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# National Information and Population Survey Systems: selected contributions from the Ministry of Health and the IBGE for analysis of Brazilian state capitals over the past 30 years

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**Abstract** *By the late 1980s, increased exchange between WHO regional offices and Health Ministers around the world raised the need for compatible methodologies and data collection tools to measure health status through population surveys, which could then complement the health records of the official statistics agencies in each country, and enabling comparison of National Information Systems. This article analyzes the main contributions of the Ministry of Health and the IBGE for the analysis of the health status of the Brazilian population. As a criterion for inclusion, only data sources in the public domain published periodically for at least the past 20 years, and those generating data at the municipal level were used. From this set, the capitals of Brazil were analyzed. The data shows that after the Unified Healthcare System (SUS) was created, the network of non-hospitalization healthcare experienced a rapid transformation. By 2009 85.5% of such units were under the municipal umbrella, compared to 40.7% when SUS was created. In Brazil, the RIPSA initiative has fulfilled the integrative role for the formation of a National Health Information System, recommended by Article 47 of Law 8.080 / 1990 that instituted the SUS, assigning major responsibility to1 the IBGE.*

**Key words** *Population surveys, Information systems*

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## Introduction

The 1988 Federal Constitution stressed the role of Brazilian municipalities in the national federative pact. Article 196 of the Constitution states that health is "the right of all and a duty of the State", and is governed by Law 8.080/90, which created the Unified Healthcare System (SUS). The Constitution also stipulates that healthcare services and activities must be part of the public sphere, in a regional and hierarchical level that is governed by the decentralization guidelines in each sphere of government. Care should must be comprehensive, and society involved. Law 8,080/90 was only regulated in 2011, when decree n. 7,508/11 was signed. The main goal is to explain the different concepts without extrapolating the limits of the Constitution, which calls for universal access to SUS services and activities.

Universal use of Health Information Services to support micro and macro management has evolved over the past decades as a State strategy, and at all healthcare system levels, from primary to tertiary care. The challenges of integrating the different subsystems remain on the agenda of countries around the world. Overcoming them will result in improved resource allocation in health, and reduced waste.

As defined by the Ministry of Health[1], *health information systems are standardized data monitoring and collection tools, the goal of which is to provide information for analysis and better understanding of important health problems in the population, subsidizing decisions made at the city, state and federal level.*

At the end of the 1980s, increased exchange between regional WHO offices and Ministers of Health around the world resulted in a need to make sure data gathering tools and methodologies used in population surveys to assess the health status of the population, and supplement the health records kept by the official statistics offices of each country were compatible. As a result, recommendations were made in reports entitled "Queries to develop common methods and tools for health surveys"[2].

Over the past 30 years, these recommendations have been embraced by two federal agencies in Brazil - the Ministry of Health and the Brazilian Institute for Geography and Statistics (IBGE), which stands out for producing, consolidating and disseminating data, providing information for decisions made by the managers of several federative agencies based on an almost infinite amount of data produced daily by the healthcare services.

The goal of this article is to analyze the main contributions of the Ministry of Health and IBGE in generating data to analyze the healthcare status and morbidity of the Brazilian population over the past 30 years, characterizing the modules/variables collected.

## Methodology

We used the main Ministry of Health Information Systems, and nation-wide IBGE Censuses and Surveys. The only inclusion criteria were that the database be in the public domain and include data for the past 20-30 years at least, and include data or estimates at the city level (at least for the 27 state capitals) (Figure 1).

### Information System, Health Surveys and Censuses published at regular intervals over the past 20-30 years

#### Ministry of Health

The main MoH population-based information systems are mortality (SIM), birth (SINAC), ambulatory care (SIA-SUS), hospitalization (SIH), disease notification (SINAN), and primary care (SIAB). The main source of data for public and private healthcare establishments is the CNES - the National Registry of Healthcare Establishments.

The oldest Ministry of Health information system is SIM (mortality), created in 1975/76. While in principle it covers the entire nation, under-reporting is quite significant, in particular in the north and northeast. Many deaths are not witnessed by a physician, and the cause of death is often unclear or poorly defined (ICD-10, Chapter XVIII)[3].

SINASC was created in March 1990 to improve the quality of the data on live births in Brazil. It also records the type of delivery and variables associated with the newborn's mother and fetal deaths. It is based on Statements of Live Birth[4].

