

Brazilian Unified Health System - the first 30 years and prospects for the future: modelling study

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Abstract

In 1988, Brazilian Constitution defined health as a universal right and state responsibility. Progress towards universal health coverage (UHC) has been achieved through a Unified Health System (*Sistema Único de Saúde*, SUS) which was created in 1990. With successes and setbacks in the implementation of health programmes and organization of its health system, Brazil has achieved nearly-universal access to health services for her citizens. The trajectory of the development and expansion of the SUS offers valuable lessons on how to scale UHC in a health system in a highly-unequal country and relatively low resources. The analysis of the 30 years since the inception of SUS shows that innovations in the Brazilian health system extend beyond the development of new models of care and highlights the importance of establishing political, legal, organizational and management-related structures, and the role of the federal and local governments in the governance, planning, financing, and provision of health services. The expansion of SUS has allowed Brazil to rapidly address the changing health needs, with dramatic scaling up health service coverage in just three decades. However, despite its successes, analysis of future scenarios suggests the urgent need to address lingering geographic inequalities, insufficient funding, and the suboptimal private-public collaboration. Recent fiscal policies that ushered austerity measures, environmental, educational and health policies of the new administration introduced in Brazil could reverse the hard-earned achievements of the SUS and threaten its sustainability and its ability to fulfil its constitutional mandate of providing 'health for all'.

1. Introduction

The year of 2018 marks the 30th anniversary of Brazil's seventh Constitution,¹ 40th anniversary of Alma-Ata Declaration,² and the 70th anniversary of the Universal Declaration of Human Rights.³ In Brazil, the 1988 Constitution represented an instrument of change and a social movement that established health as a right of the Brazilian population, incorporating important elements of the Declarations of Human Rights and Alma-Ata in a social contract. It mandated the state's responsibility to deliver health care to all – paving the way to the Unified Health System (*Sistema Único de Saúde*, SUS). It also initiated the journey to universal health coverage (UHC) to improve health outcomes in a health system that was highly fragmented and characterized by wide inequities in access to healthcare and health outcomes.

Since its creation in 1990, the SUS has made consistent progress towards delivering universal and comprehensive healthcare to the Brazilian population to help reduce inequalities in health access and outcomes, but not without challenges.^{4,5} Nevertheless, currently, the SUS is at crossroads.^{6,7} Austerity measures introduced in 2016 (Constitutional Amendment 95) imposed a strict limit to the growth of public expenditures for the subsequent 20 years at a level based on the value of its previous financial year adjusted for inflation,⁸⁻¹¹ threatening further expansion and sustainability of the SUS (Figure 1 and appendix pp 2-5),⁶ with adverse consequences for equity and health outcomes.

The evolution of the Brazilian health system have been detailed elsewhere, and we provide a summary in the appendix (pp 2-5). This paper presents an overview of the first 30 years of the SUS, highlighting legal and organizational trajectories, achievements, and remaining challenges, followed by an analysis of future financing scenarios and associated health outcomes until 2030 (the target year for the Sustainable Development Goals (SDGs), to show the consequences of fiscal entrenchment for the Brazilian health system.

The remainder of this article is organized as follows. In the next section we briefly analyse the first 30 years of the SUS. This is followed by an analysis of the effect of fiscal restrictions or expansions of federal transfers of funds to municipalities on four selected health indicators until 2030, considering different scenarios. We then discuss the risks posed to the SUS by the new, fiscal, economic, environmental, education and health policies (e.g. for adolescents, and PHC) introduced by the new president Jair Bolsonaro and his administration on the achievements of the SUS and UHC, and explore policy options that need to be introduced to sustain the SUS.

2. 30 years of the SUS

Following the establishment of its principles in the 1998 Constitution and its creation in 1990, the legal mechanisms for the operationalisation and expansion of the SUS were progressively developed over 30 years (Figure 1 and appendix pp 2-5). Major health programs were launched to tackle persistent and emerging infectious diseases, high levels of maternal and child mortality, and new challenges driven by four important transitions (Table 1): (i) migration from rural to urban areas, leading disorganised growth of conurbations with limited infrastructure,¹² (ii) opening of the Amazon frontier in the 1980s,¹³ (iii) rapid demographic transition with declining total fertility (which fell from 4.4 in 1980 to 1.7, below replacement level, in 2015) and aging of the population,^{14,15} and (iv) epidemiological transition, with increases in mortality and morbidity from non-communicable diseases (NCDs).^{16,17}

Before SUS' creation there had been improvements in coverage of health interventions and reductions in health inequalities, but large variations remained in infrastructure, human resources, management capacity, and access to effective healthcare services in different municipalities.^{18,19}

Changes in Governance and Organization

Implementation of the SUS began after the enactment of Laws 8080 and 8142 in 1990, incorporating the principles of universality, integrality, decentralization and community participation, with transfer of responsibility and funds from federal to state and municipal governments to reorient political power and responsibility to lower levels of administration. Decentralization of power was accompanied by the creation of (*tripartite and bipartite*) inter-managerial commissions, with participation of federal, state and municipal governments for shared decision-making on health policies, and health conferences and councils as mechanisms for social participation (appendix pp 2-5).

Table 1: Summary of selected demographic, economic, and health system indicators, Brazil, 1990-2015

Demographic/Epidemiologic	1990	2000	2010	2015
Population, total	149,352,145	175,287,587	196,796,269	205,962,108
Population growth (annual %)	1.80	1.45	0.97	0.85
Population ages 65 and above (% of total)	4.04	5.07	6.73	7.96
Fertility rate, total (births per woman)	2.91	2.30	1.81	1.74
Life expectancy at birth, total (years)	65.34	70.02	73.77	75.20
Improved water source (%population with access)	88.5	93.5	96.9	98.1
Improved sanitation facilities (% population with access)	66.6	74.7	80.5	82.8
Mortality from cardiovascular disease, cancer, diabetes or chronic respiratory disease between exact ages 30 and 70 (%) ^(*)		25	19	17
Suicide mortality rate (per 100,000 population)		5.2	5.9	6.3
Mortality caused by road traffic injury mortality (per 100,000 people)		15.9	20.8	22.6
Neonatal mortality (per 1,000 live births)	25.7	17.1	10.4	8.2
Under-5 mortality (per 1,000 live births)	64.2	35.8	19.8	15.7
Infant mortality (per 1,000 live births)	53.4	31.3	17.7	14.0
Maternal mortality ratio (per 100,000 live births)	104	66	65	44
Prevalence of undernourishment (% population)		12	2.5	2.5
Prevalence of overweight, male (% male adults)	36.2	44.8	53	56.8
Prevalence of overweight, female (% female adults)	40.6	47	52.4	54.9
Economic	1990	2000	2010	2015
Unemployment, total (% of total labour force)		13.9	8.5	8.5
Population below international poverty line (US\$1.90/day) (%)		13.62	5.5	3.66
GDP (current US\$ thousands)	461,951,782	655,421,153	2,208,871,646	1,796,186,586
Health expenditure, total (% of GDP) ^(§)	6.7	7.0	8.3	8.3
Health expenditure per capita, (constant 2010 US\$) ^(†)	535.1	614.5	931.6	984.9
Health expenditure per capita, public (%) ^{(§)(†)}	43.1	40.3	45.8	46.0
Health expenditure per capita, private (%) ^{(§)(†)}	56.9	59.7	54.2	54.0
Out-of-pocket health expenditure (% private expenditure on health)		63.6	50.4	47.2
Private Insurance expenditure (% private expenditure on health)		34.3	47.0	49.7
GINI index (World Bank estimate)	60.5	58.4	52.9	51.3
Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)	21.6	11.6	4.7	3.4
Health System	1990	2000	2010	2015
Births attended by skilled health staff (% of total)	87.6	98.6	98.9	99.1
Immunization, BCG (% of one-year-old children)	79	99	99	99
Immunization, measles (% of children ages 12-23 months)	78	99	99	96
Immunization, DPT (% of children ages 12-23 months)	66	98	99	96
Immunization, Hib3 (% of children ages 12-23 months)		90	99	96
Immunization, Pol3 (% of one-year-old children)	58	99	99	98
Immunization, HepB3 (% of one-year-old children)		94	96	96
Antiretroviral therapy coverage (% people living with HIV)		27	38	57

Source: Data extracted from the World Development Report Database (World Bank) and the UN Sustainable Development Goals Database (UN).

^(§) Public and private health expenditure for 1990 based on Paim et al (2011).²⁰

^(†) Total health expenditures as % of GDP, out-of-pocket expenditure as a % of private health expenditure, and private insurance expenditure as % of all private health expenditure for all years, based on World Health Organization (2017).²¹

^(†) Estimated using information of GDP (constant 2010 US\$ mill) and population size provided by World Bank,²² and the information on HE as percentage of GDP.

