Regional Inequalities in Infant Mortality and Primary Health Care in the State of Minas Gerais, Brazil

Les inégalités régionales de la mortalité infantile et des Soins de Santé Primaires dans l'État du Minas Gerais, au Brésil

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1. Introduction

1   The decline in infant mortality, and the concomitant reduction in territorial inequalities, is one of the results highlighted by the Brazilian government in the sphere of the national policy for expanding access to Primary Health Care (PHC) under the Family Health Teams (FHT) model [Brazil, 2012]. Infant mortality is known to be very sensitive to PHC [Frankenberg, 1995; Shi *et al.*, 1999; Starfield, 1992; Santana, 2005]. Indeed, the main causes of infant mortality in the world, such as diarrhoea and pneumonia [Lawn, Cousens & Zupan, 2005; Lopez *et al.*, 2006], could in fact be prevented with appropriate medical care. However, there is perhaps no other health indicator that is so dependent upon poverty-related social conditions, thereby reflecting social and geographic inequalities [Goldani *et al.*, 2001; Navarro & Shi, 2001; Szwarcwald, Andrade & Bastos, 2002; Marmot, 2005; Santana, 2005]. This explains the spatial concentrations of high infant mortality rates in regions of the world where the populations are poorer and have less access to healthcare [Lopez *et al.*, 2006].

2   PHC is defined in Brazil as a combination of actions of both an individual and collective nature, including particularly the promotion of health and prevention of disease [Brazil, 2012]. Since the advent of the Single Healthcare System (SHS), which was celebrated in the Brazilian Constitution as free and universal, the right of all and duty of the state [Brazil, 1989], Brazil has made great efforts to expand access to these services, particularly in view of its strategic role for the integration of the healthcare system, and in order to improve health indicators, particularly as regards women and

children. Hence, the Family Health Programme (FHP) was created in 1994 in response to the need for a healthcare model that was less hospital-oriented and more decentralized, and also to take control of flows in the PHC.

3 The FHP has gradually acquired a strategic dimension for health in Brazil, particularly in relation to basic indicators such as the reduction of infant and maternal mortality, increase in vaccination cover and reduction of hospitalizations. To give an idea of its significance, 6.5% of the Brazilian population were covered by the programme in 1998, but this figure had gone up to 40% by 2004 and to around 60% by 2012 (SIAB, 2012). Therefore, the National Basic Healthcare Policy (NBHP), which is the document that determines the way PHC is organized in Brazil, no longer considered to be a programme (because a programme is understood as a package of short-term solutions), but rather as a strategy for the consolidation of PHC through the implantation of Family Health Teams (FHT) [Brazil, 2012].

4 Therefore, the family is the smallest geographical unit with which PHC facilities work in Brazil. But each team, generally consisting of a doctor (general practitioner), nurse, technicians, ancillaries and community health agents, have to be responsible for the health of a geographically defined group of families. Problem-solving is one of its most important principles [Brazil, 2012]. Thus, according to Mendes (2009), these teams should be equipped to attend to and overcome most of the population's health problems.

5 Reducing regional inequalities in infant mortality was one of the Brazilian government's main objectives in developing FHTs [Brazil, 2012]. This is very important because, despite the fact that the infant mortality rate has been decreasing over the last twenty years in Brazil (from 33.9‰ in 1994 to 13.6‰ in 2011) [SIAB, 2012], there are still enormous regional inequalities in this indicator, with very high levels in the more deprived areas of the North and Northeast of the country [Victora *et al.*, 2011; Faria, 2013). But also on the interregional and even intraurban scales, there are considerable variations in the infant mortality rates. That is the case with the state of Minas Gerais, whose location at the intersection between the Northeast, Southeast and Centre-West regions of the country, combined with historical processes of occupation and the different forms of economic and productive life, has enormous social and regional inequalities and consequently enormous variations in infant mortality rates.

6 The state of Minas Gerais is the fourth largest in Brazil in territorial terms, with almost twenty million inhabitants, distributed across 853 municipalities and 66 administrative microregions [IBGE, 2010]. This state also has some specific public health policies, including in the domain of PHC. In fact, the government of Minas Gerais, through the State Secretary for Health, and in association with policies already created by the Ministry of Health, has given broad technical and financial support to the expansion of FHT coverage throughout the state. Through its structuring project "Health at Home" [SESMG, 2005], which cuts across other public health policies, the government achieved an FHT coverage of almost 72% of the population in 2012, which is above the average for the country as a whole.

