Brazil's unified health system: the first 30 years and prospects for the future

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In 1988, the Brazilian Constitution defined health as a universal right and a state responsibility. Progress towards universal health coverage in Brazil has been achieved through a unified health system (Sistema Único de Saúde [SUS]), created in 1990. With successes and setbacks in the implementation of health programmes and the organisation of its health system, Brazil has achieved nearly universal access to health-care services for the population. The trajectory of the development and expansion of the SUS offers valuable lessons on how to scale universal health coverage in a highly unequal country with relatively low resources allocated to health-care services by the government compared with that in middle-income and high-income countries. Analysis of the past 30 years since the inception of the SUS shows that innovations extend beyond the development of new models of care and highlights the importance of establishing political, legal, organisational, and management-related structures, with clearly defined roles for both the federal and local governments in the governance, planning, financing, and provision of health-care services. The expansion of the SUS has allowed Brazil to rapidly address the changing health needs of the population, with dramatic upscaling of health service coverage in just three decades. However, despite its successes, analysis of future scenarios suggests the urgent need to address lingering geographical inequalities, insufficient funding, and suboptimal private sector–public sector collaboration. Fiscal policies implemented in 2016 ushered in austerity measures that, alongside the new environmental, educational, and health policies of the Brazilian government, could reverse the hard-earned achievements of the SUS and threaten its sustainability and ability to fulfil its constitutional mandate of providing health care for all.

Introduction

2018 marked the 30th anniversary of Brazil's seventh constitution,[1] the 40th anniversary of the 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 Declaration of Human Rights and the Alma-Ata Declaration into the social contract. The constitution 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, with the aim of improving health outcomes in a health system that was highly fragmented and characterised by wide inequities in access to health care and health outcomes.

Since its creation in 1990, the SUS has made consistent progress towards delivering universal and compre-hensive health care to the Brazilian population, helping to reduce inequalities in health-care access and the achievement of better outcomes, but not without challenges.[4,5] Despite the successes, the SUS is now at a crossroads.[6,7] Austerity measures introduced in 2016 (Constitutional Amendment 95) imposed a strict limit on the growth of public expenditure until 2036 at an amount based on the value of its previous financial year adjusted for inflation,[8,9] threatening further expansion and sustainability of the SUS (appendix pp 2–5),[6] with adverse consequences for equity and health outcomes.

In this Health Policy, we present an overview of the first 30 years of the SUS (appendix pp 2–5), highlighting legal and organisational trajectories, achievements, and remaining challenges, followed by an analysis of future financial scenarios and associated health outcomes until 2030 (the target year for the UN Sustainable Development Goals) to show the consequences of fiscal entrenchment for the Brazilian health system.

The fiscal, economic, environmental, education, and health policies (eg, for adolescents and primary health care [PHC]) introduced by the Bolsonaro administration in 2019 pose a number of risks to the SUS. We discuss these threats and explore policy options that need to be introduced to sustain the SUS.

30 years of the SUS

Following the establishment of its principles in the 1988 Constitution and its creation in 1990, the legal mechanisms for the operationalisation and expansion of the SUS were progressively developed over 30 years (appendix pp 2–5). Major health programmes were launched to tackle persistent and emerging infectious diseases, high maternal and child mortality (table 1), and new challenges driven by four important transitions: first, migration from rural to urban areas, leading to disorganised growth of municipalities with limited infrastructure;[10] second, opening of the Amazon frontier in the 1980s;[11] third, rapid demographic transition with declining total fertility (which fell from 4·4 births per woman in 1980 to 1·7 births per woman below replacement level in 2015) and the ageing population;[12,13] and, fourth, epidemiological transi-tion, with increases in mortality and morbidity from non-communicable diseases.[14,15]

The SUS helped to achieve a narrowing of health inequalities with improvements in coverage and access to health care across the country, but large variations