^(*) Mortality from Cardiovascular Diseases (CVD), cancer, diabetes or Chronic Respiratory Disease (CRD) is the percent of 30-year-old-people who would die before their 70th birthday from any of cardiovascular disease, cancer, diabetes, or chronic respiratory disease, assuming that s/he would experience current mortality rates at every age and s/he would not die from any other cause of death (e.g., injuries or HIV/AIDS).

As part of the decentralization process, Brazilian municipalities were required to create an administrative structure (Municipal Health Department), and assume responsibility for co-financing of health programmes and delivery and management health services. Currently, the 5,570 municipalities of Brazil are responsible for the provision of primary health care (PHC) and health surveillance, and guarantee access to specialized and hospital care, including

emergency care and mental health.²³ Decentralization also involved the creation of health regions, development of guidelines for integrated health planning, and establishment of regional management boards, coordinated by State Health Secretariats in partnership with municipalities in their regions.²⁴

The expansion of universal access in Brazil has coincided with the evolution of a segmented health system, comprising a publicly-funded national single-payer system and a private sector accessed primarily by higher-income groups and paid by out-of-pocket payments and private insurance.^{25,26} In 1999, the National Agency for Health Surveillance (ANVISA) was established to control the quality of medicines, health products, and health services. In 2000, the National Agency for Supplemental Health (ANS) was created to regulate private insurance sector (appendix pp 2-5).

Changes in Financing

Since its creation the SUS has been underfunded. Brazil is the only country with a universal health system where public health expenditures are lower than private (Table 1). The public share of total health expenditure is 44% and the private sector's, which covers one quarter of the population, 56% (Panel 1).^{20,21} All citizens are entitled to the services provided by the SUS, which is the major source of health care for lower-income groups and those without access to private health plans, while higher-income groups utilise private sector (Panel 1) and typically revert to SUS for complex interventions such as cancer care.²⁷

The 1988 Federal Constitution stated that 30% of the social security budget, net of expenses with unemployment benefits, should be allocated to the public health sector by the federal government until the approval of the Annual Budget Law, which would establish the annual share of the federal budget directed to the public health sector (appendix pp 2-5). Although the law stipulates that the public funds to finance health should come from federal, state and municipal budgets, financing sources for the SUS have not been clearly defined in the social security budget, which as a result has been systematically allocated to other sectors. In 2000, a constitutional amendment (Figure 1 and appendix pp 2-5) defined the minimum levels of financing for each level of government as 15% of revenues for municipalities, 12% for States, and a federal share according to GDP growth.²⁸ Federal health spending in 2017 was 15% of net current revenue, but the newly introduced Constitutional Amendment 95 limits expenditure levels for 2018 and the next 20-years to 2017 spending levels adjusted for inflation.⁶

Panel 1: Financing and utilization of public and private sectors

The 1988 Federal Constitution acknowledges the role of the private sector in the Brazilian Health System. Families can deduct health expenditures from taxable income and employers can deduct the total amount paid as health benefits from their taxable profits. Non-profit providers are subsidized by federal government through tax exemptions. Altogether tax incentives for individuals, employers and not-for-profits represent around 30% of the federal health expenditures.²⁹

A benefit incidence analysis, which estimated utilization rates for each income quintile of the population multiplied by the average public expenditure of health service types, showed that those in lower income-quintiles received more health services from the SUS, and that public funds benefited primarily this when compared to higher income quintiles.²⁷ For inpatient, outpatient and dental services, health services utilization indicated a pro-poor pattern. Subsidies for these services were also pro-poor. The SUS was the major source of health care for those in lower income quintiles and those without access to private health insurance, although with significant regional differences. Access to private health insurance was lowest in the North (the poorest region) and highest in the South (the richest region).³⁰

Since 1998, several initiatives aimed to increase funding for the SUS (appendix pp 2-5), such as the creation of the Provisional Contribution on Financial Transactions (CPMF), which ensured allocation of around 30% of the federal budget to health between 1997 and 2007. CPMF stabilized funding from federal resources at the same level as that for 1995, with reductions in other social contributions (e.g., the Contribution for the Financing of Social Security – COFINS).³¹

Between 1989 and 2014, real per capita health expenditure increased by 149%, but the growth of public and private sectors was widely different at different time periods (Table 1). For example, in the 1990s, per capita health expenditures increased by 15%, mainly driven by growth in private sector expenditures, following the expansion of private health insurance coverage for the middle-income population groups who were dissatisfied with the quality of the SUS.^{32,33} However, between 2000 and 2014, when the growth of real per capita health expenditure was 60%, expenditures in the public system grew by 83% and in the private sector by 45%.

Changes in Healthcare Services

The implementation of the SUS marked a shift in the model of care in Brazil through rapid expansion of comprehensive PHC, with the development of health networks for mental health services, emergency care, and specialized out-patient services. The Community Health Workers Program (PACS – Programa de Agentes Comunitários de Saúde) was established in 1991 to service the poorest areas in the northeast region, followed by the Family Health Program (FHP) in 1994 which set standards for staffing levels for Family Health Teams (FHTs), comprising a general physician, a nurse, a nurse assistant and community health agents, providing acute services, health promotion, prevention, chronic disease management and maternal and child services. FHTs became the core of PHC in the SUS with major expansion in the subsequent years.³⁴ However, the SUS experienced inadequate staffing, hampering equitable expansion (Panel 2).

The number of FHTs progressively expanded from about 2,000 in 1998 (the first available data) to 42,975 in 2018 (the last update), increasing the provision of services from 7 to 130 million people (4% to 62% of Brazilian population respectively), incorporating more than 264,000 community health agents and 26,000 oral health teams.³⁵⁻
³⁷ In 2006, FHP was renamed Family Health Strategy (FHS) to reflect its role as the cornerstone of the public health system,³⁸ and in 2007 multiprofessional specialities, known as Family Health Support Teams (NASF), were established to support PHC.

Panel 2: Human Resources in the SUS

Since its inception, training of health workforce (from basic to higher educational level) and undergraduate health courses (regulated by the Ministry of Education) health professionals in the SUS has expanded rapidly. In 1990-2012, the number of nurses per 1000 people rose from 0.24 to 1.51 and doctors from 1.12 to 1.86.³⁹ In 2018 there were around about 2.9 million registered health professional (of which 1.1 [37.9%] had higher education [396,313 doctors, 251,777 nurses and 134,425 dentist]) around 2.3 million of which (79.3%) were linked to SUS.⁴⁰ Although in 1995-2017, the number of training positions for all health professions increased substantially⁴¹ shortages persist, especially in PHC, with high turnover, due to low salaries in the SUS, competition from the private sector..⁴²

Evidence suggests the expansion of the FHS improved population health, with reductions in morbidity and mortality levels.⁴³⁻⁴⁶ However, disparities in FHS coverage remain across income- and geographic-groups.³⁶ In order to address the shortage of doctors, disparities in coverage, and access to PHC services, the More Doctors Program (*Programa Mais Médicos*) was launched in 2013. The program increased the number of doctors working in PHC in 4,058 municipalities by 18,000, expanded PHC coverage by 15% (an additional 20 million people),⁴⁷⁻⁴⁹ enhanced quality of care and improved user satisfaction.⁵⁰

In addition to PHC, the SUS offers comprehensive hospital services, including complex treatments. Hospital beds in the SUS accounted for 76·1% of all hospital beds in Brazil in 2006, and 69·3% in 2017, but hospitals in the SUS face organizational challenges, such as lack of autonomy and accountability, inefficient financing and payment systems, inefficient use of resources, variable quality of care, lack of integration within health networks, and suboptimal management.⁵¹

Other changes in healthcare delivery in the SUS include the development of specialized reference centres and healthcare networks comprising PHC facilities and hospitals.^{52,53,54} For example, as part of the Psychiatric Reform process⁵⁵ there were pioneering innovations in mental health with the creation of community-based Centres for Psychosocial Support (CAPS). In addition, a network of emergency services have been established by bringing together ambulance services (SAMU) with centres that coordinate emergency response with hospitals (by monitoring occupancy levels in hospitals), and pre-hospital emergency services (UPA) (appendix pp 2-5).