7 However, there have been very few studies that assess the impact of this increased PHC coverage on population health indicators, particularly on infant mortality. It is worth mentioning the work of Raselha *et al.* (2013), specifically as regards the relationship between the increased PHC cover and the reduction in infant mortality. Although its main theme is rent transfer programmes, the authors show how those programmes,

associated to greater public health cover, are important to improve population health indicators. From a different perspective, though no less important, Lourenço *et al.* (2014) also show significant positive correlations between the increase in PHC and the reduction in infant mortality in the state of São Paulo. Although these studies have made an enormous contribution, there are still numerous questions to be discussed on the subject, as regards both services and social inequalities. Hence, this study aims to analyse the regional impacts of PHC on the infant mortality rates (IMRs) in the state of Minas Gerais, taking into account specific socioeconomic contexts. Infant mortality was analysed for the periods 2002-2006 and 2007-2011 in the 66 microregions of the state, with relation to three operative dimensions:

   i. the indices of families receiving PHC assistance;

   ii. indexes of prenatal care;

   iii. the Index of Sociomaterial Deprivation (ISD).

2. Materials and methods

8   The study was implemented on the level of the 66 administrative microregions of Minas Gerais for the years 2002 to 2011, grouped into two periods (2002-2006 and 2007-2011) in the case of infant mortality and prenatal care, and at intervals in the case of the FHT coverage and social deprivation indicators (2002 and 2011). The data were collected from secondary official sources, namely the Brazilian Institute of Geography and Statistics (IBGE), Live Births Information System (SINASC), the Mortality Information System (SIM) and the Basic Healthcare Information System (SIAB). The following indicators were constructed from the database in the light of the desired aims:

   i. infant mortality rate (IMR), clustered for the years 2002-2006 and 2007-2011;

   ii. index of population registered with the FHTs, calculated for the years 2002, 2006 and 2011;

   iii. index of women that did not have prenatal care during pregnancy;

   iv. Index of Sociomaterial Deprivation (ISD) in 2002 and 2011.

9   The ISD was constructed in accordance with the methodology suggested by Cartars & Morris (1991) (cited by Santana, 2005), involving the strategic selection of three social indicators:

   i. illiteracy amongst women of reproductive age;

   ii. domiciles without indoor bathrooms;

   iii. low-wage families (i.e. those earning less than half the minimum wage).

10   Following Santana (2005), those variables were standardized using the *z-score* method so each would have the same influence on the final result of the index. The ISD thus represents the sum of those standardized variables.

11   Pearson's correlation coefficient was also used to calculate the interdependence of the variables of the study and their ratios, particularly as regards regional dynamics.

12   After the construction and modelling of the indicators in accordance with the previously defined spatial and temporal scales, a thematic cartography was constructed using the Geographic Information System (GIS). For this, the IBGE cartographic base was used at a scale of 1:50,000, and the ArcGis Programme from the company Esri.

3. Results

3.1. Infant mortality: temporal variation and spatial distribution

13   As in the rest of the Brazil, the state of Minas Gerais, influenced by the policies of the country, has seen a reduction in infant mortality. In 2002-2006 the rate was 18.0‰ which declined to 13.1‰ in 2007-2011. It is, therefore, lower than the Brazilian average (13.6‰ in 2011). There was also a drop in infant mortality in the microregions generally (Figure 1) over the period, though this did not occur in all microregions. There are still enormous spatial inequalities in infant mortality in Minas Gerais, as some microregions have low rates while others are higher than the Millennium Development Goal for infant health [WHO, 2005] (the 4th MDG determines the reduction of the IMR in Brazil to 15.7‰ by 2015).

14   Figure 1 shows the spatial concentrations of high IMR in the microregions in the Northeast, and also, though with lower values, in the microregions of the "Forest Zone" and Centre. In contrast, the microregions located between the Northwest and the "Mining Triangle", and between Belo Horizonte and South have lower IMRs in the two periods, though more markedly between 2007-2011. Special attention should be given to the microregions located in the extreme Northeast: four microregions had a very high IMR, and of those, two actually worsened, while the other two experienced only a very slight reduction.

15   As Table 1 shows, there was spatial variation in IMRs between microregions in accordance with population size. The ten most populated microregions, where almost half the population of the state is concentrated and where the largest cities are located, including the capital Belo Horizonte, are those with the lowest IMR. On the other hand, the ten least populated regions, which account for only 3.7% of the population of the state and which have only small cities, have higher IMRs on average, located mostly in the Northeast of the state. It should be pointed out that the IMRs indicated in the Table 1 are the average calculated between the ten most populated and the ten least populated microregions. The others are grouped separately. It can be seen that the ten most populated microregions have IMRs that are close to the state average, accompanying the general trend towards reduction seen not only in Minas Gerais but also in Brazil as a whole. The same cannot be said of the ten least populated microregions.