SIA-SUS, the Ambulatory Care Information System, was created in 1994 to register the physical and financial transactions involved in ambulatory tests and procedures across the country. It is based on the so-called "ambulatory output", or documents such as the Ambulatory Output Bulletin and Authorizations for High-Complexity Procedures. The major limitation is that the data is available only in aggregate form. Recently, with the advances made in electronic files at primary

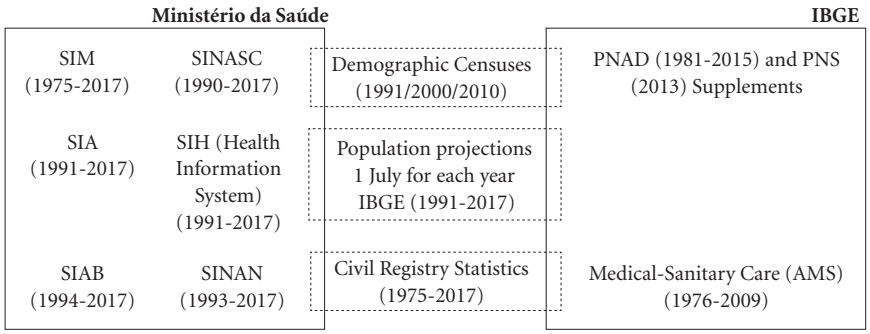


**Figure 1.** Nation-wide Health Related Information Systems, Censuses and Home Surveys: historical contributions of the Ministry of Health and the IBGE.

Source: Prepared by the authors based on DATASUS/Ministry of Health and IBGE data, and National Database Systems regularly updated with local/regional data covering the past 20-30 years.

Legend: SIM - Mortality Information System; SINASC - Live-Birth Information System; SIAB - Primary Care Information System; SIH - Hospital Information System; SIA - Ambulatory Care Information System; SINAN - National System of Notifiable Events. PNAD - Household Sample Survey; PNS - National Health Survey AMS - Medical-Sanitary Care

Note: Although not a true Information System, the Ministry of Health CNES, the National Registry of Healthcare Establishments, has an important nation-wide database that integrates and identifies healthcare units and their installed capacity.

care units, this functionality is being developed and incorporated.

Hospitalization authorizations are included in the SUS Hospital Information System (SIH-SUS) created in 1991. It is based on the National System to Control Hospital Bill Payment (SNCPCH) and the SUS Decentralized Hospital Information System[5].

SINAN, the Event Notification Information System was created in 1993. However, it has not been uniformly implemented in all states. In includes a set of diseases or health events for which notification is compulsory. The 2017 Health Surveillance Department lists 48 events for which notification is compulsory[6]. States and cities can add other events or diseases to the federal list.

The CNES was created by SAS/Ministry of Health Directive 376, signed on 3 October 2000. It governs registration of all healthcare units in the country, whether SUS-affiliated or not. The Registry is based on several of the IBGE AMS (Medico-Sanitary Care) Survey variables. This survey was performed in 1999 and in 2002. Other sources used include: (i) Forms from the SUS Ambulatory Information System (SIA-SUS), (ii) SUS Hospital Information System (SIH-SUS), APAC Authorization System, (iv) National Health Registry and (v) suggestions received from managers and society as a whole[7].

The most significant initiative of recent decades to integrate data and create a Brazilian Handbook of Health Indicators[8] was coordinated by the Pan-American Health Organization (PAHO). The Interagency Health Information Network (IHIN or RIPSA in Portuguese) has been publishing recommendations and manuals since 1995. The greatest limitation is that the analysis units for the proposed indicators are not necessarily municipal[9]. This initiative includes dozens of academic institutions and government agencies, led by the Ministry of Health and with significant involvement of the IBGE, the Brazilian Institute for Geography and Statistics.

**IBGE**

A major source of historical data on living conditions, health and morbidity in Brazil are the Civil Registry Statistics, the Demographic Censuses conducted every 10 years, the National Household Sample Surveys (PNAD) and the special supplements covering health-related topics Recently these supplements have evolved to a new survey, the National Health Survey (PNS)[10].

Furthermore, since the mid-1970s the Medico-Sanitary Care Survey (AMS) has stood out as the only national census survey that also records the profile of health equipment, human resources and installed capacity.

**Civil Registry Statistics**

Civil Registry records have been systematized since 1974, and now include live births, deaths (including fetal deaths), marriages and, since 1984, legal separations and divorce. Looking at the first published records we find that much of the data was already available at the municipal level[11]. This annual survey enables local and regional analyses on fertility, marriage and mortality, as well as studies to improve government programs in the education, social security, economics and social areas.

**Demographic Censuses**

The last three Population Demographic Censuses happened in 1991, 2000 and 2010. The smallest data collection unit used in the field is the census sector, which corresponds to the smallest territorial unit created to control data collection and registration. This analysis units respects the political-administrative boundaries in the country[12]. Grouping census sectors creates a variable known as "neighborhood" in locations where these have been officially created. A group of neighborhoods, or a sub-group of census sectors, becomes a district, which in turn can be combined and geographically defined as the municipalities of Brazil. Surveys on primary care often combine census sectors and Family Health team micro-areas, defined as a set of homes/blocks/streets where the population registered by the teams lives[7].