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See **Online** for appendix

	1990	2000	2010	2015
Demographic and epidemiological indicators				
Total population (n)	149 352 145	175 287 587	196 796 269	205 962 108
Annual population growth (%)	1·80%	1·45%	0·97%	0·85%
Proportion of population aged 65 years or older (%)	4·04%	5·07%	6·73%	7·96%
Total fertility rate (births per woman)	2·91	2·30	1·81	1·74
Life expectancy at birth (years)	65·34	70·02	73·77	75·20
Access to water sources (% of population)	88·5%	93·5%	96·9%	98·1%
Access to sanitation facilities (% of population)	66·6%	74·7%	80·5%	82·8%
Mortality due to non-communicable diseases between 30 years and 70 years of age (%)*	NR	25%	19%	17%
Mortality due to suicide (per 100 000 population)	NR	5·2	5·9	6·3
Mortality due to road traffic injury (per 100 000 people)	NR	15·9	20·8	22·6
Neonatal mortality (per 1000 livebirths)	25·7	17·1	10·4	8·2
Mortality in children aged 5 years or younger (per 1000 livebirths)	64·2	35·8	19·8	15·7
Infant (birth to 1 year) mortality (per 1000 livebirths)	53·4	31·3	17·7	14·0
Maternal mortality ratio (per 100 000 livebirths)	104	66	65	44
Prevalence of undernourishment (% of population)	NR	12%	2·5%	2·5%
Prevalence of overweight				
In men (%)	36·2%	44·8%	53·0%	56·8%
In women (%)	40·6%	47·0%	52·4%	54·9%
Economic indicators				
Unemployment (% of total labour force)	NR	13·9%	8·5%	8·5%
Poverty headcount ratio at US$1·90 a day (2011 purchasing power parity; % of population)	21·6%	11·6%	4·7%	3·4%
GDP (million $)	461 952	655 421	2 208 872	1 796 187
Total health expenditure (% of GDP)†	6·7%	7·0%	8·3%	8·3%‡
Health expenditure per capita (constant 2010 $)§	535·1	614·5	931·6	984·9‡
Health expenditure per capita†¶				
Public (%)	43·1%	40·3%	45·8%	46·0%‡
Private (%)	56·9%	59·7%	54·2%	54·0%‡
Out-of-pocket health expenditure (% private expenditure on health-care services)	NR	63·6%	50·4%	47·2%‡
Private insurance expenditure (% private expenditure on health-care services)	NR	34·3%	47·0%	49·7%‡
Gini index (World Bank estimate)	60·5	58·4	52·9	51·3
Health-system indicators				
Births attended by skilled health staff (% of total)	87·6%	98·6%	98·9%	99·1%
Vaccine coverage				
BCG (% of 1-year-old children)	79%	99%	99%	99%
Measles (% of children aged 12–23 months)	78%	99%	99%	96%
Diphtheria, pertussis, and tetanus (% of children aged 12–23 months)	66%	98%	99%	96%
Haemophilus influenzae type b, third dose (% of children aged 12–23 months)	NR	90%	99%	96%
Polio, third dose (% of 1-year-old children)	58%	99%	99%	98%
Hepatitis B virus, third dose (% of 1-year-old children)	NR	94%	96%	96%
Antiretroviral therapy coverage (% of people with HIV)	NR	27%	38%	57%

Data were extracted from the World Development Indicators database[16] and the UN Sustainable Development Goals Database.[17] NR=no record. GDP=gross domestic product. *Percentage 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 they would experience current mortality rates at every age and would not die from any other cause (eg, injuries or HIV and AIDS). †Estimates for all years are based on WHO Global Health Observatory data (2017).[18] §Data are from 2014. ‡Estimated using GDP (constant 2010 US$ millions) and population size provided by World Bank,[19] and health expenditure as percentage of GDP. ¶Public and private health expenditure estimates for 1990 are based on Paim et al (2011).[20]

Table 1: Demographic, economic, and health-system indicators in Brazil from 1990 to 2015

remained between municipalities regarding the infra-structure, human resources, management capacity, and access to effective health-care services.[21,22]

Changes in governance and organisation

Implementation of the SUS began after the enactment of Laws 8080 and 8142 in 1990, incorporating the principles of universality, integrality, decentralisation, and community participation, with the transfer of responsibility and funds to provide health care from the federal to state and municipal governments, reorienting political power and responsibility to local governments. Decentralisation of power was accompanied by the creation of tripartite and bipartite inter-managerial commissions, with the participation of federal, state, and municipal governments for shared decision making on health policies, and health conferences and councils as mechanisms for social participation (table 1; appendix pp 2–5).

As part of the decentralisation process, Brazilian municipalities were required to create a health department for administration of the health-care facilities, and assume the responsibility for the cofinancing of health programmes and the delivery and management of health-care services. The 5570 municipalities of Brazil are responsible for the provision of PHC and health surveillance and guarantee patient access to general and specialised hospital care, including emergency care and mental health services.[23] Decentralisation also involved the creation of health regions (a contiguous group of cities and towns with shared social, economic, and infrastructure context with the purpose of integrating the organisation and planning of health-care services and actions), the development of guidelines for integrated health planning, and the establishment of regional management boards, coordinated by state health secretariats in partnership with municipal authorities.[24]

The expansion of universal health-care 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 health-care system, accessed primarily by patients with a high income and paid by out-of-pocket payments and private insurance (panel).[25,26] In 1999, the National Agency for Health Surveillance was established to control the quality of medicines, health products, and health services. In 2000, the National Agency for Supplemental Health was created to regulate the 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 expenditure (around 44%) is lower than private sector expenditure (around 56%; table 1).[18,19] All citizens are entitled to the services provided by the SUS, which is the major source of health care for low-income groups and those without access to private health plans.

Panel: The financing and use of public and private sectors in health care

The 1988 Federal Constitution of Brazil acknowledges the role of the private sector in the 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 health-care providers are subsidised by the federal government through tax exemptions. Altogether, tax incentives for individuals, employers, and not-for-profits represent around 30% of the federal government health expenditure.

A benefit incidence analysis, which estimated health-care use for each income quintile of the population multiplied by the average public expenditure of health service types, showed that those in low-income quintiles received more health services from the Sistema Único de Saúde (SUS), and that public funds primarily benefited this group when compared with higher income quintiles. For inpatient, outpatient, and dental services, estimates of health service use indicated a benefit to poorer populations. Subsidies for these services were also pro-poor. The SUS was the major source of health care for those in low-income quintiles and those without access to private health insurance, although with substantial regional differences. Access to private health insurance was lowest in northern Brazil (the poorest region) and highest in southern Brazil (the richest region).