Figure 1. Infant mortality rate (IMR) by regions of the State of Minas Gerais, Brazil, for the years 2002-2006 and 2007-2012.
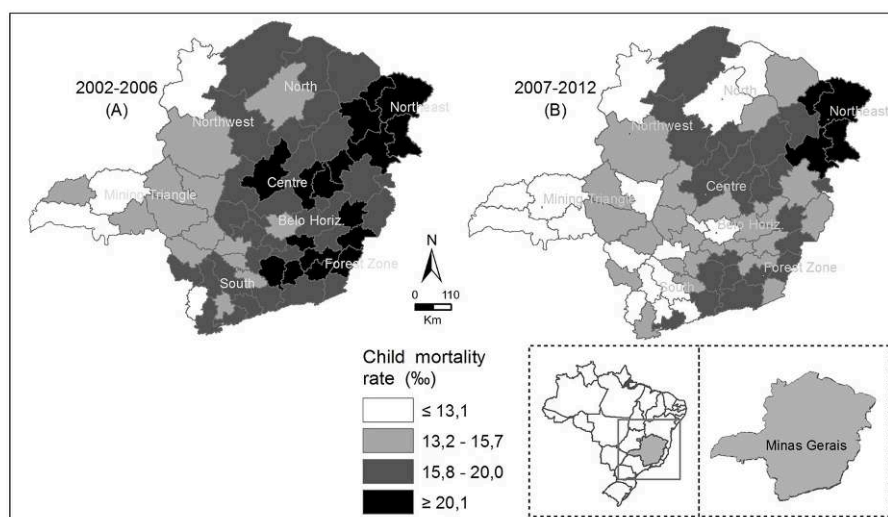
Table 1. Comparison of IMR, live births without prenatal care, ISD, and FHT coverage for the ten most and least populated microregions and others in the state of Minas Gerais, Brazil

	IMR (‰)*	LBWPC (‰)**	ISD***	FHTs (%)***	Population (%)***	Urbanization Index***
10 + populated	13.6	10.4	-1.7	63.0	48.9	89.9
10 − populated	16.6	10.6	2.4	93.9	3.7	65.6
Others	15.01	9.96	-0.16	80.4	47.4	77.9

*Referring to the aggregate period 2007-2011
** Live births without antenatal care in the aggregate period 2007-2011
***Referring to the year 2011

16   Table 1 also shows variations in IMR in accordance with the urbanization rate in the most and least populated microregions. The former are the most urbanized as they include the biggest cities of Minas Gerais (as mentioned above), including its capital, Belo Horizonte. The opposite occurs with the least populated microregions. The highest IMRs were found in the least urbanized microregions and diminished as the urbanization index increased. In fact, the ten most populated and most urbanized microregions have IMRs similar to the state average, and some are even lower than that average. For example, the two most populated microregions in the state, Belo Horizonte and Uberlândia (Mining Triangle), have IMRs of 11.6‰ and 11.8‰ respectively. Therefore, with regard to the aggregated period of 2007-2011, their rates are lower than the state average. On the other hand, the least populated and least urbanized microregions have IMRs well above the state average.

17   Nevertheless, it is relevant to analyse these rates in relation to other indicators, particularly the indicators of PHC cover and usage. This is also important to clarify a discourse that has already been presented by some authors [e.g. Sastry, 1997; Souza et al., 1999] according to which urbanization is associated to a reduction in infant mortality.

3.2. Expansion of primary healthcare provision use to antenatal care

18   With the FHT model, there was an increase in PHC coverage throughout all the microregions of Minas Gerais (Figure 2). The state average, which was 50% in 2002, went up to 64% in 2006 and 71% in 2011. The microregions located in the North, Northeast, Centre and "Forest Zone" presented higher levels of coverage in the three years analysed, while the opposite happened in the microregions located in the South, "Mining Triangle", Belo Horizonte and Northwest, where the FHT coverage was lower. In fact, the first group had levels of coverage that were higher than the state average, while the second was generally lower than the state average, despite the increase in the supply in the period analysed.

19   In any case, the data indicate the enormous advances in FHT coverage in Minas Gerais. For many microregions, particularly those of the North and Northeast of the state, provision was universal by 2011. Considering only the microregions with a provision of over 80%, there is a total of 35 microregions, which represents over half. It can also be seen that the most populated and urbanized microregions (Table 1), where the major cities in Minas Gerais are located such as Uberlândia ("Mining Triangle"), Juiz de Fora ("Forest Zone"), Belo Horizonte (Metropolitan Region), Poços de Caldas, Pouso Alegre and Varginha (South) and Montes Claros (North), are those with the lowest levels of coverage, averaging 63% of the population. In contrast, in the less populated and urbanized microregions, where the small cities are located, the level of coverage exceeds 93%. It should be mentioned that the expansion of services in the less populated microregions was one of the goals of the National Basic Healthcare Policy [Brazil, 2012]. Thus, in accordance with the principle of equity, the microregions that are less dense in public health services and consequently have greater health needs should have a greater supply of services per inhabitant.

