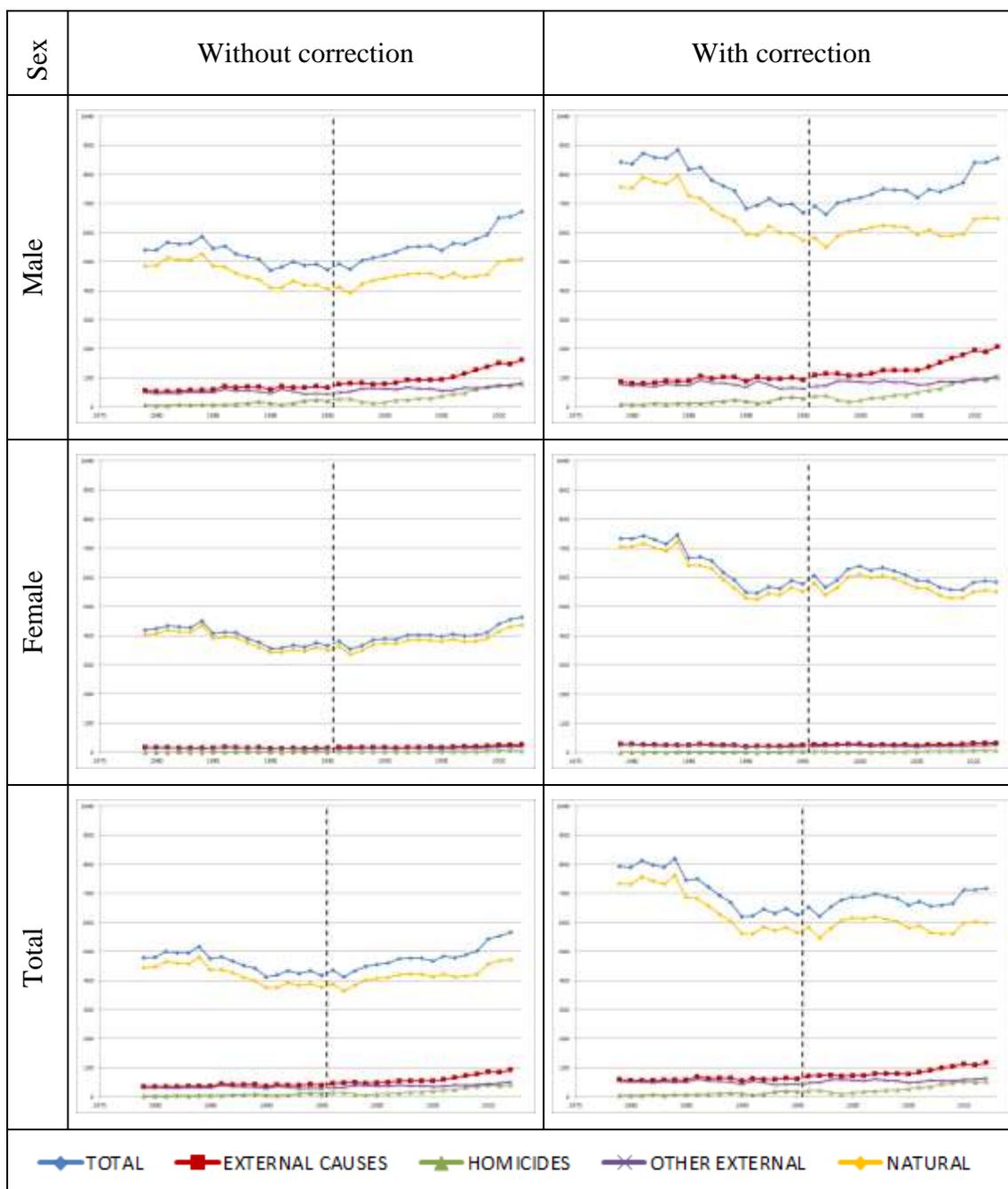


Figure A12 – Mortality rates by broad group of causes and sex – Bahia - 1979/2012

Figure A13 presents mortality rate index (1979=1) for the population of the state of Bahia. For males and females the application of the correction factor, narrows the dynamic range of all increasing curves (external causes and homicides). It is worth noting that, for males, death by homicides presents a thirteen fold increase in the period. With the application of

the correction factor, the increase is reduced to an eleven fold increase. For females, the corresponding figures are eight and six fold.