Patients with a high income will often use private sector services but switch to the SUS for complex interventions, such as cancer care.[27]

The 1988 Federal Constitution of Brazil stated that 30% of the social security budget, minus the cost of unemployment benefits, should be allocated to the public health sector by the federal government until the approval of the Annual Budget Law, which established the annual share of the federal budget directed to the public health sector (appendix pp 2–5). The Brazilian Constitution stipulates that the public funds to finance health care should come from federal, state, and municipal government budgets; however, financing sources for the SUS have not been clearly defined in the social security budget and this funding has systematically been allocated to other sectors. In September, 2000, a constitutional amendment (appendix pp 2–5) defined the minimum amount of health-care funding as 15% of yearly revenue for municipalities, 12% for states, and a federal share according to gross domestic product growth.[28] Federal health-care spending in 2017 was 15% of net revenue, but Constitutional Amendment 95, introduced in 2016, limits expenditure for 2018–36 to the amount in 2017, with spending adjusted for inflation.[6]

Since 1998, several initiatives that aimed to increase funding for the SUS have been developed (appendix pp 2–5); for example, the creation of the Provisional Contribution on Financial Transactions tax ensured the allocation of around 30% of the federal budget to health-care services between 1997 and 2007. The tax stabilised health-care funding from federal resources at the same amount as that for 1995, with reductions in other social contributions (eg, the Contribution for the Financing of Social Security).[29]

Between 1989 and 2014, real health expenditure per capita increased by 149%, but the growth of both the public and private health-care sectors was widely different

at different time periods (table 1). For example, in the 1990s health expenditure per capita increased by 15%, mainly driven by a growth in private sector expenditure following the expansion of private health insurance coverage for the middle-income population groups who were dissatisfied with the quality of the SUS.[30,31] However, between 2000 and 2014, when the growth of health expenditure per capita was 60%, expenditure in the public sector health-care system grew by 83% compared with 45% growth in the private sector (table 1).

Changes in health-care services

The implementation of the SUS marked a shift in the model of health care through the rapid expansion of comprehensive PHC centres and the development of health networks for mental health services, emergency care, and specialised outpatient services. The community health workers programme was established in 1991 to service the poorest areas in northeastern Brazil, followed by the family health programme in 1994, which set standards for staff numbers for family health teams, comprising a general physician, a nurse, a nurse assistant, and community health agents, which provide acute services, health promotion, disease prevention, chronic disease management, and maternal and child services. Family health teams became the core of PHC in the SUS with major expansion in the subsequent years.[32] However, the SUS had inadequate staffing, hampering equitable expansion.

The number of family health teams progressively expanded from about 2000 in 1998 (the first available data) to 42 975 in 2018,[33] increasing the provision of services from 7 million (4% of the population) to 130 million (62% of the population) people, incorporating more than 264 000 community health agents and 26 000 oral health teams.[34–36] In 2006, the family health programme was renamed the Family Health Strategy (FHS) to reflect its role as the cornerstone of the public health system,[37] and in 2007 multiprofessional specialties, known as family health support teams, were established to support PHC teams.

Evidence suggests that the expansion of the FHS improved the health of the population, with reductions in morbidity and mortality.[38–41] However, disparities in FHS coverage remain across income and geographical groups.[35] To address the shortage of doctors, disparities in coverage, and access to PHC services, the More Doctors programme (Programa Mais Médicos) was launched in 2013. The programme increased the number of doctors working in PHC in 4058 municipalities by 18 000, expanded PHC coverage to include a further 15% of the Brazilian population (an additional 20 million people),[42–44] and enhanced the quality of care and improved patient satisfaction.[45]

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, which declined slightly to 69·3% of beds in 2017, but hospitals in the SUS face organisational challenges, such as a 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.[46]

Other changes in health-care delivery by the SUS include the development of specialised reference centres and health-care networks comprising PHC facilities and hospitals.[47–49] For example, the psychiatric reform process[50] included pioneering innovations in mental health services with the creation of community-based centres for psychosocial support. In addition, an emergency services network has been established by bringing ambulance services, emergency response coordinators that monitor hospital occupancy, and pre-hospital emergency services together (appendix pp 2–5).

However, access to specialist care remains a major bottleneck resulting in unmet demand, queues, long waiting times, and delays in diagnoses. Additionally, supplier-induced demand, overuse, and excess use of diagnostics exacerbate the situation.[51] As a response, the public and private sectors are developing integrated PHC, secondary care, and tertiary care networks,[52] and introducing outsourcing and establishing public–private sector partnerships, such as the Brazilian social health organisation (Organizaçao Social de Saúde) in which funding and facilities are paid for by the public but the management and staff are from the private sector.[46]

The SUS has implemented several initiatives to better regulate health products and to improve their availability and affordability (appendix pp 2–5), including the Generic Drugs policy, an essential drugs list, and promoting local production of strategic health products.[53] The national immunisation programme was expanded to provide 19 vaccines for 20 diseases, accounting for about 95% of all doses given to the population.[54] Access to essential medicines has increased over time,[55] reducing avoidable hospitalisation and mortality.[56] However, catastrophic expenditures for medicines is still a main cause of family budget overload, mainly affecting the low-income families.[57]