Access to specialist care remains a major bottleneck, however, resulting in unmet demand, queues, long waiting times and delays in diagnoses⁵⁶, while supplier induced demand, overuse and excess use of diagnostics exacerbate the situation.⁵⁶ As a response, public and private sectors are developing integrated PHC, secondary care and tertiary care networks,⁵⁷ and introducing outsourcing and establishing public-private partnerships – for example with the OSS (*Organização Social de Saúde*) where the funding and facilities are public and management and staff are private.⁵¹

SUS has implemented several initiatives to better regulate health products, improve their availability and affordability, (Panel 3 and appendix pp 2-5) including the Generic Drugs Policy and an essential drugs list, and foster local production of strategic health products.⁵⁸ The national immunization programme was expanded to

provide 19 vaccines for 20 diseases – accounting for about 95% of all doses given to the population.⁵⁹ Access to essential medicines has increased over time,⁶⁰ with effect in reducing avoidable hospitalization and mortality.⁶¹ However, catastrophic expenditures for medicines is still a main cause of family budget overload, affecting mainly the low-income groups.⁶²

Judicialization of health – invoking the constitutional right to health, as a mechanism to compel the government to provide health products and services – has proved a challenge to medicines access.⁶³ Between 2008 and 2015 federal government funding for these claims rose from R\$70 million to R\$1 billion.⁶⁴ Most of these lawsuits were filed by private lawyers, representing one individual, for access to high-cost medicines not covered by the SUS for treating genetic diseases or cancer, raising equity concerns.⁶⁵ However, there are regional differences in judicialization of health, and in some regions individuals with lower-incomes are the majority of litigants, who use litigation as an instrument to improve access to care.^{66,67}

Panel 3: Strategies to expand access to medicines and better regulate health products

Several strategies were implemented to improve access to medicines in the SUS. These included the establishment of shared-responsibility among the three levels of government for funding, purchase and delivery of essential drugs, including low- and high-cost products,⁶⁸ implementation of CONITEC (a national commission for health technology assessment to support decisions of inclusion, exclusion and guidelines for the essential drugs list for the SUS),⁶⁹ and the Popular Pharmacy programme, in partnership with private drugstores, to provide free or subsidized-price medicines (appendix pp 2-5).^{70,71}

The SUS was a pioneer in providing free-access to HIV/AIDS medication in the 1990's, and in 2007, the federal government compulsorily licensed Efavirenz, an antiretroviral medicine for AIDS, to enable more affordable prices based on domestic production.⁷²

Since 2003, the Brazilian Health Regulatory Agency (ANVISA) has been responsible for regulating drug prices. From 2007 to 2017 the average price of medicines grew 64.7%, below the general inflation rate (82.3%) and other health products (120.3%).⁷³ An industry policy was established to reduce external dependency on new and high-cost

health technologies. Several public-private partnerships have been developed, using government's purchasing power to transfer technology and develop local capacity for production of medicines and vaccines.^{74,75}

Major achievements of the SUS

The SUS has contributed substantially to increased health service utilization, better health outcomes, and improved health equity.^{20,76} Compared to neighboring countries in Latin America, other upper-middle-income countries, and countries of the Organization Economic Co-operation and Development (OECD), Brazil has achieved large improvements in access to water and sanitation, immunization coverage, and life expectancy at birth (Figure 2).

Healthcare access and utilization has increased for the entire population (Table 2).⁷⁷ For example, based on the 2013 National Health Survey, among those who sought healthcare, about 95% received care the first time they sought it, a figure that has been largely consistent over time. These measures of access compare favourably to those observed in high-income countries.^{78,79}

Figure 2: Life expectancy, immunization and improved water and sanitation in Brazil, Latin America and English Caribbean (LAC), Upper Middle-Income Countries (UMIC), and OECD Countries, 1990 and 2015

Table 2: Trends in healthcare utilization. Brazil, 1998, 2003, 2008, and 2013

Indicators	1998		2003		2008		2013	
	All	SUS-only	All	SUS-only	All	SUS-only	All	SUS-only
Doctor visit <12 months	54·69	49·27	62·82	57·74	67·68	63·26	74·20	69·32
Any USC	71·22	68·55	79·27	78·14	73·64	72·39	77·07	76·03
USC= health post/centre	41·93	55·30	52·70	67·66	57·01	73·81	47·87	61·13
USC= hospital	34·58	33·92	27·07	24·87	21·47	18·15	21·03	20·34
USC=private/other	23·49	10·78	20·23	7·48	21·52	8·04	31·11	18·53
Sought service <2 weeks	12·99	11·14	14·59	12·86	14·50	12·90	17·54	15·96
Not treated first time	3·68	5·03	3·59	4·79	3·75	5·09	4·75	6·28
Hospitalized < 12 months	6·94	6·59	7·01	6·59	7·11	6·75	7·03	6·54
Dentist <2 years	51·76	44·83	57·83	51·52	64·93	59·19	63·69	58·19

Source: Results are weighted proportions from nationally-representative surveys conducted in 1998, 2003 and 2008 (National Household Survey - PNAD), and 2013 (National Health Survey - PNS). The 2013 survey altered some questions and used a different sampling strategy than previous national surveys. All within-group (ALL and SUS-only) time trends are statistically significant ($p < 0.01$), except hospitalizations, which showed no change for either group.

Expansion of PHC coverage, underpinned by the Family Health Programme then FHS, has led to large improvements in health outcomes^{34,43,45,46,80-82} with significant declines in infant mortality^{44,83,84}, avoidable hospitalizations,^{82,85,86} a reduction in racial inequality in mortality, and a fall in amenable mortality rates, especially in municipalities with stronger governance.⁸⁰

As with improvements in health outcomes, user satisfaction with the SUS has improved, though challenges remain. Figure 3 shows that, in 1998, the percentage of a user assessing hospital services as “better than average” ranged from 80.7% (North) to 87.7% (South) for the SUS, and from 89.4 (North) to 95.3% (Southeast) for private hospitals. In 2013, satisfaction with both the SUS and private hospital services declined, ranging from 69.4% (North) to 87.5% (Southeast) respectively for the SUS, and from 87.8% (Northeast) to 93.3% (South) respectively for private services

Figure 3: Percentage of self-assessed inpatient services as good or very good, by the SUS and private insurance Users. Brazilian regions, 1998 and 2013.

Source: PNAD 1998 and PNS 2013. Results from Poisson regression, controlling for demographics, socioeconomic status, health needs, private health plan coverage, region, survey design and weights.

3. Projected population health effects of changes in future financing of SUS

While the the SUS expanded access to health services accompanied by falling inequalities in population health indicators, its future performance is threatened by demographic, epidemiological, economic, political, and social transitions faced by Brazil (Table S2 in Supplementary Appendix).

To assess how these threats could affect four health indicators until 2030 (the target year for the SDGs), we considered four hypothetical scenarios of federal transfer of funds to municipalities. In the first, federal health transfers were maintained constant at the level of 2015 until 2030. In the remaining three scenarios, we assumed transfers would grow at the same rate as the GDP; specifically, 1% per year in the second scenario, 2% in the third, and 3% in the fourth. For each of the four scenarios, we simulated the performance of four health indicators (all SDG 3 targets) until 2030: (i) infant mortality rate (IMR), a commonly used measure of population health;⁸⁷ (ii)

proportion of births whose mother attended seven or more antenatal care (ANC) visits, a measure of preventive health services; (iii) FHS coverage, a measure of access to PHC; and (iv) amenable mortality (premature deaths under age 75 that could potentially be avoided, given effective and timely healthcare) due to cardiovascular diseases (CVD (the main cause of death in Brazil) among those aged 60 years or more (using ICD codes I05-I09, I15, I20-I25, and I60-I68 of the International Classification of Diseases, 10th revision),⁸⁸ a measure of quality of care.⁸⁹ We present in detail our methods, assumptions and robustness checks in the supplementary appendix (pp6-12).

Overall, increases in federal transfers were associated with reductions in IMR, higher coverage of the FHS, and more frequent ANC visits (table 3, columns 1, 4, and 7). Each 10% increase in federal transfers to municipalities was associated with an increase of 1.74 percentage points in FHS coverage, and an increase of 0.19 percentage points on frequent ANC visits. We replicated the most saturated regressions, adding interactions between federal transfers and dummies that indicate different municipality sizes. In the case of IMR (table 3, column 2) estimated effects were highest in the smallest municipalities and there were no significant differences between the effect of transfers in the first and second size categories. The magnitude of the effect decreased significantly in the municipalities in the third size categories and were not statistically different from zero in the fourth and fifth categories. An analogous pattern of larger effects for smaller municipalities was also observed for the FHS coverage (table 3, column 5) and for ANC visits (table 3, column 8). These results suggest that the subsidy from federal transfers are much more effective in smaller municipalities, which compared to larger municipalities, are more reliant on federal funds.

Since *Bolsa Família* is a programme that targets the poorest, and considering that benefit incidence analysis showed that public health services and public spending under the SUS benefit mostly the poor, we replicated the saturated model adding an interaction between federal health transfers and *Bolsa Família* coverage (table 3, columns 3, 6, and 9). Results showed that the effect of federal health transfers on IMR was much stronger when *Bolsa Família* programme coverage was higher, suggesting that in poorer regions the return of the federal health investments in tackling the infant mortality problem was higher. Similar results were observed for frequent ANC visits, one of the conditionalities of the *Bolsa Família* programme, namely, pregnant women must register in the prenatal care programme and follow the schedule of visits.