**National Household Sample Survey (PNAD)**

To fill the data gap in between census periods, in 1967 the IBGE created PNAD, a Household Sample Survey[13], which for half a century has been conducting surveys of samples of households in Brazil. Guerra[14] has included the concept of a "PNAD System", such is the geographic and topic scope of these surveys.

Over the past 30 years, PNAD surveys have covered dozens of theme areas, complementing the basic questionnaire and addressing themes such as demographics, work and income, child labor, social aspects and health itself. In this case, the dimensions surveyed are related to healthcare services, the health of those living in the households, preventive services in women's health, physical mobility, risk factors and health protection, smoking, and sports and exercise. In terms of the National Primary Care Policy, the survey covers the characteristics of Family Health Strategy (Chart 1).

**Medical-Sanitary Care Survey**

According to Oliveira[15], the Medical-Sanitary Care Survey (AMS) was originally created by the Ministry of Health in 1953, and was comprised of two parts: "Hospital and Para-Hospital Care" and "Official Public Health Services". In 1975, the Ministry of Health and IBGE signed an agreement, which created the Medical-Sanitary Care Survey (AMS), which started to be used in 1976. In 1988 the "General Information" and "Registration Update" questionnaires were created and combined into a single tool used to update registration data. This helped preserve the existing historical records for the period between 1976 and 1991. In 1992 it incorporated isolated services for diagnostic and therapeutic support (SADT).

Performed each year through 1992, the survey was suspended between 1993 and 1998. While it returned in 1999, it was no longer conducted at regular intervals. The most recent surveys were completed in 2002, 2005 and 2009, with the support of the Ministry of Health. The IBGE website has no information as to when the survey will be taken up again.

This is the first IBGE administrative census survey to collect data on the installed capacity of all public and private healthcare establishments in Brazilian cities and towns, whether or not they provide hospitalization. It includes questions on the healthcare units themselves, physical facilities, services provided (number of visits and hospitalizations per specialty), number of beds and healthcare professionals with primary, technical or university education by category, equipment in and out of use, and since 2002 listing those available to SUS. This survey led to the Ministry of Health creating the National Registry of Healthcare Establishments (CNES).

**IBGE contributions to the analysis of the healthcare situation in Brazilian state capitals: some results**

Of the many ways to analyze the data gathered over the past 30 years, we chose to break it down by municipality. This is consistent with the 1988 Federal Constitution and the SUS, both of which recommend guidelines that are strongly state-based. We remind readers that Palmas became the capital of Tocantins when that state was created (formerly part of Goiás), and the new regional design for the nation's administration, following the 1988 Constitution.

Between 1988 and 2017, more than 1,000 municipalities were created as municipal dis-

**Chart 1.** Supplemental and special themes covered by PNAD and PNS surveys - Brazil - 1986/2015.

| Area | Theme | Year | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 86 | 88 | 89 | 90 | 92 | 93 | 95 | 96 | 97 | 98 | 99 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 11 | 12 | 13 (*) | 14 | 15 |
| Demographics | Fertility | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Birth-control (1) | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Marriage | | | | | ■ | ■ | ■ | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ |
| Health | Access to healthcare services | ■ | | | | | | | | | | | | | ■ | | | | | ■ | | | | ■ | | |
| | Inhabitant health characteristics (2) | | | | | | | | | | ■ | | | | ■ | | | | | ■ | | | | ■ | | |
| | Preventive services in women's health | | | | | | | | | | | | | | ■ | | | | | ■ | | | | ■ | | |
| | Physical mobility | | | | | | | | | | | | | | ■ | | | | | ■ | | | | ■ | | |
| | Risk factors and health protection | | | | | | | | | | | | | | | | | | | ■ | | | | ■ | | |
| | Family Health Strategy | | | | | | | | | | | | | | | | | | | ■ | | | | ■ | | |
| | Smoking/tobacco use (1) | | | | | | | | | | | | | | | | | | | ■ | | | | ■ | | |
| | Sports and exercise | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| Work and income | Work | | | ■ | ■ | | | | | | | | | | | | | | | | | | | | | |
| | Access to productive inclusion programs | | | | | | | | | | | | | | | | | | | | | | | | ■ | |
| | Aspects related to working relationships and union membership | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| Child labor | Working children aged 5 to 9 | | | | | ■ | ■ | ■ | | ■ | ■ | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Working children aged 5 to 17 | | | | | | | | | | | | ■ | | | | | ■ | | | | | | | | |
| | Domestic chores, children aged 5 to 17 | | | | | | | | | | | | | | | | | ■ | | | | | | | | |
| Social aspects | Migration | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Associations | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Nutritional supplements | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| | Political and social involvement (3) | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| | Social mobility | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| | Socio-occupational mobility | | | | | | | | | | | | | | | | | | | | | | | | ■ | |
| | Access to income transfer and social programs | | | | | | | | | | | | | | | ■ | | ■ | | | | | | | | |
| | Access to the Federal Government's social program unified registration system | | | | | | | | | | | | | | | | | | | | | | | | ■ | |
| | Food Security | | | | | | | | | | | | | | | ■ | | | | | ■ | | | ■ | | |
| | Justice and Victimization | | ■ | | | | | | | | | | | | | | | | | | ■ | | | | | |
| | Aspects related to the care of children under the age of 4 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| | | 86 | 88 | 89 | 90 | 92 | 93 | 95 | 96 | 97 | 98 | 99 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 11 | 12 | 13 | 14 | 15 |