Figure 2. Coverage of Family Health Teams (in percentage of population) by regions of the State of Minas Gerais, Brazil, in 2002 (A), 2006 (B) and 2011 (C)
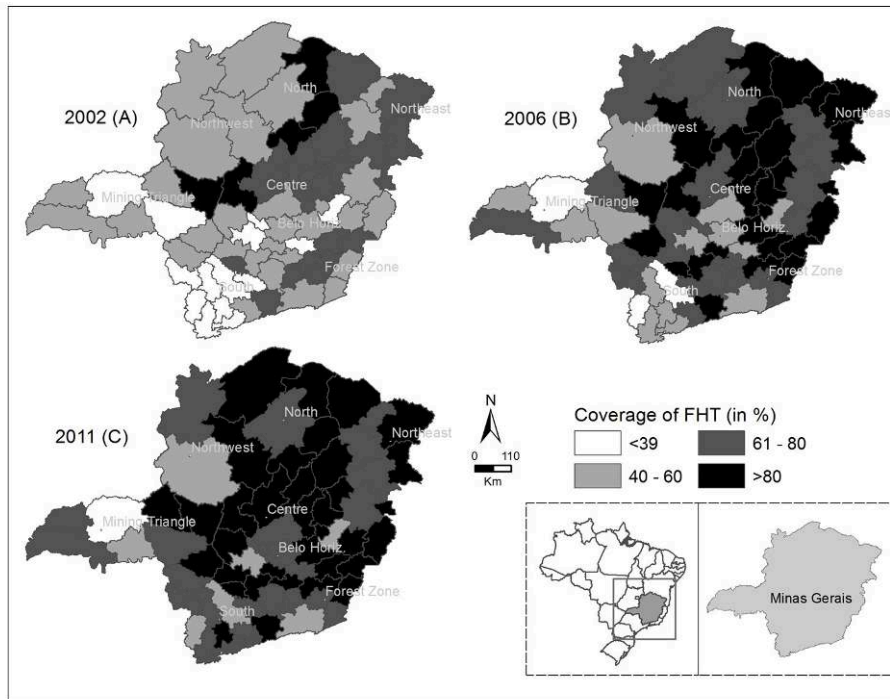

20 However, if we compare the way services are distributed (percentages per population), as in Figure 2, there is clearly a tendency for a homogenization of supply; by 2011, there was a predominance of microregions with over 61% provision, and a reduction of microregions with less than this. In fact, in 2002, there were 44 microregions (accounting for 66.9% of state's population) with less than 60% provision, while in 2011 this figure had dropped to 9 microregions (19.9% of the population). Similarly, in 2002 there was 80% coverage in only 5 microregions (5.3% of the population) and by 2011, it existed in 35 microregions (over 28%).

21 Thus, it can be concluded that the policy of expanding PHC through the establishment of FHTs has yielded numerically important results, in keeping with the policies produced for the sector. This is despite the fact that the National Basic Healthcare Policy [Brazil, 2012] does not stipulate the figure to be achieved, but merely aims for an expansion of coverage in the least populated/most deprived areas.

22 It should be added, however, that the existence of services, or rather the expansion of provision, does not mean that these health services are properly accessed and used, nor does it automatically produce good health outcomes. It is necessary to analyse the impact of the services upon the population's living conditions and health. In this case, it is worth reflecting on the population's access to and use of services, and on health outcomes, particularly for infant mortality. There are numerous indicators of access/ use of primary health services by the population. In relation to child health and impacts upon infant mortality rates, prenatal care is important, given its potential for the prevention of disease and infant mortality through the promotion of maternal health. Therefore it is to be hoped that the increased FHT coverage in Minas Gerais will have had a positive impact by providing greater access to prenatal care, and consequently helping reduce infant mortality.

23   In accordance with the World Health Organization [WHO, 2002], there should be at least six prenatal consultations during pregnancy. The Brazilian Ministry of Health has recommended that these should take place every four weeks, and every 15 days after the 36th week of pregnancy [Brazil, 2006] As this is an important indicator of maternal and child health, the Ministry of Health itself monitors the number of prenatal consultations that have taken place during pregnancy in relation to the numbers of live births. However, the official data do not distinguish between consultations that have taken place in the public and private healthcare systems. Thus, only data relative to live births without any prenatal care during pregnancy have been collected. In other words, what is assessed is the vulnerability of women and foetuses when prenatal consultations do not take place. This is shown in Figure 3 for the years 2002-2006 and 2007-2011.