Table 3: Relationship between federal health transfers to municipalities and selected indicators

	Ln(IMR)			Proportion FHS coverage			Proportion ≥ 7 ANC visits		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(ft)	-0.027 (0.014)**	-0.288 (0.065)***	-0.004 (0.018)	0.174 (0.006)***	0.180 (0.007)***	0.173 (0.008)***	0.019 (0.003)***	0.035 (0.004)***	-0.009 (0.004)***
Ln(ft) * BF coverage			-0.110 (0.059)			0.005 (0.019)			0.137 (0.013)***
Ln(ft) * MunSize2		-0.052 (0.081)			0.011 (0.006)			0.004 (0.004)	
Ln(ft) * MunSize3		0.153 (0.069)**			0.008 (0.007)			0.003 (0.004)	
Ln(ft) * MunSize4		0.305 (0.065)***			-0.023 (0.007)***			0.003 (0.004)	
Ln(ft) * MunSize5		0.317 (0.065)***			-0.089 (0.008)***			-0.030 (0.004)***	
Observations	61,187	61,187	61,187	61,187	61,187	61,187	61,187	61,187	61,187
Municipalities	5,101	5,101	5,101	5,101	5,101	5,101	5,101	5,101	5,101

Notes: Standard errors shown in parenthesis, and clustered at the municipality level. Significance: 1% (***) and 5% (**). All regression models control for an interaction term between baseline levels and a linear time trend in the indicator, for year and municipal fixed-effects, for year and state fixed-effects, and for the variables Ln(municipal GDP per capita), *Bolsa-Familia* (BF) coverage (in % of the total population), private insurance coverage (in % of the total population), and political alignment between Mayor and Governor. Regressions for IMR and ANC are weighted by the municipal average number of births computed over the sample period.

Considering the absolute difference between the smallest (< 5,000) and the largest municipalities ($\geq 50,000$), simulated results indicated that, under scenario 1, the gap in IMR would move from 0.8 in 2015 to 1.2 points in 2030 (an increase of about 0.4 deaths/1,000 births), while under scenario 4 it the gap would move from 0.8 to -0.6 points (figure 4). Inequality in simulated IMRs was assessed through the use of the inequity ratio (a ratio between the IMR of smallest and the largest municipalities, which provides a measure of the relative gap in the regional distribution of the IMR);⁹¹ the ratio increased from 1.07 in 2015 to 1.10 in 2030. For scenarios 2, 3, and 4, the inequity ratio was, respectively, 1.049, 0.998, and 0.953, all lower than the 2015 ratio. Focusing on smaller municipalities, the ratio between the simulated IMR under scenario 1 and 4 was 1.14 for the smallest (< 5,000), and 1.17 for those with 5,000-9,999 inhabitants.

With regards to ANC visits, results showed that declines in the proportion of frequent ANC visits (≥ 7) would only be observed by 2030 under scenario 1, and these declines would be negligible for larger municipalities (figure 5A). Starting from a 2015 level of 0.7123, the proportion of frequent ANCs was simulated to reach 0.7122 for Brazil under scenario 1, and 0.725 under scenario 4. The inequity ratio between the smallest and the largest municipalities

was less pronounced than that observed for the IMR; it increased from 1·10 to around 1·11-1·12 for different scenarios.

Figure 4: Difference in IMR simulated outcomes between the smallest (< 5,000) and largest municipalities (≥ 50,000), by hypothetical scenarios, 2015-2030

The simulated effects on the FHS coverage were larger than those observed for frequent ANC visits. Regardless of the municipality size, coverage would be reduced under scenario 1 (figure 5B). Considering data for all municipalities, the proportion of the population covered by the FHS 2015 was 0·88, declining to 0·87 in scenario 1, and increasing to 0·94 in scenario 4. Municipalities with less than 20,000 inhabitants would bear the largest declines under scenario 1, and the largest increases under scenarios 2-4.

Figure 5: Difference between the 2030 simulated outcomes and 2015 levels, by municipality size and hypothetical scenarios

(A) Difference in proportion of births whose mother attended seven or more ANC visits **(B) Difference in proportion of FHS coverage**

Table 4 shows the results for CVD amenable mortality. The most saturated model (column 1) was not significant. Considering the capacity of the municipality to manage resources (IQIM), an interaction term between federal transfers and IQIM (column 3) indicated that the higher the capacity of the municipality to manage resources (higher IQIM), the higher the reduction in CVD amenable mortality under scenarios of larger federal transfers (figure 6). The point estimate of federal transfers remained stable when we added interactions with municipality size and coverage of the *Bolsa Família* program (column 5). Adding interactions between federal transfers and dummies that indicate different municipality sizes (column 4) revealed that smaller municipalities would bear the largest burden under a scenario of reduced federal transfers.

Table 4: Relationship between federal health transfers to municipalities and CVD amenable mortality among people aged 60 or more

	Ln(CVD of 60+)				
	(1)	(2)	(3)	(4)	(5)
Ln(ft)	0.019 (0.013)	-0.047 (0.016)***	0.393 (0.057)***	0.187 (0.047)***	0.346 (0.079)***
Ln(ft) * BF coverage		0.338 (0.059)***			0.208 (0.066)***
Ln(ft) * IQIM			-0.093 (0.014)***		-0.056 (0.016)***
Ln(ft) * MunSize2				-0.089 (0.053)	-0.093 (0.053)
Ln(ft) * MunSize3				-0.113 (0.049)**	-0.112 (0.049)**
Ln(ft) * MunSize4				-0.191 (0.047)***	-0.169 (0.048)***
Ln(ft) * MunSize5				-0.199 (0.047)***	-0.144 (0.048)***
Observations	60,088	60,088	60,088	60,088	60,088
Number of municipalities	5,032	5,032	5,032	5,032	5,032

Notes: Significant at 1% (***) and 5% (**). Standard errors clustered at the municipality level. All regression models control for an interaction term between baseline levels and a linear time trend in the indicator, for year and municipal fixed-effects, for year and state fixed-effects, and for the variables Ln(municipal GDP per capita), *Bolsa-Família* (BF) coverage (in % of the total population), private insurance coverage (in % of the total population), and political alignment between Mayor and Governor. Also, all models are weighted by the municipality average population with 60 years or more (municipality average computed over the sample period).

Figure 6: Difference between the 2030 simulated CVD amenable mortality and observed 2015 rates, by hypothetical scenarios, detailed by IQIM, and municipality size

4. Discussion: Looking ahead

In this study we analysed the first 30 years of the SUS, highlighting, major achievements and challenges (remaining and new), exploring the economic, political, demographic, and epidemiological contexts of Brazil at SUS' inception, and how these contextual changes facilitated or hindered its continued expansion. We constructed hypothetical scenarios of federal health transfers to municipalities that are likely to be affected by the changes in the socio-political context, and assessed how they affected the trend in four indicators: IMR, ANC visits, FHS coverage, and CVD amenable mortality. Our results indicate a deterioration of all four health indicators under a scenario of constant transfers. Most importantly, that deterioration was larger among smaller municipalities, exacerbating geographic inequalities, and thus reversing a recent trend of overall improvements.⁴

In 1990, the World Summit for Children adopted a target to reduce the 1990 IMR by one third, or to 70 per 1,000, whichever was the greater reduction, by the year 2000. Brazil registered a 42% decline in IMR between 1990 and 2000, surpassing the set target, and achieving an IMR of 27.6 per 1,000 in 2000. Brazil had the second best performance in reducing under-5 mortality during 1990-2006,⁹² and was among the few countries to meet the Millennium Development Goal 4 (MDG): reduce child mortality by two-thirds between 1990 and 2015.^{92,93} Moreover, after 1995, inequality in infant deaths between poorer and richer areas (which associated with the size of the municipality) started to decline, with those with the highest IMRs observing the largest declines.⁹⁴ However, results of our simulated scenarios show that the recent austerity measures are likely to reverse this declining trend, and, most importantly, worsen regional inequalities in IMR, penalizing the most vulnerable. Indeed, in 2016 infant mortality increased by 5%, compared to 2015; the first increase in this indicator since 1990.⁹⁵

Increased inequalities were also observed from the simulated scenarios of the FHS coverage and of the proportion of frequent ANC visits. The reduction of FHS coverage in smaller municipalities is likely to have a large effect, since they rely on the FHS to provide PHC to their population. Indeed, the benefits from the FHS for health outcomes was critical in smaller areas.³⁵ As for ANC, although modest in simulated magnitude, the results suggest that scenario 1 would contribute to increase the gap in access to ANC.