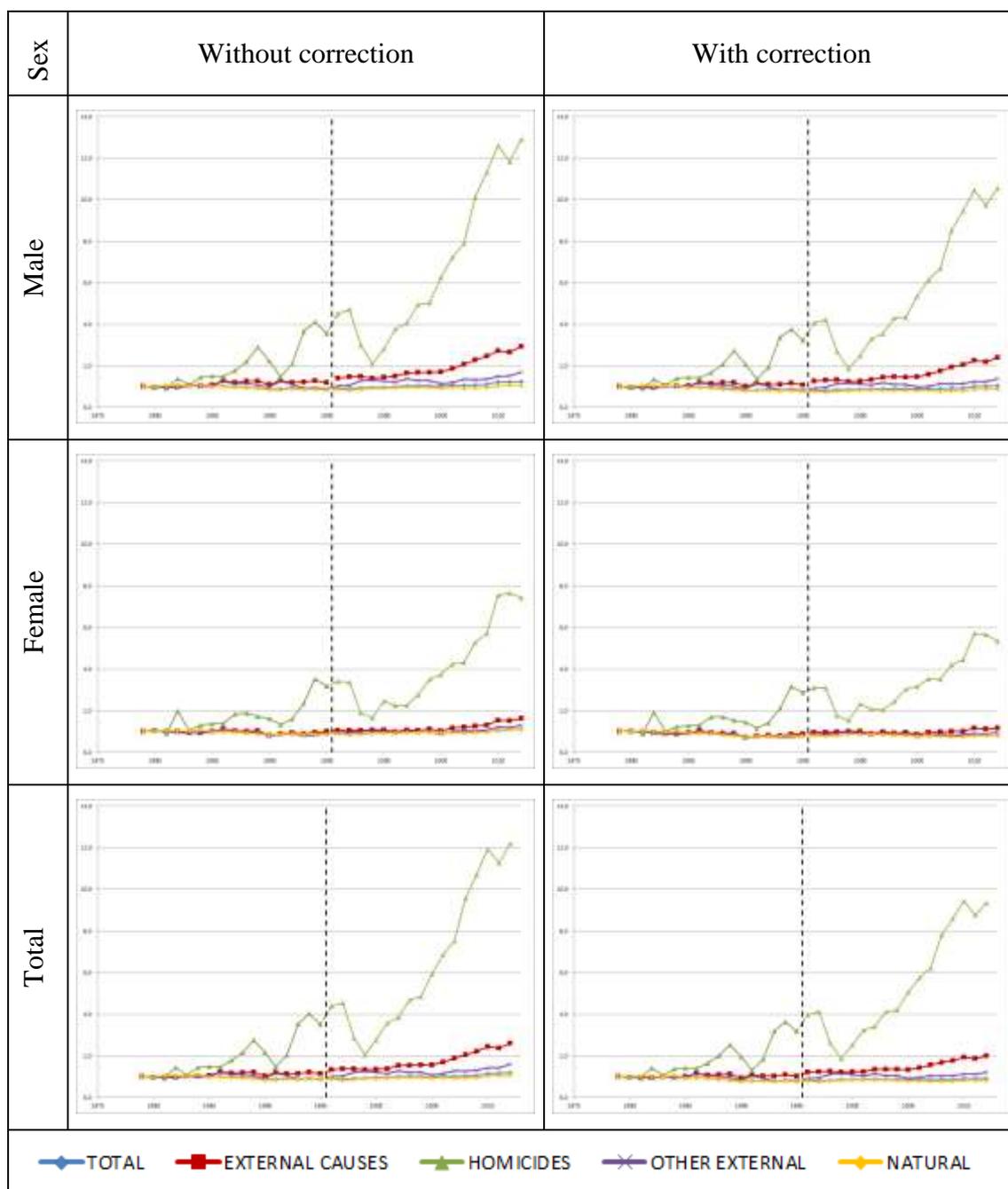


Figure A13 – Mortality rates index (1979=1) by broad group of causes and sex – Bahia - 1979/2012

Figure A14 presents mortality rates for young adults of the state of Bahia disaggregated by sex and broad group of causes. For both sexes, the decline presented by deaths by natural causes for young adults seems steeper with the application of the correction factor. For males, as can be observed in the figure, patterns with and without correction are very similar for all broad groups of causes, presenting higher values when correction is applied. For both sexes, driven by homicides, external and all causes present an increasing trend up to the end of the period. The dynamic range for deaths by homicides is narrower for data with the correction factor.

