

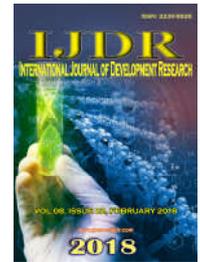


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MEASURING THE HEALTH AND POPULATION DIMENSIONS BASED ON SUSTAINABILITY APPROACH

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ABSTRACT

Indicators related to Health and Population represents the progress or regresses toward a goal, and they are considered as resource of perception, phenomenon and trend. Indicators can be used to guide public planning and management. The performance of indicators has an important role in determining the applicability and efficacy on municipality management, in public sphere. Indicators set contribute to the strategic monitoring and should be based on an accurate analysis and meaning at every stage of development indicators. However, the proper use of indicators in the Brazilian public management is still a methodological and political challenge with rather vague guidelines in many municipalities. Furthermore, the indicators are important assessment tools to identify social needs and contribute to public planning and management. The aim of this research was to evaluate the sustainability level of Health and Population dimensions in Ribeirão Preto, Brazil. The analysis was based on secondary data of specialized governmental agencies. The main results demonstrated good levels of sustainability for the analyzed indicators.

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INTRODUCTION

The indicators historical contextualization show the complement role on decisions makers, become noticeable a current condition that is result of historical practices process and actions guided by function and purpose of indicators, considering reflections of previous planning. When an indicator is analyzed, we observe your current situation, the historical perspective, supporting the ability to project future trends and conditions to develop models to monitor and measure their behavior during a certain period (Ramos, 2009). The chosen assessment tool for present research was Barometer of Sustainability (BS) (Prescott-Allen, 2001). This tool allows us to understand, evaluate and communicate

the society about sustainability levels using the indicators to generate thematic indexes. The methodology to formulate these thematic indexes enables the construction Performance Scales containing sustainable levels intervals, with comparative assignments. The aim was to analyze Health and Population dimensions using BS as an evaluation tool to monitor the development of this theme in municipal scale. The relevance of this research is on exhibition and communication to society of public services sustainable levels provided by governments at the municipal level, generating diagnostics and thematic reviews. A challenge in this study was the definition of indicators that could be used to calibrate the assessment tool, to obtain robust and reliable results.

Theoretical-Methodological Foundation

The public sector has been increasingly questioned about your utility in public services to society, as well as their

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performance and effectiveness. Therefore, this sector has to legitimate its existence increase productivity, competitiveness and users satisfaction. The public services needs create an intrinsic value that highlight the state as a service provider, where the public organs play a central role in the national and global progress and sustainable development (Domingues *et al.*, 2015). Indicators serves as raw material for planning and public management, as they are a manageable metric that gathers and summarizes relevant information for decision making, highlighting the demands and social problems. Valentin and Spangenberg (2000) defines the indicators as representatives and important information for monitoring the development of a society, establishing a broad process of dialogue. Dahl (2012) says the indicators are a tool the can influence the political process making many problems visible to the governments. According to Bellen (2006) the function of the indicators is a relationship that measures the change of variable in relation to a specific base, as a result of a simulation model. The same author observe that indicators are a reality model, but it can't be considered the own reality. However, these indicators should be analytically legitimate and built by a consistent methodology of measurement. The indicators purpose is aggregate and quantifies information to become your significance more apparent. They simplify information about complex phenomenon, trying to improve the communication process. Health and Population indicators are parameter that can be used to evaluate the wellbeing human in geographic space, and provide subside to municipal planning to follow historical process and consider different patterns in different time periods. Figure 1 relates the information organization obtained by indicators from different information levels. The information is organized with increasing information levels. The highest point is the results combination.

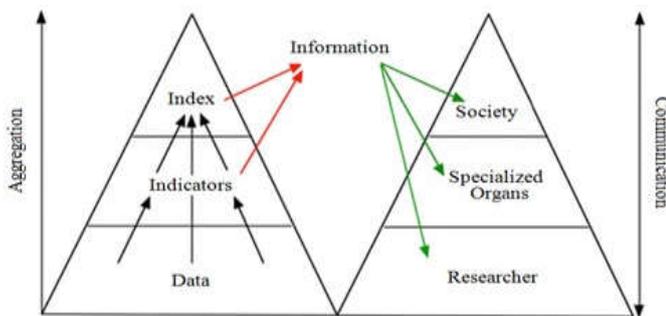


Figure 1. The relation among primary data, analyzed data, indicators and indices

Indexes are used as representation of synthesis information is widely accepted by the scientific community. A single metric inserted into a theme may be interesting to many researchers. In general, the indexes, more than a simple indicators, is able to simplify, quantify, communicate and express briefly various social phenomena (Santos, 2004).