Source: Prepared by the authors, adapted from Chart 2, page 15 of the 2015 PNAD special supplement on "Aspects related to the care of children under the age of 4."

(1) Special survey. (2) In the three years in which the survey was performed it covered the following: health conditions, healthcare plan coverage, access to healthcare services, use of healthcare services and hospitalizations. Spending on healthcare goods and services was included only in the 1998 survey. In 2008 the following topics were added: in-home emergency care, violence, traffic accidents and sedentary living.

(3) The survey covered the following topics: justice and victimization, education, means of transportation, associations and registration, home services,
social mobility, healthcare services, migration, religion and communication means.

(*) In 2013, the special PNAD supplement on Health became a special survey, known as the National Health Survey (PNS),
broken down by the 27 capital cities, 21 metropolitan regions (in all states except RO, AC, RR, TO, PI, MS), 27 states, the geographic regions and the entire country).

tricts became emancipated. This large number of municipalities created after the SUS was created in 1988 is mostly made up of municipalities with fewer than 20,000 inhabitants, further complicating comprehensive healthcare management as each state may independently stipulate the constitutional limits.

With the creation of the SUS, municipalization of healthcare services drastically changed the structure of healthcare establishments, in particular those providing ambulatory care only - healthcare centers and posts. If we look at data before and after SUS it becomes clear that this phenomenon happened at different speeds in the various state capitals. In the cities of Salvador, Natal, João Pessoa, Recife, Aracaju, Vitória, Belo Horizonte, Porto Alegre and Goiânia more than 90% of the public ambulatory units are the responsibilities of the city government (Table 1). The country-wide average increased from 40.7% to 85.5% between 1986 and 2009.

**National Health Survey: the new IBGE contribution, starting in 2013**

The National Health Survey (PNS) emerged from breaking down the major growth of elements included in the PNAD Special Health Supplements, published every 5 years since 1998 (1998, 2003 and 2008), maintaining the same investigational aspects so that data may be compared to previous surveys. This survey is part of SIPD, the IBGE Integrated System of Household Surveys, and uses the "Master Sample" infrastructure. This sample is associated to a set of units in selected areas, chosen using a probabilistic approach from which sub-samples can be selected and used in the different surveys[16].

This is a household survey designed by the IBGE and the Ministry of Health, and first applied in 2013. A second round of this survey is scheduled for 2018. Although based on previous PNAD Health Supplements analyzed by a range of authors[17,18] , this new household survey is considerably larger in scope and includes 21 modules and over 750 questions covering areas such as education of inhabitants 5 or older, children under the age of 2, health and the elderly, the health of women 18 or older, pre-natal care, people with special needs, oral health, medical care, household work and income, chronic diseases, healthcare plan coverage, home visits from the Family Health Team and Community agents, perception of health status, use of healthcare services, live styles, accidents and violence. For the first time in the history of IBGE household surveys, blood-pressure and anthropometric data were collected from a sub-sample of the people interviewed, and specimen samples collected for supplemental tests. For logistics reasons, these sub-samples were collected only in municipalities with more than 80 thousand inhabitants[10].

Sampling for the 2013 National Health Survey was designed to produce indicators for 80 geographic sections: the country, Major Regions, 27 states, 21 metropolitan regions and 27 state capitals (this one the maximum level of granularity allowed). It is important to point out the need to disclose estimates and their coefficients of variation, which in the case of the IBGE for example, might include the use of SUDAAN software[19].

The innovation of collecting data at the city level (state capitals), and the possibility of making estimates and calculating their relative standard deviation made the 2013 National Health Survey the most comprehensive ever. Some 80 thousand households in 1,600 municipalities across the country were visited in the 2nd half of 2013. It is the most important sample-based survey conducted in Brazil this decade. Its scope is broad and there are new options for decomposing the data collected.