Figure 3. Live births without prenatal care (in ‰) between the years 2002-2006 and 2007-2012 by regions of the State of Minas Gerais, Brazil
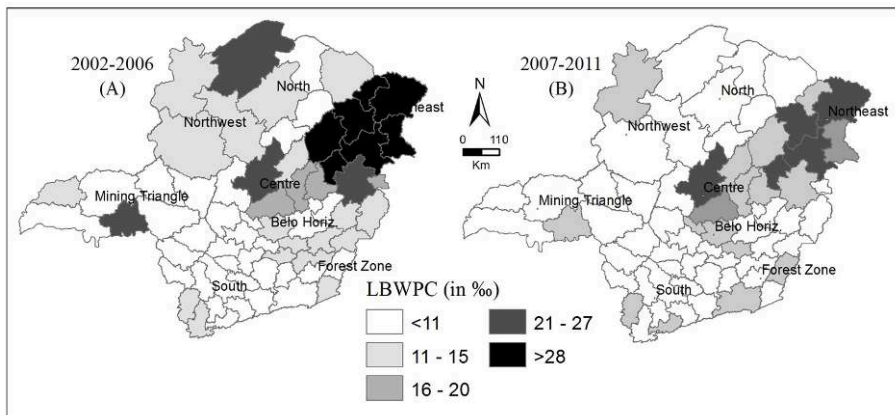

24   Figure 3 shows that there was a reduction in the number of live births without prenatal care in almost all the microregions of Minas Gerais. The state average, which was 14.4‰ in 2002-2006, dropped to 10.1‰ in 2007-2012, a reduction of almost 30%. These values are below the national average of 36.7‰ in 2002-2006 and 26.9‰ in 2007-2012 (a reduction of 26.5%). Therefore, not only is the average in the state of Minas Gerais better than the country as a whole, its performance was also better in this indicator. However, the indexes of live births without prenatal care are still high in some microregions, compared with the state and national averages. Moreover, the spatial concentration of these indices is visible in microregions located between the Centre and Northeast of the state. In fact, though there has been a reduction, there continue to be spatial concentrations of higher rates of live births without prenatal care over the two periods.

3.3. Index of Sociomaterial Deprivation and regional inequalities in Minas Gerais

25   The Sociomaterial Deprivation Index (SDI) adds a new dimension to the analysis of regional differences in IMR in Minas Gerais. The indicators used to construct it are based upon the social living conditions and health of the population:

  i. illiteracy levels amongst women of child-bearing age;

  ii. private homes without indoor bathrooms;

  iii. low wages. It is well known that the social and economic deprivation of families and territories is an important indicator of regional inequalities [Wong, 2006], as it clearly expresses spatial differences in living conditions.

26   Social indicators such as those used in the ISD are difficult to collect and update because they can only be gathered during censuses. For this reason, the data used were taken from the censuses of 2000 and 2010 and updated for the years 2002 and 2011. As the variation was very small, compared to the two years analysed (Figure 4), it was considered that an analysis of the beginning and end of the period would be adequate for our purposes (i.e. using the sociomaterial deprivation index as an indicator of regional inequalities and thus as a determinant of regional inequalities in IMR, in the state of Minas Gerais).

27   Figure 4 shows the ISD for the years 2002 and 2011, on the level of the microregions of the state Minas Gerais. There was a very slight alteration in the geography of social deprivation during the period under analysis. In fact, the scenario remained practically unaltered, with the exception of an increase in ISD in some microregions. This increase may be easily identified, for example, in two microregions, one located in the North and the other in the Northeast of the state. Together with this slight alteration in the geography of social deprivation, two distinct social and geographic situations have persisted. One of these, which also coincides with a region, may be easily identified as that where the ISD oscillates positively, indicating that the population is more deprived. The second region is one where the ISD clearly oscillates negatively, and is therefore where the population is less deprived.

Figure 4. Index of Sociomaterial Deprivation in the State of Minas Gerais, Brazil, calculated at the level of microregions for the years 2002 (A) and 2011 (B).
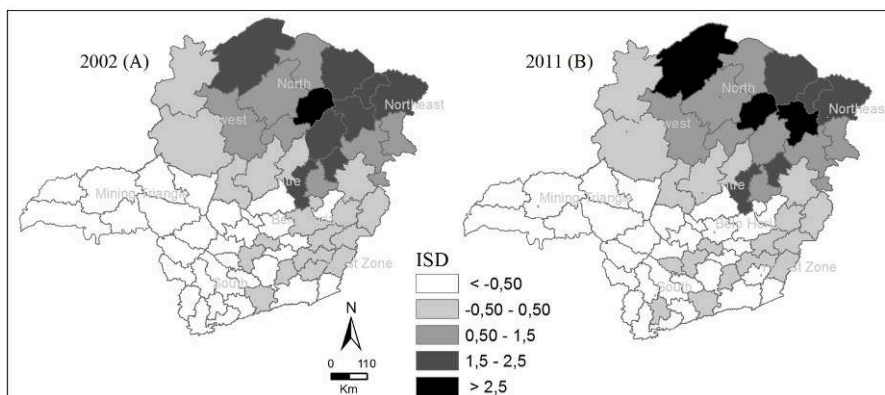
28   There is a greater spatial concentration of deprived microregions in the Northeast of the state, followed by, to a lesser degree, microregions located in the North and Centre. In contrast, the least deprived areas are concentrated in the "Mining Triangle", Belo Horizonte and the South of the state. Located in a transition zone are the microregions in the "Forest Zone", Northwest and again the Centre.