CVDs are the main causes of death in Brazil,⁸⁹ and between 1996 and 2007 a 20% decline was observed considering the age-standardised mortality rates, in part due to reduction in smoking rates and better access to PHC through the FHS.^{17,46,80} While a declining trend in CVD amenable mortality among people aged 60 years or more was observed between 2004 and 2015, on average rates declined about 6% during the period; in 2015, 598.8 amenable CVD deaths per 100,000 people aged 60 and above were observed. Declines in IMR and CVD mortality follow distinct pathways, however, mainly due to different risk factors, chronicity of conditions, and level of care where conditions are treated (e.g primary vs. secondary care). Treatment that can reduce CVD mortality, available through secondary care, is also likely to be more expensive, and not necessarily available in smaller and/or less wealthy municipalities. Although our simulated scenarios indicated small effects on CVD amenable mortality, increases in federal transfers were associated with mortality reductions in municipalities that have better quality of public sector management. Therefore, changes in federal transfers are likely to have an effect on IMR (directly associated with PHC), particularly in smaller municipalities, and on CVD amenable mortality (associated with both primary and secondary care), particularly in municipalities that have better capacity to manage resources.

Our study has some limitations. First, we use administrative data in our analysis, which may have underreporting. We accounted for possible underreporting in our models (appendix pp 6-8), we adjusted the CVD data for ill-defined causes of death, and we excluded 459 municipalities which had no information on federal health transfers (yet, those were very small municipalities, and unlikely to change the magnitude or direction of our results). Second, and most importantly, our simulated scenarios were not built to precisely quantify the effect of austerity measures, but to indicate likely trends in selected outcomes. Third, we argue that our results provide a very conservative picture of the effect magnitude of changes in the transfer of federal funds for health. In the case of IMR, Brazil is already at low levels, and thus further declines over time are not as sizeable as when the IMR was above 30.⁹⁶ The simulations held all other factors constant and varied only the federal health transfers per capita. It is likely that other social programs will be reduced or brought to an end following recent austerity measures; thus the negative impacts in infant mortality will probably be larger. Further, the likely reduction in the percentage of women that adhere to Brazilian recommendations of ANC visits under a scenario of restricted federal health transfers can affect maternal health, and consequently the rates of foetal and neonatal deaths,^{97,98} thus further increasing infant mortality. The reduction in the coverage of FHS directly impacts the provision of PHC, particularly in smaller municipalities, likely resulting in further increases in IMRs, as well as deterioration of other health outcomes.⁴⁴ In addition, reduced federal transfers per capita are likely to also affect services provided at the secondary care, which could compromise the provision of critical services needed to mitigate CVD-related conditions. Notwithstanding limitations, however, our findings are in line with other studies,⁹⁹ and with the newly released vital statistics and health indicators that point to increases, from 2015 to 2016, in infant, child, and maternal mortality, as well as a drastic reduction in vaccination coverage.⁹⁵

Although the SUS has undoubtedly contributed to improvements in health, and wellbeing of the Brazilian population and helped to reduce disparities these gains are fragile. Brazil is undergoing a major socio-political and economic transition, with an apparent shift to far-right populism and with many unknowns, testing democracy and threatening human rights which are likely to impact adversely not just on the SUS, but the disparities and the fabric of the society.

The new fiscal policy to end targeted funding of the federal budget to health and education, risks crowding out investments in these sectors.¹⁰¹ While the proposal of the Ministry of Health to further strengthen and expand access to PHC¹⁰² is encouraging, the government has also announced the end of cooperation with Cuban government for

More Doctors Program where of the 16 132 doctors working in the Program 52% were from Cuba. But 16% of, 21% of the positions have been abandoned and of those positions filled 40% were individuals already working in the SUS¹⁰², merely redistributing problems from one area to another.

The changes in relation to reproductive health and adolescents are particularly concerning. At a UN conference in March 2019, Brazil rejected the use of the expressions "including universal access to sexual and reproductive health care services" and "the exclusion of sexual and reproductive health care services from universal health coverage programs", as citing these policies may promote abortion.¹⁰³ In addition the government has banned drawing illustration from booklets distributed to adolescent that provide instructions on how to use condoms. In the same vein the Ministry of Women, Family and Human Rights declined to add the LGBTQ+ community as a group explicitly protected by its mandate, stating "diversity policies have threatened the Brazilian family", while the Ministry of Education has provided support to a controversial project, 'Schools Without Party', which promotes policies prohibiting teachers from encouraging students to engage in discussions on gender identity, diversity, sex education and politics¹⁰⁴. Combined, these policies will likely affect the health and wellbeing of adolescents in a setting where syphilis and other sexually transmitted infections are rising and underage pregnancy among the most vulnerable communities is a major challenge.

A new decree to modify the Disarmament Statute on the registration, possession and commercialization of firearms and ammunition¹⁰⁵ will lead to increased availability of guns in a country which has one of the highest levels of homicide and violent deaths in the world¹⁰⁶. The pipeline of policies is concerning for health. A working group established by the Ministry of Justice and Public Security is evaluating the convenience and opportunity of reduced tax on cigarettes manufactured in Brazil,¹⁰⁷ while several new bills and constitutional amendments are currently under discussion at the National Congress to eliminate or considerably reduce the restrictions of the environmental licenses for new infrastructure projects and other economic activities, and prevent demarcation of new indigenous and protected areas or even revoke existing ones to make way for the expansion of agribusinesses – policies that threaten to Brazil's environmental system.¹⁰⁸

Considering some of the current and possible future scenarios, we make six recommendations. First, the principles of the SUS should be maintained to ensure efficient, effective and equitable use of public resources. Universality, completeness, and free-care in the SUS are fundamental for progressing towards UHC in Brazil. However, the lack

of clear definitions and regulatory weaknesses for effective application of SUS principles results in the 'judicialization of health', with the Brazilian judiciary accepting individual demands and determining provision of health services and products that, in many cases, are not regularly offered by SUS, with consequent inequities.⁶⁶ To mitigate judicialization and ensure equity, national and local lists of health services and products offered by the SUS (with suitable assessment and priority setting) should be defined.

Second, sufficient public financing with its efficient allocation is critical for sustainability of the SUS. The recent austerity measures will exacerbate chronic underfunding of the SUS, leading to a health system that serves the poorest populations with poor quality of care, with worsening health outcomes, financial protection and inequities.

Third, health services should be delivered through an integrated network. The FHS model has improved health outcomes and reduced health inequalities in Brazil,^{44,83-86} but the lack of integration between primary, secondary and tertiary services, and suboptimal regulation of the private sector has produced fragmentation, redundancy or major gaps in health care. An integrated network of public and private health services, underpinned by strong PHC could enhance efficiency, effectiveness and access to health care for the entire population.

Fourth, a new inter-federative governance model should be developed. The expansion of SUS was possible due to the key role of municipalities in delivering health care. However, decentralization to local levels has financially and technically burdened municipalities with insufficient resources and capacity. New organizational forms are needed to improve coordination of health care at regional level, with a new federal pact between federal, state and municipal governments to promote a balance of power, roles, and responsibilities for managing regional healthcare networks. This governance framework should also consider inter-governmental equalisation transfers to reduce disparities among municipalities. Municipalities with smaller populations have lower revenues and higher dependence on intergovernmental transfers. Medium and large municipalities, have higher revenues, but attract lower intergovernmental transfers and on average use a higher proportion of their revenues for healthcare. Hence intergovernmental transfers to smaller municipalities to address existing inequalities should be from new sources, and should not disadvantage medium-sized municipalities.

Fifth, it is necessary to expand investments in the health sector and strengthen economic, technological, industrial and social policies and regulatory frameworks that affect the production and valuation of health technologies and services, including for intellectual property and to develop the health-industrial complex. Policies for training and

better allocation of human resources is critical to address health needs, and inequalities, along with better career paths for those working in the SUS.^{47,48}

Sixth, promotion of social dialogue as a strategy is critical for transforming the SUS based on the principle of right to health, and for learning from national and international experience on strengthening UHC. An open and honest debate and a broad dialogue among government actors, those working in the SUS, academia, and civil society is important to develop shared values and a vision to sustain the SUS.

The defence of health as a right, combined with creativity and the ability to overcome adversity, made the SUS an example of health system innovation for Latin America and a reference to the world. That legacy cannot (and should not) be squandered. Looking ahead, as the new context unfolds, critical assessments of the impact of new policies on health outcomes, disparities and the wellbeing of the society as a whole must be critically examined to assess the consequences of fiscal, economic, environmental, education and health policies on the Brazilian population.