One of the basic care questions in the survey enables making estimates and calculating the relative standard deviation of coverage of households registered by Family Health teams. If we look at these indicators in the different state capitals, and compare them to average household income, we find that average HH income is lower (R$1.562,40) in those registered with Family Health Strategy, than those not registered (R$ 2.960,49) (Table 2). The difference is larger in state capitals in the North and Northeast of the country. As a rule, the low-income population has better access to primary healthcare in the 27 state capitals. This clearly shows that the National Basic Care Policy (PNAB) has been playing its role to provide access to primary care services to the economically less favored segments of the population. People who have a private healthcare plan have higher incomes (R$ 3.763,03) that those who do not (R$ 1.274,92).

## Discussion

Since the 1990s the Ministry of Health IT Department (DATASUS) has played a key role in the electronic disclosure of month/annual micro-data produced by the different National In-

**Table 1.** Municipal ambulatory healthcare units as a percent public ambulatory healthcare unit in Brazilian state capitals - 1986/1999/2009.

| Region/ Capital | 1986 | | | 1999 | | | 2009 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N° de estab | Total | (%) | N° de estab | Total | (%) | N° de estab | Total | (%) |
| **Brazil - all state capitals** | **688** | **1692** | **40.7%** | **1435** | **2049** | **70,0%** | **2641** | **3089** | **85,5%** |
| North (1) | 70 | 250 | 28.0% | 230 | 508 | 45.3% | 603 | 840 | 71.8% |
| Porto Velho | 33 | 34 | 97.1% | 65 | 65 | 100.0% | 66 | 84 | 78.6% |
| Rio Branco | 0 | 49 | 0.0% | 5 | 51 | 9.8% | 60 | 72 | 83.3% |
| Manaus | 19 | 45 | 42.2% | 51 | 115 | 44.3% | 236 | 271 | 87.1% |
| Boa Vista | 9 | 33 | 27.3% | 14 | 170 | 8.2% | 59 | 69 | 85.5% |
| Belém | 9 | 39 | 23.1% | 32 | 40 | 80.0% | 108 | 131 | 82.4% |
| Macapá | 0 | 50 | 0.0% | 36 | 40 | 90.0% | 74 | 86 | 86.0% |
| Palmas | nsa | nsa | na | 27 | 27 | 100.0% | 0 | 127 | 0.0% |
| Northeast (1) | 243 | 559 | 43.5% | 433 | 517 | 83.8% | 929 | 1005 | 92.4% |
| São Luís | 17 | 28 | 60.7% | 27 | 39 | 69.2% | 40 | 47 | 85.1% |
| Teresina | 33 | 59 | 55.9% | 39 | 43 | 90.7% | 84 | 95 | 88.4% |
| Fortaleza | 45 | 84 | 53.6% | 76 | 89 | 85.4% | 44 | 53 | 83.0% |
| Natal | 1 | 29 | 3.4% | 51 | 58 | 87.9% | 201 | 208 | 96.6% |
| João Pessoa | 14 | 36 | 38.9% | 37 | 46 | 80.4% | 86 | 92 | 93.5% |
| Recife | 43 | 89 | 48.3% | 64 | 77 | 83.1% | 105 | 112 | 93.8% |
| Maceió | 1 | 39 | 2.6% | 22 | 29 | 75.9% | 69 | 86 | 80.2% |
| Aracaju | 76 | 97 | 78.4% | 31 | 41 | 75.6% | 132 | 140 | 94.3% |
| Salvador | 13 | 98 | 13.3% | 86 | 95 | 90.5% | 168 | 172 | 97.7% |
| Southeast (1) | 215 | 549 | 39.2% | 406 | 612 | 66.3% | 338 | 390 | 86.7% |
| Belo Horizonte | 54 | 98 | 55.1% | 145 | 156 | 92.9% | 54 | 58 | 93.1% |
| Vitória | 20 | 27 | 74.1% | 24 | 27 | 88.9% | 132 | 140 | 94.3% |
| Rio de Janeiro | 50 | 105 | 47.6% | 85 | 110 | 77.3% | 86 | 118 | 72.9% |
| São Paulo | 91 | 319 | 28.5% | 152 | 319 | 47.6% | 66 | 74 | 89.2% |
| South (1) | 84 | 197 | 42.6% | 221 | 250 | 88.4% | 198 | 231 | 85.7% |
| Curitiba | 41 | 61 | 67.2% | 85 | 91 | 93.4% | 51 | 59 | 86.4% |
| Florianópolis | 35 | 50 | 70.0% | 46 | 48 | 95.8% | 35 | 52 | 67.3% |
| Porto Alegre | 8 | 86 | 9.3% | 90 | 111 | 81.1% | 112 | 120 | 93.3% |
| Middle-West (1) | 76 | 137 | 55.5% | 145 | 162 | 89.5% | 573 | 623 | 92.0% |
| Campo Grande | 34 | 44 | 77.3% | 35 | 39 | 89.7% | 57 | 66 | 86.4% |
| Cuiabá | 10 | 35 | 28.6% | 51 | 56 | 91.1% | 51 | 60 | 85.0% |
| Goiânia | 32 | 58 | 55.2% | 59 | 67 | 88.1% | 465 | 497 | 93.6% |

Source: AMS/IBGE, 1986, 1999, 2009.