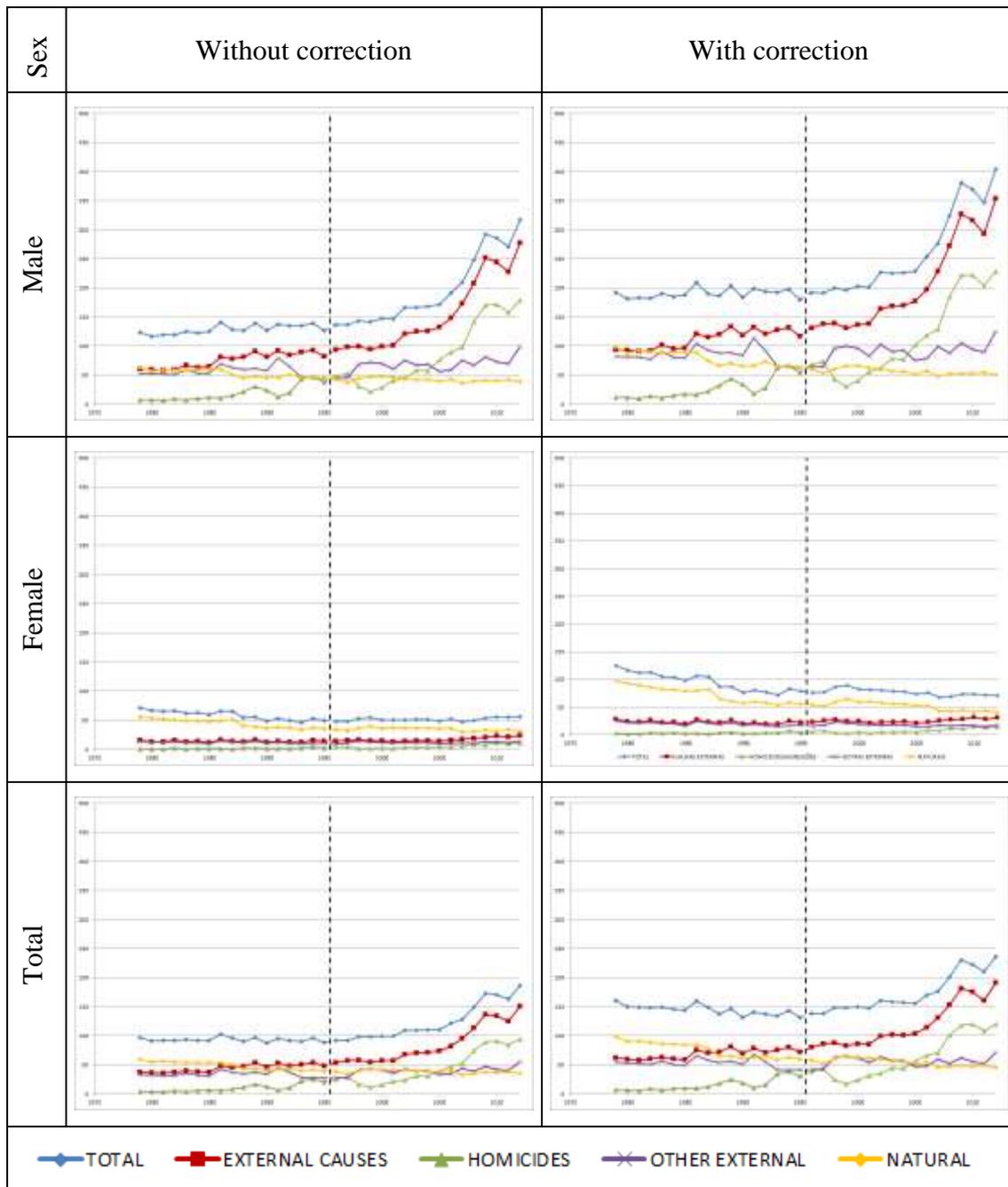


Figure A14 – Mortality rates by broad group of causes and sex – Young adults - Bahia - 1979/2012

Figure A15 presents mortality rate index (1979=1) for the population of young adults of the state of Bahia. For males and females the application of the correction factor, narrows the dynamic range of all curves. It is worth noting that, for males, death by homicides presents

a twenty four fold increase in the period. With the application of the correction factor, the increase is reduced to a nineteen fold increase. For females, the corresponding figures, like those observed for the total population, are eight and six fold.