Judicialisation of health care, invoking the constitutional right to health as a mechanism to compel the government to provide health products and services, has proved a challenge to medicine access.[58] Between 2008 and 2015, federal government expenditure for claims related to medicines rose from 70 million to 1 billion Brazilian reais.[59] Most of these lawsuits were filed by private lawyers, representing one individual attempting to access high-cost medicines for the treatment of genetic diseases or cancer not covered by the SUS, raising equity concerns.[60] However, regional differences in the people who make use of judicial pathways exist; in some regions, individuals with low incomes, who use litigation as an instrument to improve access to care, are the majority of litigants.[61,62]

	1998	2003	2008	2013*	p value
All centres					
Doctor visit within the past 12 months	54·69% (54·15–55·23)	62·82% (62·32–63·32)	67·68% (67·24–68·12)	74·20% (73·41–74·98)	p<0·001
Any USC	71·22% (70·27–72·15)	79·27% (78·44–80·06)	73·64% (72·91–74·36)	77·07% (76·19–77·93)	p<0·001
USC=health post or centre	41·93% (40·61–43·27)	52·70% (51·53–53·86)	57·01% (55·99–58·02)	47·87% (46·52–49·22)	p<0·001
USC=hospital	34·58% (33·31–35·87)	27·07% (25·95–28·22)	21·47% (20·54–22·44)	21·03% (20·06–22·02)	p<0·001
USC=private or other	23·49% (22·70–24·29)	20·23% (19·61–20·87)	21·52% (20·87–22·19)	31·11% (29·91–32·33)	p<0·001
Sought service within the past 2 weeks	12·99% (12·71–13·26)	14·59% (14·34–14·84)	14·50% (14·24–14·77)	17·54% (16·90–18·19)	p<0·001
Not treated first time	3·68% (3·44–3·93)	3·59% (3·36–3·82)	3·75% (3·53–3·98)	4·75% (4·09–5·52)	p<0·001
Hospitalised within the past 12 months	6·94% (6·80–7·09)	7·01% (6·88–7·15)	7·11% (6·97–7·27)	7·03% (0·0665–7·42)	Not significant
Dentist within the past 2 years	51·76% (51·18–52·34)	57·83% (57·33–58·34)	64·93% (64·48–65·38)	63·69% (62·85–64·53)	p<0·001
SUS centres					
Doctor visit within the past 12 months	49·27% (48·68–49·85)	57·74% (57·16–58·31)	63·26% (62·75–63·77)	69·32% (68·40–70·22)	p<0·001
Any USC	68·55% (67·40–69·68)	78·14% (77·15–79·10)	72·39% (71·52–73·24)	76·03% (75·00–77·04)	p<0·001
USC=health post or centre	55·30% (53·61–56·98)	67·66% (66·24–69·04)	73·81% (72·61–74·99)	61·13% (59·72–62·51)	p<0·001
USC=hospital	33·92% (32·32–35·56)	24·87% (23·51–26·27)	18·15% (17·02–19·34)	20·34% (19·26–21·46)	p<0·001
USC=private or other	10·78% (10·19–11·39)	7·48% (7·13–7·84)	8·04% (7·68–8·41)	18·53% (17·52–19·59)	p<0·001
Sought service within the past 2 weeks	11·14% (10·85–11·43)	12·86% (12·58–13·13)	12·90% (12·62–13·19)	15·96% (15·29–16·65)	p<0·001
Not treated first time	5·03% (4·70–5·38)	4·79% (4·49–5·10)	5·09% (4·79–5·40)	6·28% (5·40–7·29)	p<0·01
Hospitalised within the past 12 months	6·59% (6·42–6·76)	6·59% (6·44–6·74)	6·75% (6·57–6·92)	6·54% (6·13–6·98)	Not significant
Dentist within the past 2 years	44·83% (44·23–45·43)	51·52% (50·98–52·06)	59·19% (58·70–59·68)	58·19% (57·27–59·10)	p<0·001

Results are weighted proportions from nationally representative surveys done in 1998, 2003, and 2008 (National Household Survey [PNAD]),[63] and 2013 (National Health Survey [PNS]).[64] All within-group (all centres and SUS-only centres) time trends are statistically significant (statistical Wald tests were done pairwise within each row and confidence intervals are listed in parentheses), except hospitalisations within the past 12 months, which showed no change for either group. SUS=Sistema Único de Saúde. USC=Usual source of care. *The 2013 survey altered some questions and used a different sampling strategy compared with the previous national surveys.