(1) Refers to all capital cities. Note: Palmas was created with the state of Tocantins in 1988, so the data does not apply (NA).

formation Systems[20]. Although under-reporting remains a problem in the North and Northeast Information Systems, the situation has improved steadily over the decades, and they can now be used alone or together with IBGE estimates. This is a RIPSA[8] recommendation, as it suggests that the ratio between live births or deaths reported and the IBGE estimates be used as indicators of consistency. There remains a challenge at the Ministry of Health level, which is country-wide implementation of electronic records for SUS users. The most recent strategy towards this is the consolidation of e-SUS electronic medical record within the context of primary care[21].

The IBGE has numerous limitations in using the micro-data from their household surveys. However, this does not mean the data cannot be used if the investigator or manager is careful and the limits made clear. One of the more traditional ways is to calculate and inform readers of relative standard-deviations (coefficients of variation). These must be interpreted in light of Statistics to

check the precision and accuracy of the estimates made. In addition, as one would expect, there is a complex sample design to be respected, weighing in the expansion factors in each step of the sampling, the design effects, and IBGE weighting for missing data, which sometimes makes it impossible to disclose data comparisons, i.e. when ignored cases are larger than 10 % and/or the costs involved are high. This is questioned by Viacava[22], who analyzed the technique used to input data when respondents refuse to answer or there are other data collection problems. Data can be inputted in several ways, such as by assigning average values, using sub-samples of similar individuals and statistical regression techniques. The IBGE for instance, uses specific software for this, the Canadian Census Edit & Imputation System (CANCEIS), developed by Statistics Canada[23].

The IBGE created the SIPD, an Integrated System of Household Surveys to integrate its household sample surveys. This system allowed the IBGE to improve the data it produces on population demographics and socioeconomic conditions. It was offered a number of advantages that encouraged it to develop this system. The SIPD is based on international studies and uses a selection database known as the "Master Registry", and a shared sample known as the "Master Sample', used to improve the output of statistical information from sample-based household surveys. This definition was critical for reformulating the IBGE sample-based household surveys.

The so-called "Master Registry" is a set of area units with well-defined limits that cover the entire country. The aim is to design the profile of each one. Each of these units is associated with information about administrative regions, population counts and other sociodemographic data. The main source of information is the Demographic Census, however other sources may also be used. A decision had to be made on the basic registration unit. In this case, the choice was the smallest area for which information was available. A census sector was the natural choice, however other administrative divisions can be considered, including a geographic unit[24].

The so-called "Master Sample" is a set of selected areas from a registry using a probabilistic selection method to select sub-samples for a set of surveys[25]. Sub-samples may be selected differently for different surveys. A sub-sample may be based on area units or a sub-sample of homes in all unit areas selected for a master sample. Sub-samples maybe selected independently or with a measure of control to arrive at samples that may or may not overlap, seeking some form of longitudinal monitoring. If the target population lives in fixed homes included in the surveys in which it is used, its geographic scope becomes the census sectors in the 2010 geographic operating base.

## Final Considerations

Numerous countries in the Americas have been inspired by the Brazilian model for decentralized implementation of health information systems providing nation-wide coverage. For over 20 years, the PAHO has published the "Public Health Information Platform for the Americas", a comparative analysis of the health indicators of all member countries[26].

In Brazil, the RIPSA initiative has fulfilled its role of integrator to create a National Health Information System, stipulated in Article 47 of Law 8,080/1990 (the law that created SUS), assigning major responsibility to the IBGE. This agency should go back to the Medico-Sanitary Care (AMS) Survey, which historically is the only census of healthcare establishments that helped city, state and federal managers plan healthcare actions and services, anticipating the theme - not analyzed in this article - of a growing supplemental health market in the 2000s and 2010s.

To expand the possibility of analyzing data at the city level, the scope of the IBGE National Health Survey should expand to cover not only state capitals, but also cities with more than 500 thousand inhabitants. This would take the number of cities covered from 27 to 48, based on the estimated population in 2017[27]. For this reason, in addition to ensuring the resources required to perform the survey, partnerships with the Ministry of Health, the agencies responsible for health statistics and the academic institutions in some 50 Brazilian cities that would have representative sub-samples for analyzing the health situation of their populations.