29   We should note that, according to the indicators given in Table 1, the most deprived microregions, whose values oscillate positively, are the least populated and least urbanized, while the least deprived microregions, whose values oscillate negatively, are the most populated and the most urbanized in the state. Therefore, there is a positive relation between social deprivation and urbanization, suggesting that the least urbanized microregions do not offer the same geographic or social conditions for the reduction of infant mortality. This is why the reduction was unable to reduce the inequalities, particularly in the northeast of the state, despite the fact that it occurred in almost all the microregions of Minas Gerais.

4. Discussion and final considerations

30   Brazil in general and the state of Minas Gerais in particular have adopted effective measures in order to reduce infant mortality, with a view to also achieving the indicators agreed upon in the ambit of the Millennium Development Goals [WHO, 2005]. In fact, the IMR has declined in almost all the microregions of the state between the years 2002-2006 and 2007-2011, due partly to the policy of expanding PHC under the FHT model.

31   The results show an increase in FHT cover in all microregions of the state of Minas Gerais between 2002 and 2011, which is positive, as it substantiates the political intention expressed in policies such as the National Basic Healthcare Policy [Brazil, 2012]. Also positive was the government's strategy of privileging the expansion of services in the most deprived microregions of the North and Northeast of the state. Even the microregions with less coverage (namely those located in "Mining Triangle", South and Belo Horizonte) showed an increase in provision over the period. For this reason, the spatial distribution of the FHTs was more homogeneous in 2011 than it had been in 2002.

32   However, the increase in FHT coverage was not accompanied by a similar reduction in the index of live births without prenatal care. Although Figure 3 shows an improvement in this indicator, the indexes of live births without prenatal care were still very high in 2007-2011 for many microregions, particularly those located in the Northeast of the state. Moreover and paradoxically, the highest indexes of FHT coverage were found precisely in these microregions. This is, therefore, a problem of access rather than of supply.

Some conclusions may be drawn by comparing the variations in IMR (Figure 1) with FHT supply/coverage (Figure 2), access to /use of prenatal care (Figure 3) and ISD (Figure 4):

4.1. Increase in FHT coverage and reduction in the number of live births that had received no prenatal care

33 Though other factors may contribute to improving access to prenatal care, the existence of the service is of course a primary condition. Therefore, associated to other factors, such as education, the increased coverage may be considered a positive policy in this sense. However, there are some contradictions, as the microregions where the FHT coverage indices are very high, practically universal, are also those that have the highest levels of live births without prenatal care. This occurs most clearly in the microregions located between the Centre and Northeast of the state. The opposite also occurs (i.e. microregions where the FHT coverage indices are lower but which generally have a lower rate of live births without prenatal care), mostly in microregions located between the "Mining Triangle" and the South.

4.2. Infant mortality rate, FHT coverage and live births without prenatal care

34 There is a close relationship between microregions that have a high IMR and those with a high rate of live births without prenatal care, as can be seen in the positive correlation in both 2002-2006 (r = 0,49) and 2007-2011 (r = 0,52). Therefore, as an indicator of PHC use, the absence of prenatal care is clearly implicit in the continuing high IMRs in some microregions (particularly microregions located in the Northeast of the state, which are the places where the highest rates are found for both indicators). However, there is also a close relation between microregions with high indices of FHT coverage and microregions with high IMR. Though this might seem contradictory, as it suggests that the FHTs are not solving the problem of spatial inequalities in infant mortality, the government's concern to reinforce services in microregions where the health needs are greater (as expressed by high infant mortality rates) is indeed a positive development. It should also be added that the improvement in health indicators, particularly avoidable mortality indicators, as is the case with most infant mortality, are conditioned by social factors that have to do with the context, and therefore does not always fall into the sphere of healthcare. This may explain regional inequalities in both infant mortality and access to PHC.

35 These results are in accordance with the study developed by Campos, Carvalho & Barcellos (2000) in Rio de Janeiro, which also demonstrated the importance of quality medical assistance in the reduction of IMR. Similarly, in other contexts, authors such as Frankenberg (1995); Starfield (2004); Macinko, Guanais & Souza (2006); Shi *et al.* (1999); Raselha *et al.* (2013); amongst others, have referred to the equivocal nature of the PHC in reducing infant mortality. Therefore, the expansion of the supply of FHTs has positively influenced both access/use of prenatal care and the reduction in IMR, though regional inequalities have persisted in these two indicators.

4.3. Territorial planning of PHC in Minas Gerais

36 Firstly, although efforts have been made to expand FHTs throughout the state, priority has been given to the most deprived microregions. This shows a concern with allocating resources in accordance with territorial inequalities. However, the provision

and coverage of services continues to be a concern, and there is no direct relationship between supply and use.