Table 2: Proportions of the population using health-care services across all Brazilian health-care institutions and SUS-specific centres from 1998 to 2013

Major achievements of the SUS

The SUS has contributed substantially to increased health service use, better health outcomes, and improved health equity.[14,65] Compared with neighbouring countries in Latin America, other upper-middle-income countries, and countries of the Organisation for Economic Co-operation and Development, Brazil has achieved large improvements in access to water and sanitation, immunisation coverage, and life expectancy at birth (appendix p 12). Health-care access has improved and service use has increased for the entire Brazilian population (table 2);[66] for example, based on the 2013 National Health Survey, among those who sought health care, about 95% received care the first time they sought it, a figure that has been largely consistent from 1998 to 2013.[67] These measures of access are similar to those observed in high-income countries.[68,69]

Expansion of PHC coverage, underpinned by the family health programme and the subsequent FHS, has led to large improvements in health outcomes,[32,38,40,41,70–72] with substantial declines in infant mortality[39,73,74] and avoidable hospitalisations,[72,75,76] a reduction in racial inequality in mortality, and a fall in amenable mortality, especially in

municipalities with stronger governance—for example, the municipalities of state capitals including Rio de Janeiro, São Paulo, Curitiba, Recife, and Belém.[70]

As with improvements in health outcomes, user satisfaction with the SUS has improved, although challenges remain. In 1998, the proportion of users assessing hospital services as better than average ranged from 80·7% (North region) to 87·7% (South region) for SUS hospitals, and from 89·4% (North region) to 95·3% (Southeast region) for private hospitals. In 2013, satisfaction with both SUS and private hospital services declined, ranging from 69·4% (North region) to 87·5% (Southeastern region) for SUS hospitals and from 87·8% (Northeast region) to 93·3% (South region) for private services (appendix p 13).

Projected population health effects of changes in future financing of the SUS

Over the past 30 years, the SUS expanded access to health services accompanied by falling inequalities in population health indicators, but its future performance is threatened by demographic, epidemiological, economic, political, and social transitions faced by Brazil.

	ln (infant mortality)			Proportion with family health strategy coverage			Proportion of mothers attending ≥7 antenatal care visits		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
ln (federal health transfers)	−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 (federal transfers)-by-family allowance coverage interaction	..	..	−0·110 (0·059)	..	..	0·005 (0·019)	..	..	0·137 (0·013)†
ln (federal transfers)-by-municipality size 2 interaction	..	−0·052 (0·081)	..	..	0·011 (0·006)	..	..	0·004 (0·004)	..
ln (federal transfers)-by-municipality size 3 interaction	..	0·153 (0·069)*	..	..	0·008 (0·007)	..	..	0·003 (0·004)	..
ln (federal transfers)-by-municipality size 4 interaction	..	0·305 (0·065)†	..	..	−0·023 (0·007)†	..	..	0·003 (0·004)	..
ln (federal transfers)-by-municipality size 5 interaction	..	0·317 (0·065)†	..	..	−0·089 (0·008)†	..	..	−0·030 (0·004)†	..

SEs (shown in parentheses) are 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 gross domestic product per capita), family allowance (Bolsa Família) coverage (% of the total population), private insurance coverage (% of the total population), and political alignment between mayor and governor. Regressions for infant mortality and antenatal care visits are weighted by the municipal average number of births computed over the sample period. Full details are provided in the appendix. ln=natural logarithm. Municipality size 2=5000–9999 inhabitants. Municipality size 3=10 000–19 999 inhabitants. Municipality size 4=20 000–49 999 inhabitants. Municipality size 5=≥50 000 inhabitants. *p<0·05. †p<0·001.

Table 3: Regression model results of the relationship between federal health transfers to municipalities and selected health indicators in Brazil (2004–15)

To assess how these transitions could affect four health indicators until 2030 (the target year for the UN Sustainable Development Goals), we considered four hypothetical scenarios of federal transfer of funds to municipalities. In the first, federal health transfers to municipalities were maintained constant at the amount transferred in 2015 until 2030. In the remaining three scenarios, we assumed transfers would grow at the same rate as gross domestic product (GDP): 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 the four indicators (all targets of Sustainable Development Goal 3) until 2030. We present in detail our methods, assumptions, and robustness checks in the appendix (pp 6–11). The first indicator considered was infant mortality, a commonly used measure of population health;[77] second, the proportion of births whose mother attended seven or more antenatal care centre visits, a measure of preventive health services; third, FHS coverage, a measure of access to PHC; and last, amenable mortality (premature deaths under the age of 75 years that could have been avoided, given effective and timely health care) due to cardiovascular diseases, the main cause of death in Brazil among those aged 60 years or older (using codes I05–I09, I15, I20–I25, and I60–I68 of the International Classification of Diseases, 10th revision),[78] a measure of care quality.[79]

Overall, increases in federal transfers of funds to municipal governments were associated with a reduction in infant mortality, greater FHS coverage, and more frequent antenatal care centre visits (table 3). Each 10% increase in federal funding to municipalities was associated with an increase in FHS coverage of 1·74 percentage points, and an increase of 0·19 percentage

points of the proportion of mothers completing seven or more antenatal care centre visits. We replicated the most saturated regressions, adding interactions between federal transfers and dummies that indicate different municipality sizes. In the case of infant mortality the estimated effects of funding changes were highest in the smallest municipalities and there were no significant differences between the effect of transfer of funds in the first and second size categories. The magnitude of the effect of altered funding 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 small population municipalities was also observed for the FHS coverage and for antenatal care centre visits (table 3). These results suggest that federal subsidies are much more effective in smaller municipalities, which are more reliant on federal funds than are larger municipalities.