Another issue that is a challenge for disseminating Information System and Household Survey data is the time it takes to make results available. As new technology tools and software emerges to gather, critique, input, systematize and disseminate information, we expect that municipal microdata from the 2020 census may be available to managers, researchers and civil society in a timely way, revealing the new demographic profile of this country.

Access to nominal public databases is governed by the Freedom of Information Law (Law

**Table 2.** Households registered with Family Health Teams, households where inhabitants own a healthcare plan and average household income between registered and non-registered households in Brazilian state capitals – 2013.

| Capital/State | (%) households registered with Family Health | | Average income (nominal in R$) | | | | (%) households with some form of healthcare plan | | Average income (nominal in R$) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Households registered with Family Health | | Households not registered with Family Health | | | | Households with healthcare plans | | Households without healthcare plans | |
| | (%) | cv | (R$) | cv | (R$) | cv | (%) | cv | (R$) | cv | (R$) | cv |
| Brazil - all state capitals | 36.7 | 2.0 | 1.562,40 | 1.8 | 2.960,49 | 5.4 | 40.1 | 1.5 | 3.763,03 | 5.1 | 1.274,92 | 1.2 |
| North (1) | 33.1 | 4.1 | 1.378,15 | 4.7 | 2.074,48 | 6.7 | 25.1 | 4.0 | 3.123,72 | 6.5 | 1.174,81 | 2.2 |
| Porto Velho | 38.8 | 8.6 | 1.421,82 | 7.2 | 2.027,91 | 8.0 | 25.9 | 8.4 | 2.415,84 | 6.6 | 1.383,06 | 5.8 |
| Rio Branco | 25.9 | 9.6 | 1.122,09 | 7.2 | 1.551,78 | 6.0 | 12.1 | 12.9 | 2.805,16 | 6.0 | 1.161,50 | 4.2 |
| Manaus | 31.1 | 8.6 | 1.443,44 | 11.0 | 2.282,15 | 11.1 | 24.9 | 7.2 | 3.601,41 | 12.4 | 1.247,63 | 4.6 |
| Boa Vista | 47.6 | 6.9 | 1.272,14 | 5.9 | 2.116,91 | 13.0 | 11.9 | 16.8 | 3.681,90 | 11.1 | 1.202,41 | 5.3 |
| Belém | 24.1 | 12.1 | 857,59 | 3.6 | 2.050,63 | 14.1 | 33.1 | 7.2 | 2.745,81 | 11.1 | 901,12 | 4.0 |
| Macapá | 23.1 | 11.3 | 1.480,57 | 8.0 | 1.627,87 | 6.9 | 16.9 | 9.0 | 2.649,83 | 7.2 | 1.316,76 | 4.8 |
| Palmas | 85.8 | 2.2 | 2.071,95 | 10.1 | 2.675,04 | 10.8 | 28.2 | 12.7 | 3.855,51 | 10.2 | 1.343,01 | 6.5 |
| Northeast (1) | 34.7 | 3.0 | 1.136,93 | 2.8 | 2.211,58 | 4.5 | 33.7 | 2.9 | 3.003,41 | 3.8 | 969,57 | 1.6 |
| São Luís | 35.5 | 8.1 | 1.016,13 | 4.8 | 1.720,35 | 11.1 | 19.3 | 8.4 | 2.375,99 | 12.6 | 1.079,99 | 4.4 |
| Teresina | 66.8 | 5.8 | 1.066,12 | 5.7 | 2.037,39 | 18.2 | 30.1 | 7.7 | 2.249,55 | 9.4 | 819,20 | 3.1 |
| Fortaleza | 37.0 | 7.5 | 1.099,50 | 8.2 | 2.050,08 | 9.0 | 34.2 | 6.9 | 2.871,32 | 7.8 | 900,32 | 3.4 |
| Natal | 24.7 | 10.9 | 1.153,01 | 7.4 | 1.930,73 | 11.3 | 31.5 | 8.0 | 2.873,45 | 10.7 | 1.037,91 | 5.8 |
| João Pessoa | 66.5 | 5.2 | 1.146,46 | 5.6 | 3.764,97 | 9.5 | 29.9 | 8.7 | 3.474,63 | 8.8 | 1.099,33 | 5.7 |
| Recife | 45.1 | 8.5 | 1.177,97 | 8.0 | 3.827,32 | 10.3 | 41.3 | 8.0 | 4.152,60 | 8.0 | 1.031,71 | 5.6 |
| Maceió | 21.4 | 13.0 | 1.050,38 | 9.1 | 1.713,70 | 9.4 | 28.6 | 9.3 | 2.771,64 | 7.6 | 909,94 | 4.3 |