37　What is more, indicators that are not directly related to health also need to be taken into account. This is particularly true for infant mortality, as this is one of the health indicators that is most sensitive to social and economic inequalities, according to Goldani *et al.* (2001) and Navarro & Shi (2001). For this reason, the ISD was used, as a context indicator that is not directly related to health and thus may be able to explain the persistence of high IMRs in some microregions of Minas Gerais. This has been very productive, as the most deprived microregions are also those with the highest IMR and the highest indices of live births without prenatal care, despite having the highest indices of FHT coverage.

38　There was also a very slight alteration in the geography of social deprivation in Minas Gerais between 2002 and 2011. In fact, the scenario has remained practically unaltered, with the exception of an increase in the ISD in some microregions (for example, it can be seen in one microregion located in the North and another in the Northeast of the state) (Figure 4). This contradicts, or at least challenges, the claim that living conditions have improved in Brazil at the beginning of the 21st century. Certainly, there has been a reduction of poverty, as shown by the works of Hoffmann (2006) and Ravallion (2009), though perhaps this has not occurred for everyone, nor in every sector and region.

4.4. Sociomaterial deprivation, the PHC expansion policy (FHTs), prenatal access and spatial variations in IMR

39　Sociomaterial deprivation is an indicator that cuts across all the others, either determining them, as in the case of infant or prenatal mortality, or influencing health policy, as in the case of FHT expansion. In fact, microregions with a high ISD, particularly in the Northeast of the state, simultaneously present high IMRs, high levels of live births without prenatal care, and high FHT coverage. Pearson's correlation index showed a significant positive correlation between ISD and TMI (r = 0,47 and r = 0,60 with relation to the two periods analysed respectively) and between the ISD and the index of live births without prenatal care (r = 0,62 and r = 0,46, with relation to the two periods analysed respectively). Moreover, all the figures showed spatial concentrations in the microregions located in the Northeast of the state, which suggests that more effective contextualized and integrated interventions are required in these microregions as a long-term policy.

40　Interventions are also required to overcome obstacles preventing access to PHC facilities. The supply is almost universal in the microregions in the Northwest of the state, but these centres are still not being used effectively. In this situation, the ISD may be conceived as a mutable barrier relative to use, in accordance with the classification proposed by Santana (2005). It is relative to use because it reveals the conditions of greater or lesser deprivation that may be associated to the demand for services by the population; and it is mutable because it may be altered by effective and proactive public policies. It is well known, for example, that the population with the lowest income has the most clinically recognised needs, but also greater difficulties in using the services available [Ettner, 1996; Ecob &Smith, 1999; Santana, 1995; Butler *et al.* 2013; Verdom & Cao, 2011]. Even access to the free public service may be difficult for someone on a low income because of the expenses of travelling to the health centre and

acquiring the prescribed medicines, the mismatch between working hours and health centre attendance hours, etc. Level of schooling may also interfere in terms of the amount of information that can be received by these pregnant women, producing more health problems, as indicated by Grossman (1976) Kemma (1987). What is more, disinformation may also be used to inhibit access to the service [Godlee *et al.*, 2004].

41   Therefore, along the lines of work developed by Santana (2005), the ISD may also be conceived as an obstacle to access to services and a contextual determinant of health issues, such as infant mortality. This explains not only the spatial concentration of high IMRs in the microregions located to the Northeast of the state but also the low IMR levels in microregions between the "Mining Triangle", Belo Horizonte and South. Obviously, in these cases, there are other factors to be taken into account that are not directly related to health but determine it, such as deprivation itself. Hence, there is a need to integrate services and actions, associating policies that promote health territories to health promotion policies. In fact, the mere inclusion of the urbanization indicator shows the close relation between infant mortality, ISD and PHC cover. Less populous and less urbanized microregions are more deprived and have higher IMRs. Although there have been great efforts made to increase FHT cover, resulting in a cover index above 90%, in these an IMR of 16.6‰ has been found (referring to the average for the years 2007-2011). This value is not only above the state average of 13.1‰, but also above the value defined by the Millennium Development Goals [WHO, 2005] for this indicator (15.7‰ by 2015). Despite the relative proximity of the goal to be reached, there are some that consider, when we individualize the microregions located in the Northeast (Figure 1), we have indicators above 20‰. This is worryingly way off the desired goal.

42   In short, the most deprived microregions of the Northeast of Minas Gerais have higher indices of live births without prenatal care (an access indicator) and a higher IMR (a population health indicator), which suggests that a reduction of infant mortality will require an improvement in other contextual social indicators, such as education, housing and income. We can also conclude that the expansion of FHTs, as an isolated sectorial policy, cannot on its own respond to the complex health scenario, in relation to either health (morbidity and mortality) or access indicators. In this case, it is important to value the principle of intersectoriality in specific FHT actions [Brazil, 2012]. Therefore, this requires the integration of policies and sectors in public administration. This is perhaps the greatest challenge for the sector: to tailor and integrate its actions in order to respond to a complex health scenario.