Because the Bolsa Família (cash transfer) scheme aims to help the poorest families, and because the benefit incidence analysis showed that public health services and public spending under the SUS mostly benefit low-income families, we replicated the saturated model outlined previously and added an interaction between altered federal health funding and family allowance coverage (table 3). The results showed that the effect of federal health funding on infant mortality was much stronger when the cash transfer programme coverage was wider, suggesting that in poorer regions the return of the federal health investments in tackling the infant mortality was higher. Similar results were observed for the proportion of mothers frequently attending antenatal care centre visits. Notably, one of the conditionalities of the family allowance programme is that pregnant women

	Model 1	Model 2	Model 3	Model 4	Model 5
ln (federal transfers)	0·019 (0·013)	–0·047 (0·016)*	0·393 (0·057)*	0·187 (0·047)*	0·346 (0·079)*
ln (federal transfers)-by-family allowance coverage interaction	..	0·338 (0·059)*	..	..	0·208 (0·066)*
ln (federal transfers)-by-IQIM interaction	..	..	–0·093 (0·014)†	..	–0·056 (0·016)*
ln (federal transfers)-by-municipality size 2 interaction	..	..	..	–0·089 (0·053)	–0·093 (0·053)
ln (federal transfers)-by-municipality size 3 interaction	..	..	..	–0·113 (0·049)†	–0·112 (0·049)†
ln (federal transfers)-by-municipality size 4 interaction	..	..	..	–0·191 (0·047)*	–0·169 (0·048)*
ln (federal transfers)-by-municipality size 5 interaction	..	..	..	–0·199 (0·047)*	–0·144 (0·048)*

SEs (shown in parentheses) are 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 gross domestic product per capita), family allowance (bolsa família) coverage (% of the total population), private insurance coverage (% of the total population), and political alignment between Mayor and Governor. Additionally, all models are weighted by the municipality average population aged 60 years or older (municipality average computed over the sample period). Full details are provided in the appendix. ln=natural logarithm. IQIM= Municipal institutional quality index. Municipality size 2=5000–9999 inhabitants. Municipality size 3=10 000–19 999 inhabitants. Municipality size 4=20 000–49 999 inhabitants. Municipality size 5=≥50 000 inhabitants. *p<0.001. †p<0.05.

Table 4: Regression model of the associations between federal health transfers to municipalities and amenable cardiovascular disease mortality among people aged 60 years or older

must register in the prenatal care programme and follow the schedule of visits, which is thought to contribute to improved antenatal care centre attendance.

Considering the absolute difference in infant mortality between the smallest (<5000 people) and the largest (≥50 000 people) municipalities, simulated results indicated that in scenario one, the difference would increase from 0·8 points in 2015 to 1·2 points in 2030 (an increase of about 0·4 deaths per 1000 births). By contrast, in scenario four (where funding increased by 3% per year), this difference in infant mortality would decrease from 0·8 points in 2015 to –0·6 points in 2030 (appendix p 14). Inequality in simulated infant mortality was assessed through the use of an inequity ratio (a ratio between infant mortality in the smallest and the largest municipalities), which provides a measure of the differences in the regional distribution of infant mortality.[80] In scenario one, the inequity ratio increased from 1·07 in 2015 to 1·10 in 2030. By 2030, the inequity ratio for scenario two was 1·049, 0·998 for the third scenario, and 0·953 for the fourth scenario. Focusing on smaller municipalities, the ratio of simulated infant mortality in scenario one to that in scenario four was 1·14 for the smallest municipality (<5000 people) and 1·17 for municipalities with 5000–9999 inhabitants.

Analysis of antenatal care centre visits showed that a decline in the proportion of mothers attending the antenatal care centre frequently (≥7 visits) would only be observed by 2030 in scenario one, and these declines would be negligible for larger municipalities (appendix p 15). In 2015, the proportion of mothers frequently attending the antenatal care centre was 0·7123; this was modelled to reach 0·7122 in scenario one and 0·725 in scenario four. The inequity ratio between the smallest and the largest municipalities was less pronounced than that observed for infant mortality; it increased from 1·10 in scenario one to between 1·11 and 1·12 for the other three scenarios.

The simulated effects of funding changes on FHS coverage were larger than those observed for frequent antenatal care centre visits. Regardless of the municipality size, FHS coverage would be reduced in scenario one (appendix p 15). Analysing the data from all municipalities, the proportion of the population covered by the FHS in 2015 was 0·88 and this value decreased to 0·87 in 2030 in scenario one but increased to 0·94 in scenario four. Municipalities with fewer than 20 000 inhabitants would have the largest declines in health-care coverage in scenario one but the largest increases in the other three scenarios (table 4).

To account for the capacity of municipalities to manage resources (municipal institutional quality index [IQIM]),[81] we added an interaction term between the amount of federal health transfers and IQIM (table 4; model 3) to the model, which indicated that an increased capacity of the municipality to manage resources (higher IQIM) was associated with a greater reduction in amenable cardio-vascular disease mortality in scenarios two, three, and four (figure). The point estimate of federal funding remained stable when we added interaction terms for municipality size and coverage of the family allowance programme (table 4; model 5). The addition of inter-actions between federal funding and dummy terms representing different municipality sizes revealed that smaller municipalities would have the smallest re-ductions in amenable cardiovascular disease mortality (table 4; model 4).