| Aracaju | 69.7 | 4.8 | 1.523,36 | 7.8 | 3.648,67 | 14.4 | 37.5 | 10.0 | 3.105,60 | 9.2 | 1.144,21 | 7.6 |
| Salvador | 12.5 | 14.1 | 975,03 | 5.3 | 1.896,30 | 9.7 | 38.2 | 6.5 | 2.695,23 | 10.1 | 926,56 | 3.3 |
| Southeast (1) | 37.4 | 3.7 | 1.651,38 | 3.1 | 3.342,39 | 9.7 | 45.8 | 2.4 | 3.993,10 | 9.2 | 1.378,88 | 2.2 |
| Belo Horizonte | 59.7 | 3.7 | 1.633,93 | 4.0 | 3.583,00 | 6.2 | 51.6 | 4.2 | 3.493,72 | 4.2 | 1.202,85 | 2.9 |
| Vitória | 55.2 | 6.4 | 2.258,73 | 8.2 | 3.699,10 | 9.2 | 54.9 | 6.4 | 3.663,74 | 6.2 | 1.370,18 | 5.5 |
| Rio de Janeiro | 32.6 | 6.9 | 1.363,19 | 4.1 | 2.613,69 | 5.5 | 43.4 | 4.5 | 3.102,58 | 5.1 | 1.319,86 | 3.2 |
| São Paulo | 34.8 | 6.1 | 1.774,66 | 5.1 | 3.704,80 | 14.3 | 45.7 | 3.5 | 4.583,39 | 14.0 | 1.446,00 | 3.4 |
| South (1) | 56.7 | 2.7 | 2.031,22 | 3.1 | 4.237,84 | 7.18 | 48.2 | 3.0 | 4.007,22 | 5.1 | 1.584,15 | 2.8 |
| Curitiba | 63.6 | 3.6 | 2.239,58 | 4.3 | 3.780,49 | 7.3 | 48.9 | 4.1 | 3.730,70 | 6.5 | 1.756,18 | 4.4 |
| Florianópolis | 68.7 | 4.6 | 2.343,06 | 6.7 | 4.250,87 | 11.3 | 46.5 | 6.5 | 3.817,13 | 7.6 | 1.595,16 | 5.7 |
| Porto Alegre | 45.1 | 5.4 | 1.541,15 | 5.6 | 4.533,95 | 11.2 | 47.8 | 5.4 | 4.386,87 | 9.2 | 1.360,70 | 4.2 |
| Middle-West (1) | 26.0 | 4.5 | 1.727,43 | 4.0 | 3.153,54 | 5.2 | 41.0 | 3.1 | 4.221,71 | 4.4 | 1.540,19 | 3.1 |
| Campo Grande | 71.0 | 3.7 | 1.677,39 | 6.2 | 2.154,67 | 9.4 | 38.4 | 6.3 | 2.415,94 | 7.2 | 1.203,62 | 3.9 |
| Cuiabá | 42.0 | 8.5 | 1.501,46 | 7.1 | 2.813,19 | 10.5 | 42.2 | 7.2 | 2.916,43 | 8.1 | 1.349,13 | 5.9 |
| Goiânia | 19.1 | 15.3 | 1.759,31 | 11.4 | 2.587,28 | 9.6 | 46.0 | 5.9 | 3.102,12 | 8.6 | 1.505,54 | 6.8 |
| Brasília | 12.5 | 11.3 | 1.936,50 | 7.6 | 3.551,93 | 6.8 | 39.1 | 4.9 | 5.680,28 | 5.6 | 1.701,51 | 4.6 |

Source: Micro-data from the 2013 National Health Survey / Work and Income Coordination / Research Department / IBGE.

(1) Refers to all capital cities.

Note 1: Average household income was calculated as the sum of the income in the household (Questionnaire module F), divided by total # of households. Note 2: The coefficient of variation (cv) indicates limited data dispersion when it is 10% or less, and average dispersion between 10% and 20%. It the cv is higher than 20% it is recommended that estimates not be published. Coefficients of variation in this table were calculated using SUDAAN software. Note 3: In the mid 2013, R$ 1,00 = US$ 0,45.

12.527/2011)[28], which stipulates that legal agencies have the constitutional right to access to access these nominal public databases for research purposes. Nevertheless, there are hurdles to such access on the part of some public sectors or agencies. This must be overcome to enable building

and advancing knowledge, and suitable analyses may be performed by ratify or rectify public policies in Brazil.

## Collaborations

LF Pinto helped design, outline and draft the paper, and analyze the data. MPS Freitas completed a critical review of the article. AWS Figueiredo contributed to the methodology and data analysis.

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