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Figure 2

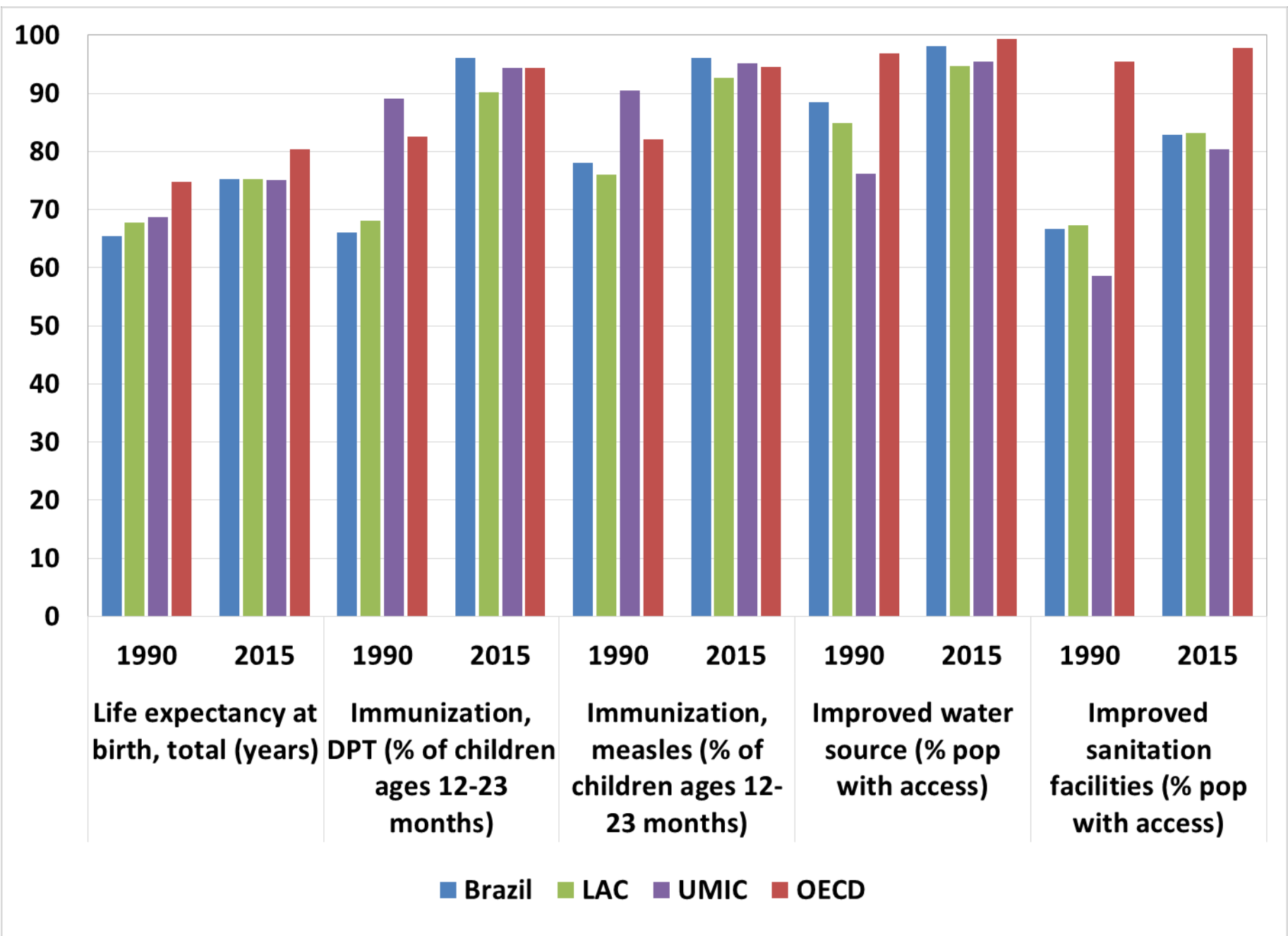


Figure 3

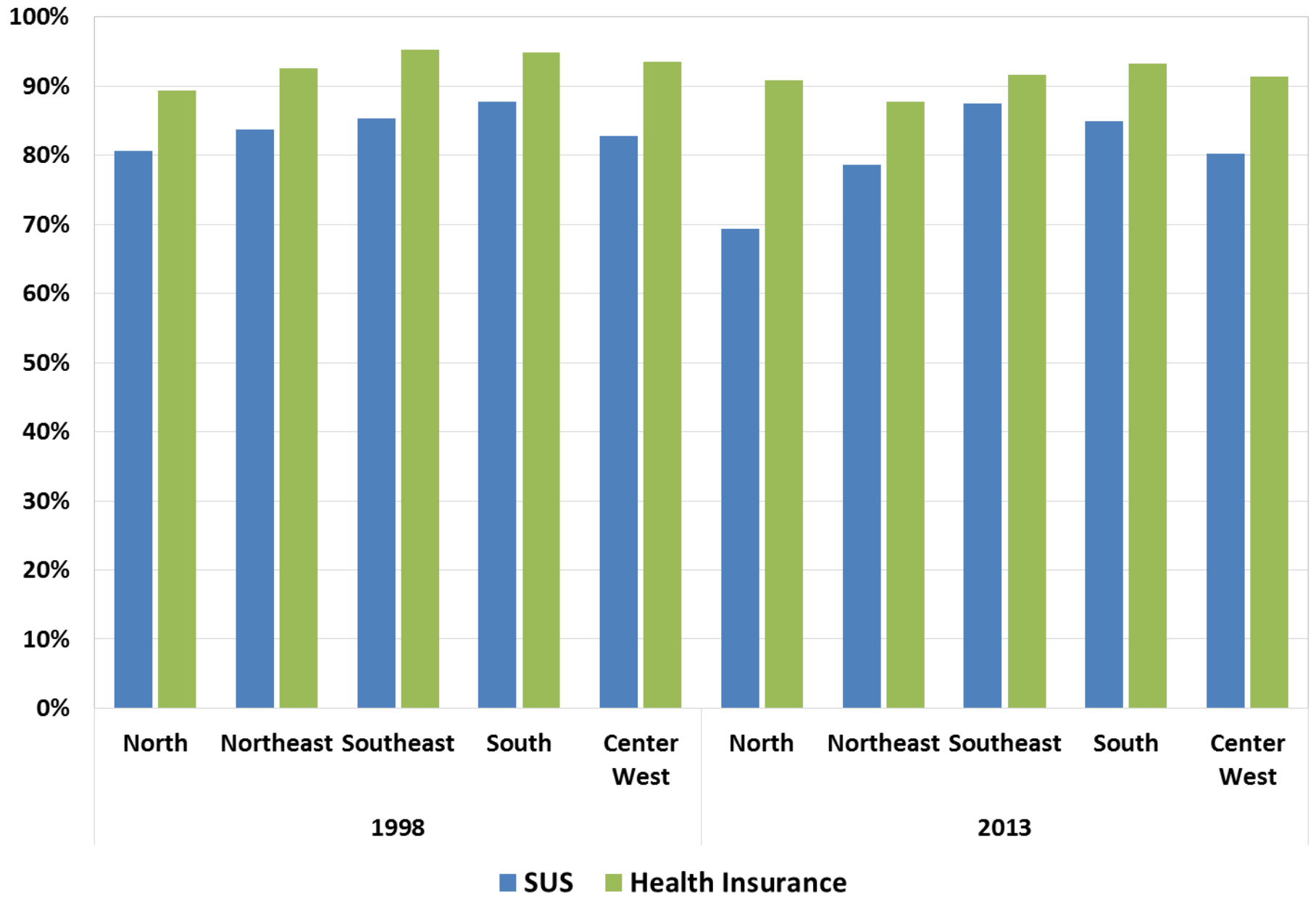


Figure 4

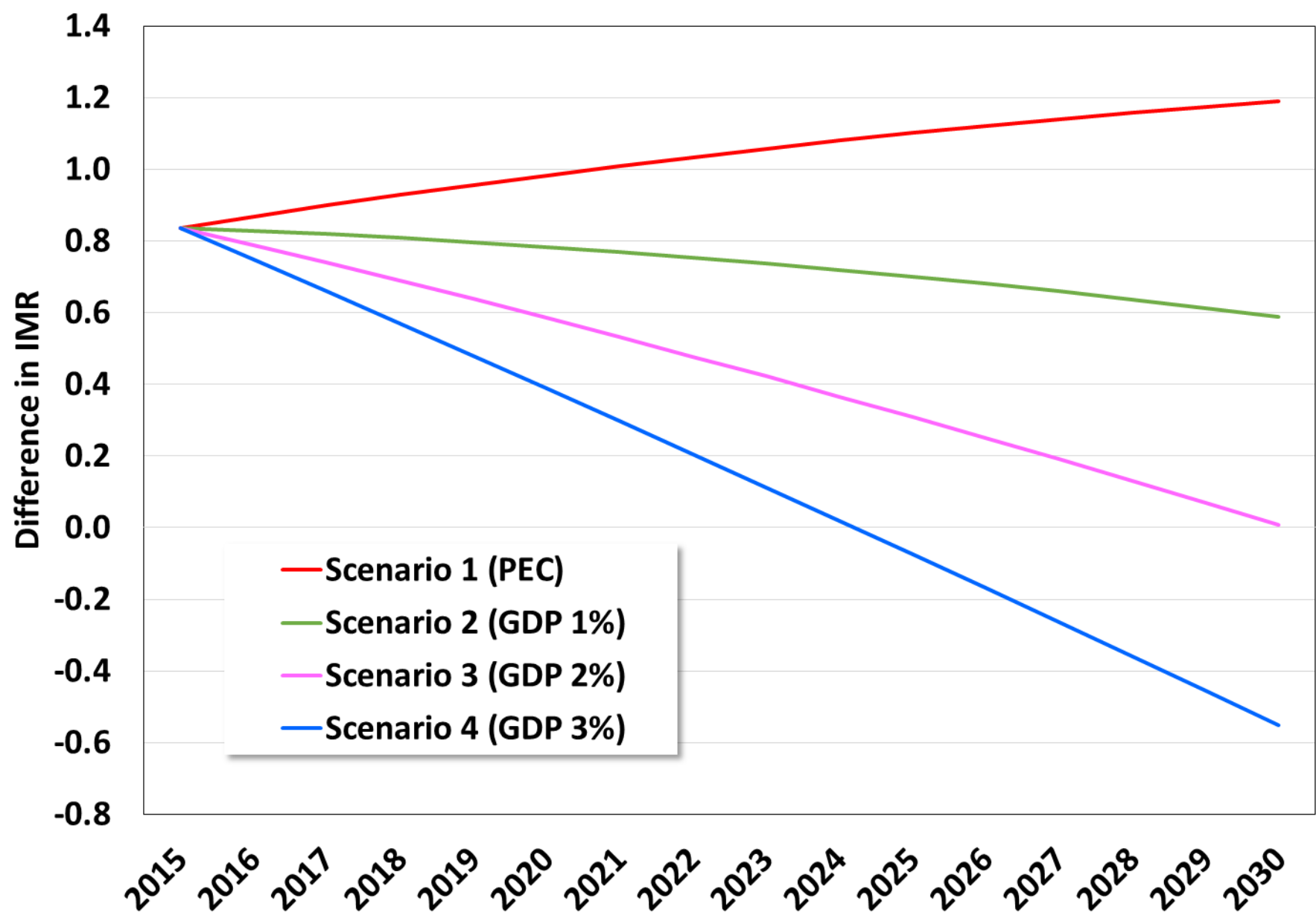


Figure 5a

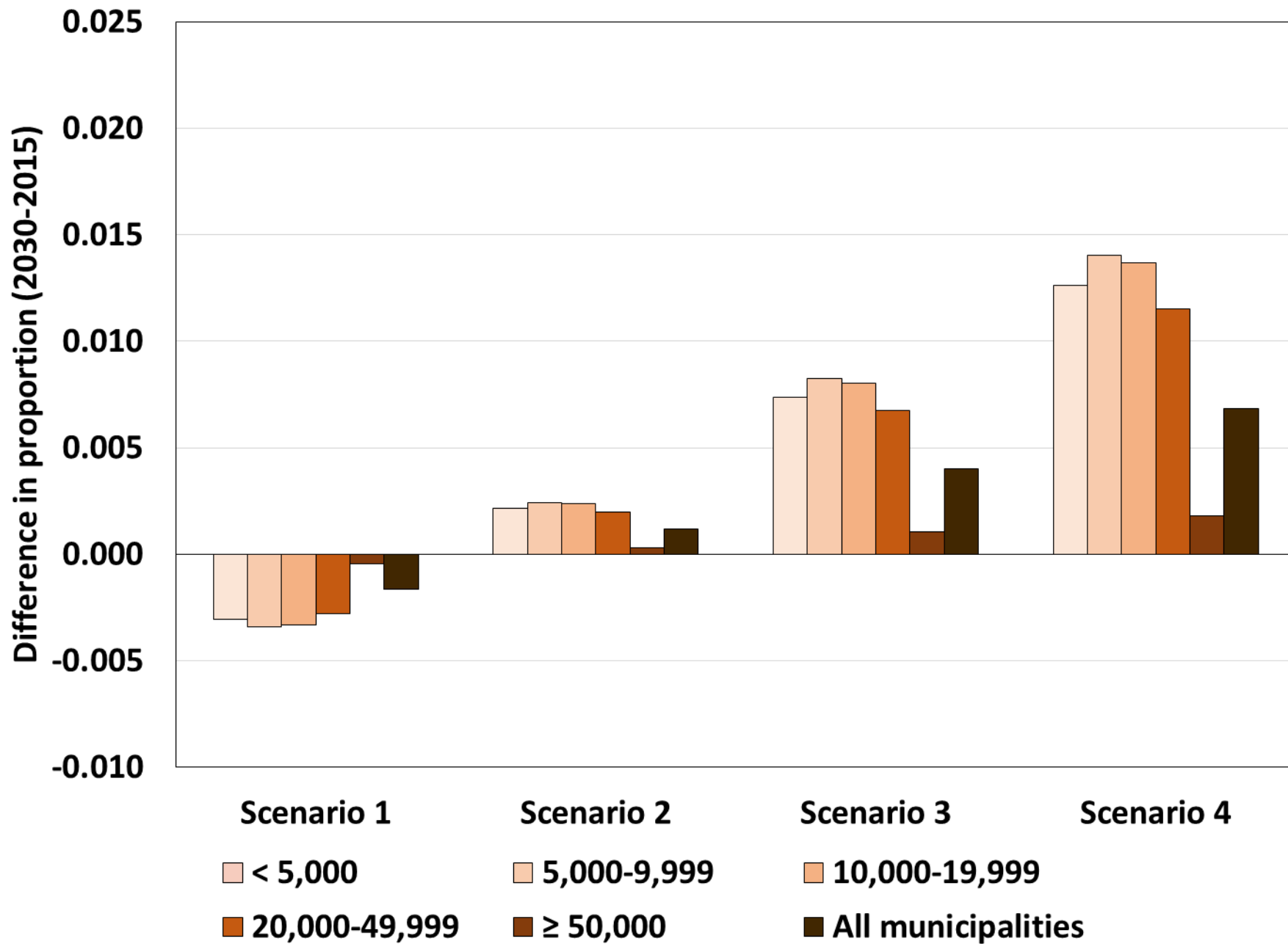


Figure 5b

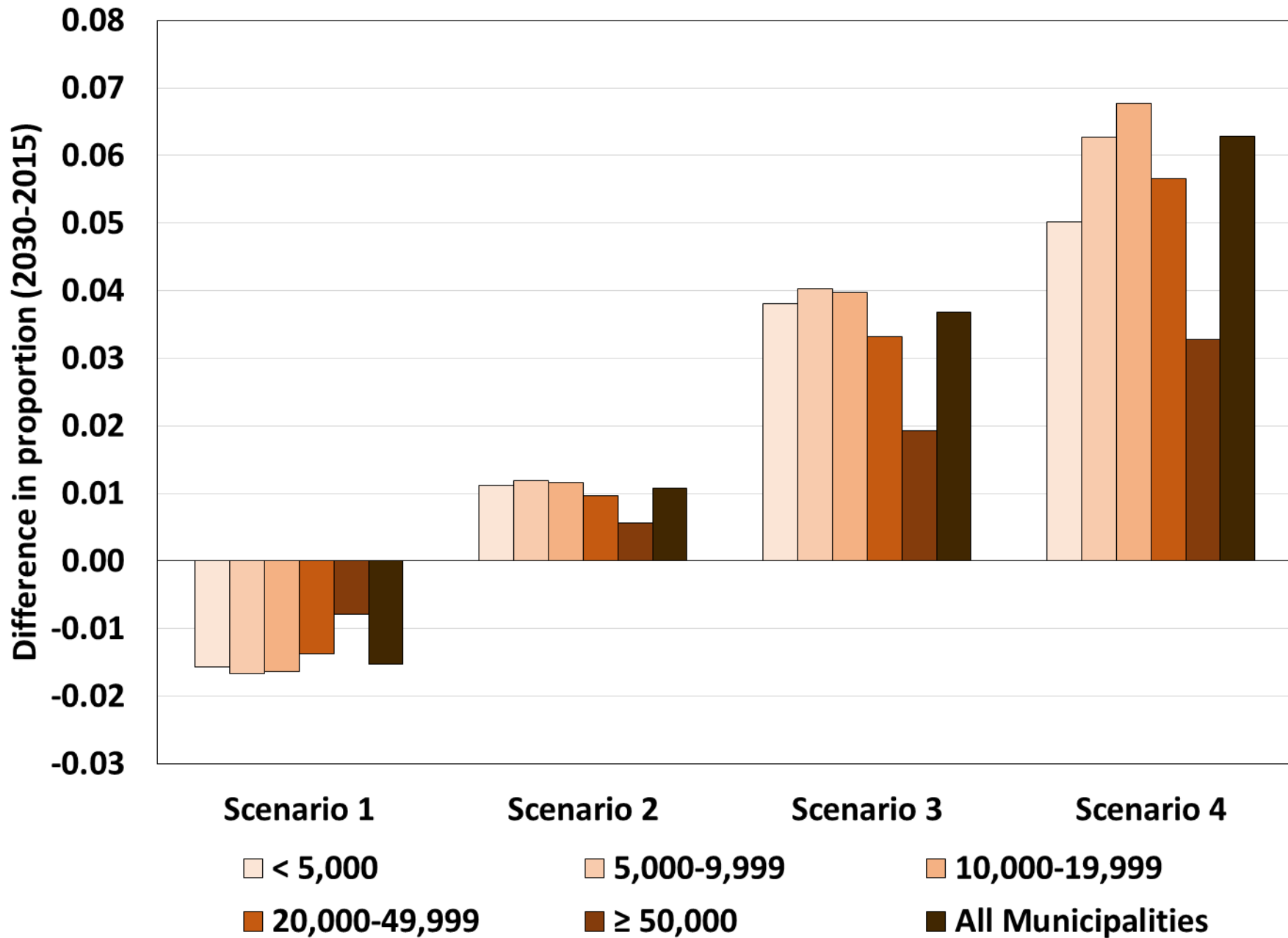


Figure 6

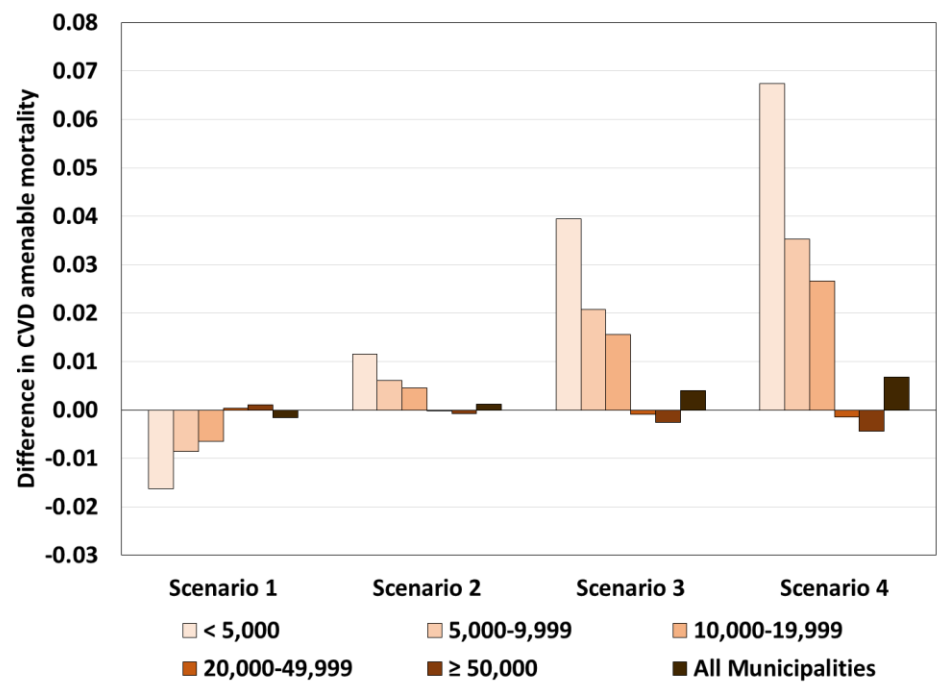
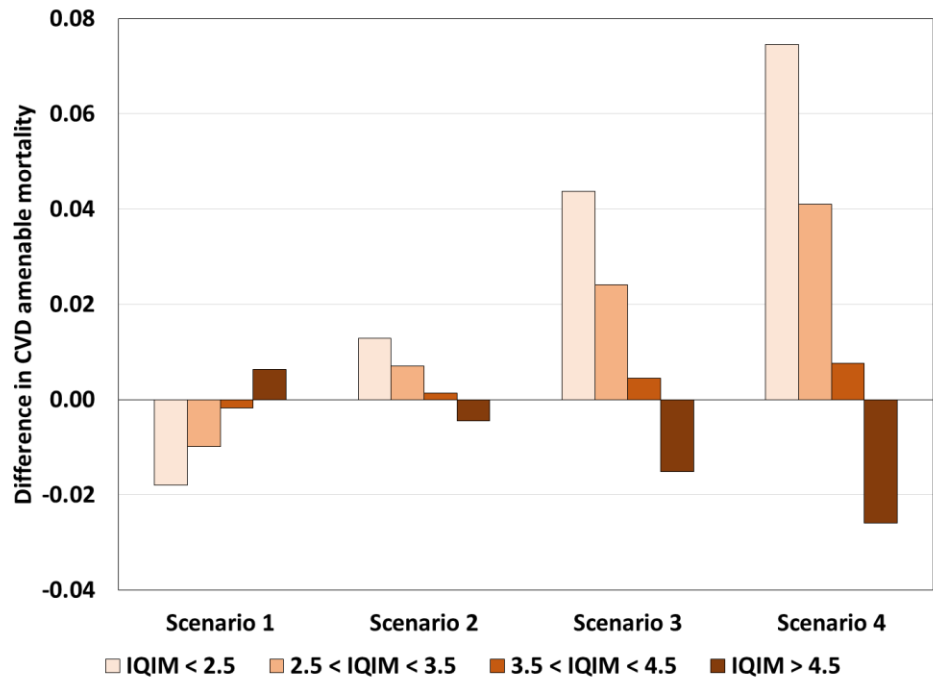


Figure 1: Timeline of major events related to the Brazilian Health System

	MAJOR POLITICAL (P), ECONOMIC (E), AND LEGAL EVENTS (L)	YEAR	MAJOR HEALTH AND HEALTH SYSTEMS EVENTS		
José Sarney (1985-1990)	(L) New constitution establishing health as a right and the government obligation to deliver health care	1985			
		1986	VIII National Health conference defining new health system principles and guidelines		
		1987			
		1988			
		1989			
Fernando Collor de Mello (1990-1992)	(L) Law establishing guidelines of the health system organization (SUS), social participation, and decentralization	1990	Creation of the SUS		
		1991	Transfer of federal resources to local levels; Community health agents program (PACS)		
		1992			
Itamar Franco (1993-1994)		1993	Rules for decentralization of health services to local levels and extinction of the Social Security National Institute of Social Assistance (INAMPS)		