Discussion: looking ahead

Our results indicate a deterioration of all four health indicators in scenario one, where funding does not increase. Most importantly, the deterioration was larger among smaller municipalities, exacerbating geographical inequalities, and thus reversing a recent trend of overall improvements.[4]

In 1990, the World Summit for Children adopted a target to reduce infant mortality by a third or to 70 deaths per 1000 livebirths, whichever was the greater reduction, by the year 2000.[82] Brazil registered a 42% decline in infant mortality between 1990 and 2000 and an incidence
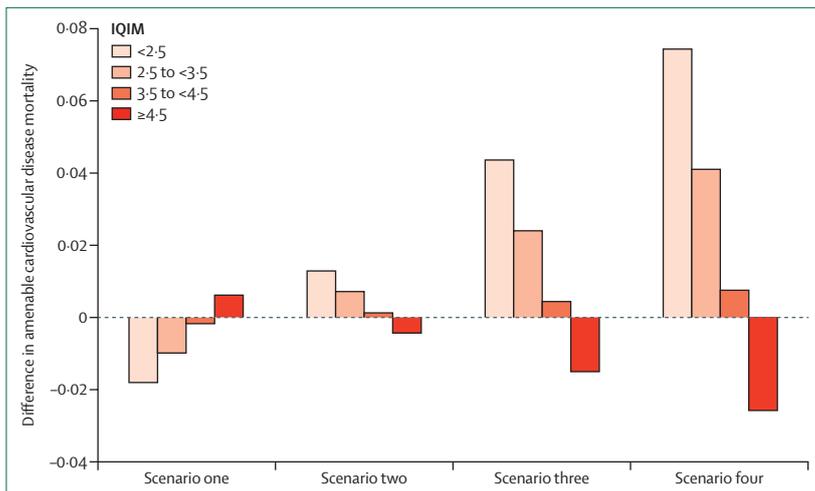
Figure: Effect of different amounts of federal funding on the difference between modelled amenable cardiovascular disease mortality in 2030 and the observed mortality in 2015
Graph shows the difference in cardiovascular disease amenable mortality under the different funding models categorised by IQIM values. Scenario one=federal health transfers are maintained constant at the amount transferred in 2015 until 2030. Scenario two=federal health transfers grow by 1% per year. Scenario three=federal health transfers grow by 2% per year. Scenario four=federal health transfers grow by 3% per year. IQIM=municipal institutional quality index

of 27·6 deaths per 1000 livebirths after the 10 year period, surpassing the set target. Brazil had the second best performance in reducing mortality in children younger than 5 years from 1990 to 2006,[83] and it was among the few countries to meet Millennium Development Goal 4, to reduce child mortality by two-thirds between 1990 and 2015.[83,84] Moreover, after 1995, the inequality in the number of infant deaths between poorer and richer areas started to decline, and the municipalities with the highest infant mortality observed the largest declines in the number of deaths.[85] However, the results from our simulated scenarios show that the austerity measures, implemented in 2018, are likely to reverse this decline and worsen regional infant mortality inequalities, affecting the poorest areas by 5% compared with 2015, the first increase in this indicator since 1990.[86]

Increased inequalities with regard to FHS coverage and of the proportion of mothers frequently attending an antenatal care centre were also observed in our simulated funding scenarios. The reduction in FHS coverage is likely to have a larger effect in smaller versus larger municipalities because the municipal governments rely on the FHS to provide PHC to the population. The benefits of the FHS on health outcomes are essential in smaller municipalities.[34] As for the effect of funding alterations on antenatal care centre visits, although modest in magnitude, the results suggest that scenario one, in which funding would remain constant from 2015 to 2030, would contribute to an increasing difference in service access between larger and smaller municipalities.

Cardiovascular diseases are the main cause of death in Brazil;[79] however, between 1996 and 2007 a 20% decline in the age-standardised cardiovascular disease mortality

occurred. In part, this decrease was due to a reduction in the number of smokers and better access to PHC through the FHS.[20,41,70] A decline in amenable cardiovascular disease mortality among people aged 60 years or older was observed between 2004 and 2015: on average, mortality declined by about 6% during this period, with 598·8 amenable cardiovascular disease deaths per 100 000 people aged 60 or older occurring in 2015. Declines in infant mortality and cardiovascular disease mortality have different pathways, mainly due to their different risk factors, chronicity of conditions, and level of care where conditions are treated (eg, primary vs secondary care). Treatment that can reduce cardiovascular disease mortality, available through secondary care, is also likely to be more expensive and not always available in smaller and less wealthy municipalities. Although our simulated scenarios indicated small effects on amenable cardiovascular disease mortality, increases in federal funding were associated with mortality reductions in municipalities that have a better quality of public sector management. Therefore, changes in federal transfers are likely to have an effect on infant mortality (directly associated with PHC), particularly in small municipalities, and on amenable cardiovascular disease mortality (associated with both primary and secondary care), particularly in municipalities that have good capacity to manage resources.