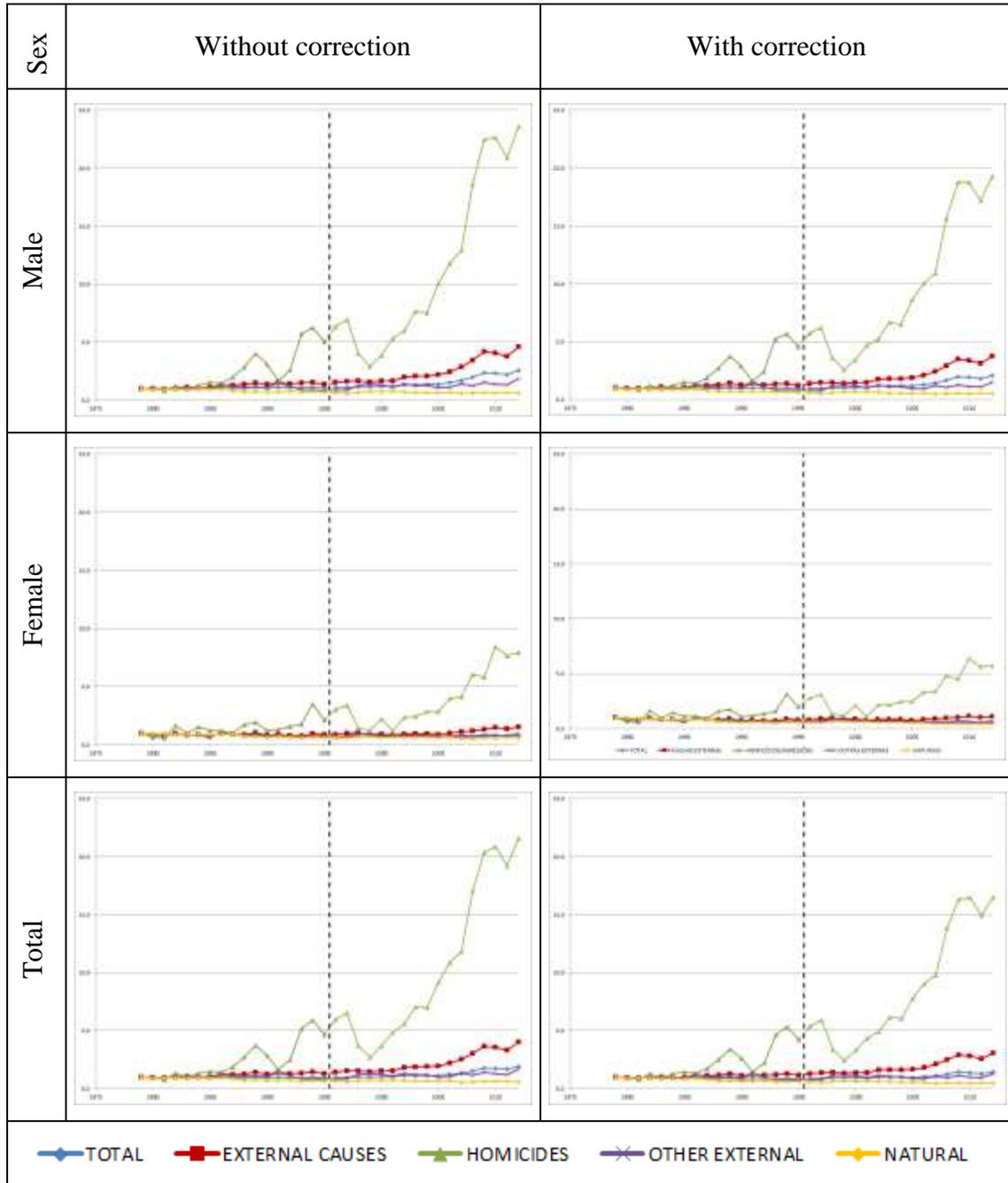


Figure A15 – Mortality rates index (1979=1) by broad group of causes and sex – Young adults - Bahia - 1979/2012

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