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ABSTRACTS

Infant mortality has declined in Brazil in recent years, partly as a result of increased Primary Health Care (PHC) coverage and better access to it. However, there are still enormous regional

inequalities in these indicators, and therefore spatial variations in infant mortality. In a country like Brazil that is of continental proportions, it is important to analyse/assess health policies in the context of regional inequalities in order to ensure equity. This study thus aims to analyse the regional impacts of PHC and assess the importance of socioeconomic contexts upon infant mortality rates (IMRs) in the state of Minas Gerais. This is the fourth biggest state in Brazil, with a population of almost 20 million, distributed over 66 microregions. The IMR was assessed for the periods 2002-2006 and 2007-2011 in the 66 microregions, considering three operative dimensions:

i. indexes of families aided by PHC;

ii. indexes of prenatal care;

iii. and the Index of Sociomaterial Deprivation (ISD).

The data were collected from secondary official sources, and modelled on temporal and spatial scales defined and worked in a Geographical Information System. The ISD, which is a composite indicator used to express social and regional inequalities, was constructed on the basis of three indicators: i) illiteracy; ii) wages; and iii) homes without indoor bathrooms. The results showed a reduction in IMR in almost all the microregions of Minas Gerais between 2002-2006 and 2007-2011. However, there were inequalities in this decrease, with a continuing concentration of mortality in microregions with higher ISD. The expansion of PHC is more marked in the microregions with higher ISD, which is a positive sign from the Brazilian Health System. However, the expansion of these services as an isolated sectorial policy, though important, has not on its own been able to reduce the geographical inequalities in infant mortality in Minas Gerais. Hence, it is necessary to consider the social and economic contexts of families when attempting to improve indicators that go beyond mere healthcare intervention. In other words, infant health is the result of integrated public policies (eg. housing, employment/wages, education/training) and multi-level decisions and actions (local, municipal, regional, federal).

La mortalité infantile a diminué au Brésil au cours des dernières années, grâce, entre autres, à l'extension de la couverture et l'accès aux soins de santé primaires (SSP). Cependant, d'énormes inégalités régionales persistent en ce qui concerne ces deux derniers indicateurs qui ont un impact sur les variations spatiales de la mortalité infantile. Dans les pays de la taille d'un continent comme le Brésil, il est pertinent d'analyser / d'évaluer les politiques de santé dans le contexte des inégalités régionales, dans le but d'assurer plus d'équité. Ceci a motivé la présente étude, dont l'objectif est d'analyser les impacts régionaux du SSP, en incluant également l'analyse des contextes socio-économiques, sur le taux de mortalité infantile (TMI) dans l'État du Minas Gerais, au Brésil. Cet état est le quatrième plus grand État du Brésil, sa population s'élève à près de 20 millions d'habitants, répartis en 66 microrégions. L'analyse de TMI a été réalisée pour les périodes 2002-2006 et 2007-2011 dans chacune de ces microrégions, en relation avec trois dimensions opérationnelles de l'analyse:

i. le taux de familles assistées par SSP,

ii. les taux de couverture des soins prénataux

iii. et l'indice de défavorisation matérielle et sociale (IDMS).

Les données ont été recueillies à partir de sources secondaires officielles, adaptées à des échelles spatiales et temporelles définies et travaillées avec un Système d'Information Géographique. L'indice de défavorisation matérielle et sociale, indicateur composite utilisé pour exprimer les inégalités sociales et régionales, a été construit sur la base de trois indicateurs i) l'analphabétisme, ii) les revenus et iii) le nombre de ménages sans installations sanitaires au sein de leur foyer. Les résultats ont montré une baisse du taux de mortalité infantile dans presque toutes les microrégions du Minas Gerais, entre 2002-2006 et 2007-2011. Toutefois, on constate des inégalités dans cette baisse avec une mortalité plus forte dans les régions ayant un IDMS plus élevé. L'expansion des SSP est plus importante dans les régions qui possèdent un IDMS plus élevé, ce qui est un signal positif pour le Système de Santé brésilien. Cependant, l'expansion des SSP en

tant que politique sectorielle isolée, malgré son importance, n'est pas suffisante pour réduire les inégalités spatiales de la mortalité infantile à l'intérieur du Minas Gerais. Pour cela, il est nécessaire de prendre en compte le contexte social et économique des familles quand l'objectif est d'améliorer les indicateurs au-delà d'une simple intervention sanitaire. Pour le dire autrement, la santé de l'enfant est la résultante des politiques publiques intégrées (exemples : logement, emploi/revenu, éducation/instruction,) et des décisions et actions à différents niveaux (local, municipal, régional, fédéral).

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