Our study has some limitations. First, we used administrative data in our analysis, which might have been under-reported. We accounted for possible under-reporting in our models (appendix pp 6–11), by adjusting the cardiovascular disease data for ill-defined causes of death, and we excluded 459 very small municipalities, which are unlikely to change the magnitude or direction of our results, because they had no information on federal health-care funding. Second, and most importantly, our simulated scenarios were not built to precisely quantify the effects of austerity measures, but to indicate probable trends in selected outcomes. Third, we argue that our results provide a very conservative picture of the effect that changes in federal funding for health care can have. Brazil already has a low infant mortality, and thus further declines over time are not as sizeable as when the infant mortality was above 30 deaths per 1000 livebirths.[87] The simulations held all other factors constant and varied only the federal health funding per capita, but reduced funding or closure of other social programmes following austerity measures is likely. Thus, the negative effect of austerity on infant mortality could be larger than that modelled. Furthermore, the likely reduction in the percentage of mothers who adhere to Brazilian recommendations on the number of antenatal care centre visits under a scenario of restricted federal health funding could affect maternal health, and consequently the number of fetal and neonatal deaths,[88,89] further increasing infant mortality. The reduction in FHS coverage directly affects

the provision of PHC, particularly in small municipalities, which is likely to result in further infant mortality increases and a deterioration of other health outcomes.[39] In addition, reduced federal funding per capita is likely to affect services provided at the secondary care centres, which could compromise the provision of essential services needed to mitigate cardiovascular disease-related conditions. However, despite the limitations, our findings are in line with other studies[90] and with the newly released vital statistics and health indicators, which point to increases in infant, child, and maternal mortality and a drastic reduction in vaccination coverage, from 2015 to 2016.[86]

Although the SUS has undoubtedly contributed to improvements in the health and wellbeing of the Brazilian population and helped to reduce health disparities, these gains are fragile. Brazil is undergoing a major sociopolitical and economic transition; the political shift to far-right populism is testing democracy and threatening human rights. This shift, which is often accompanied by austerity policies, is likely to adversely affect the SUS and worsen inequalities.

The new fiscal policy to end targeted funding of the federal budget to health and education risks crowding out investments in these sectors.[91] A comprehensive plan for future health actions under the new Government of Brazil has not been developed, which sends conflicting messages. On one hand, a proposal from the Ministry of Health to further strengthen and expand access to PHC is encouraging.[91] On the other hand, changes and reorganisation of successful health programmes might set back achievements of the past. For example, the end of the cooperation with the Cuban Government for the More Doctors programme could adversely affect the health of the poorest populations. The first initiative to replace 7271 positions of Cubans by Brazilian doctors were filled by 2844 health professionals who were already working in the SUS,[92] which amounted merely to redistributing resources from one area to another.

The changes in relation to reproductive health and adolescents are particularly concerning. At a UN conference in March, 2019, the Brazilian Government 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", citing that these policies might promote abortion.[93] In addition, the government has banned illustrations from booklets distributed to adolescents 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 that "diversity policies have threatened the Brazilian family",[94] while the Ministry of Education has provided support to the controversial Schools Without Party scheme, which promotes policies prohibiting teachers from encouraging students to engage in discussions on gender identity, diversity, sex education, and politics.[95] Combined, these policies will probably affect the health and wellbeing of adolescents in a setting where increasing cases of syphilis and other sexually transmitted infections and underage pregnancy among the poorest communities is a major challenge.

A new decree to modify the Disarmament Statute on the registration, possession, and commercialisation of firearms and ammunition[96] will lead to increased availability of guns in a country that has one of the highest incidences of homicide and violent deaths in the world.[95] 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.[97] In addition, several other new bills and constitutional amendments are currently under discussion at the National Congress to eliminate or considerably reduce the restrictions of the environmental licences for new infrastructure projects and other economic activities, and prevent the demarcation of new indigenous and protected areas, or even revoke existing ones to make way for the expansion of agribusinesses—policies that threaten Brazil's environmental system.[98]

As a result of the situation in Brazil and our modelled scenarios, we make six recommendations to ensure the sustainability of the SUS and to prevent worsening of health outcomes and further widening of health inequalities. 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 universal health coverage in Brazil. However, the lack of clear definitions and regulatory weaknesses for effective application of SUS principles results in the so-called judicialisation of health, with the Brazilian judiciary accepting individual demands and determining the provision of health services and products that, in many cases, are not regularly offered by the SUS, with consequent inequities.[63] To mitigate judicialisation 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 and efficient allocation of resources essential for sustainability of the SUS must be ensured. The austerity measures, implemented in 2016 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,[39,73–76] but the lack of integration between primary, secondary, and tertiary services, and suboptimal regulation of the private sector has caused fragmentation, redundancy, and major gaps in health care. An integrated

network of public and private health services, underpinned by strong PHC practice could enhance efficiency, effectiveness, and access to health care for the entire population.

Fourth, a new interfederative governance model should be developed. The expansion of the SUS was possible because of the key role of the municipalities in delivering health care. However, decentralisation has financially and technically burdened municipalities with insufficient resources and capacity. New organisational forms are needed to improve the coordination of health care at a 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 health-care networks. This governance framework should also consider intergovernmental 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 health care. Thus, intergovernmental transfers to small municipalities to address existing inequalities should be from new sources and should not disadvantage medium-sized municipalities.

Fifth, expanding investments in the health sector and strengthening economic, technological, industrial, and social policies and regulatory frameworks that affect the production and valuation of health technologies and services, including intellectual property, are essential. Additionally, the development of health industrial complex policies for improved training and better allocation of human resources is essential to address health needs, and inequalities, along with better career paths for those working in the SUS.[42,43]

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

Conclusion

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, the effect 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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