		1994	Family Health Program		
Fernando Henrique Cardoso (1995-2002)	(E) Temporary Tax on Financial Transactions to finance public health (CPMF)	1995	SUS National Audit System (DENASUS)		
		1996	Access to HIV/AIDS medication free at the point of delivery		
		1997	National waitlist for transplant of organs under the SUS		
		1998	Financial transfers from federal to municipal government to finance the Family Health Program (PAB)		
		1999	National Health Surveillance Agency (ANVISA)		
		2000	National Health Plan Regulation Agency (ANS)		
		2001	Psychiatric reform Law establishing the rights for mental health patients and guidelines for treatment		
		2002			
		Luiz Inácio Lula da Silva (2003-2010)	(L) Law establishing the national program for food access (<i>Fome Zero</i>) (L) Law creating the conditional cash transfer program (<i>Bolsa Família</i>) to target poverty and improve health and education	2003	Human Resources, Science & Technology, Strategic & Participation, and Health Surveillance Secretariat added to Ministry of Health structure
				2004	National ambulance service (SAMU); Smile Brazil program - offer preventive and curative dental care; Farmacia Popular Program of subsidized medicines
2005					
2006	National Policy on Primary Care (PNAB); National Policy in Health Promotion; National Policy for Tobacco Control; Pact for Health and the SUS governance; Expansion of Farmacia Popular to partner with private network pharmacies				
2007	National policy on alcohol and driving under the influence				
2008	Emergency Units (UPA) established				
2009					
2010	Indigenous Health Department added to the Ministry of Health structure				
Dilma Rouseff (2011-2016)	(L) Federal smoke ban legislation; Law for incorporation of health technologies; (E) Legislation establishing new rules for health system governance			2011	National program to improve quality of primary care (PMAQ); Free access to some medications, at the point of delivery; Regional health services network

Michel Temer (2016-present)	Law defining health expenditures	2012	SUS performance index
		2013	More Doctors program (<i>Mais Médicos</i>)
	(E) Recession started	2014	
	Federal Law allowing foreign investment in health care	2015	
	(P) President Rousseff impeached	2016	
	(E) Austerity measures established by President Temer	2017	Health financing budget unified (all levels of care consolidated)
		2018	