MATERIALS AND METHODS

Ribeirão Preto as analyses reference: study area characterization

The study area was Ribeirão Preto, localized in northeast of Sao Paulo's State, Brazil, 313 km from São Paulo capital. The total territorial area (urban and rural) is 650.96 km²,

urbanization degree of 99.72%, and population of 613.346 inhabitants (Seade, 2013). This municipality is part of the Resource Management Water Unit 4, composed of 23 municipalities, fueled by Guarani Aquifer (Cetesb, 2013). Ribeirão Preto is the center of high development rates of the region in relation to Brazilian municipalities, and has economy diversification and presents good quality life of the inhabitants. In 1856, the city was driven to develop with the coffee plantations cultivated by immigrants who counted on an excellent quality of soil, known as land-purple (Ribeirão Preto, 2012).



Figure 2. Ribeirão Preto area, Brazil

Search steps

The methodology used is based on Seven-Stage Cycle for BS application, with exploratory and descriptive characteristics, and filed research. Secondary data were used from official's data bases. Seven-Cycle Stage (Guijt *et al.*, 2001) underlying the selection of indicators to compose the BS with a hierarchical method, composed of seven stages, which helps justify the importance and relevance of the chosen indicators. The seven stages is: 1) purpose of evaluation; 2) setting systems and targets; 3) choice of dimensions and performance criteria; 4) selection of indicators; 5) data collection and mapping of indicators; 6) aggregation of indicators; and 7) review of the results and assessment of the implications. The indicators selected are from Health and Population dimension, a topic of great importance for municipal planning and management. An important stage of research is the transposition of the numerical value to BS performance scale. It is done by simple linear interpolation formula (Kronemberger *et al.*, 2004) that relates the quality level each indicator. The formula below relates the transposition of scales and relationship between DL_x (Local Development) and BS_x (scale on Barometer of Sustainability).

It is done at the local level indicator calculation:

$$BS_x = \left\{ \left[\frac{(DL_A - DL_x)(BS_A - BS_P)}{(DL_A - DL_P)} \right] (-1) \right\} + BS_A \quad (1)$$

A= previous limit of range that contains X.

P= rear limit of range that contains X.

After performing the above calculation to finalizing to BS scale, noticed where the sustainability sector the indicator is located. BS has five sections that feature the sustainability level. In Table 1 we can see the start and end of each sector.

Table 1. Five sectors of Barometer of Sustainability

Points			
Band	Range	Top	Definition
Good	100-81	100	Desirable performance
Fair	90-61	80	Acceptable performance
Medium	60-41	60	Neutral or transitional performance
Poor	40-21	40	Undesirable performance
Bad	20-1	20	Unacceptable performance
Base	0	0	Base of scale

Development of Performance Scales

The performance scales of Ribeirão Preto were determined according to the national and international references in specialized literature, using indicators of other regions of the world, in different development levels. During development performance scales set up were considered national and international goals and standards. In Table 2 you find the information regarding the theme, indicators, references and temporal delimitation of parameters to performance scale elaboration for Health and Population theme.

RESULTS AND DISCUSSION

In Table 3 you can find the values and sustainability levels on Barometer Scale for Ribeirao Preto, Brazil. The indicator with the lowest value found for the theme was the Maternal Mortality Rate (per 100.000 live births), also known as Maternal Mortality Ratio (MMR) and the greater value was Hospital Beds indicator (coefficient per 100.000 inhabitants). MMR estimates the risk of women's death occurred during pregnancy, abortion, childbirth or within 42 days after delivery, attributed to causes related to or aggravated by pregnancy, abortion, the birth, the puerperium or measures taken in relation to them (Brazil, 2012). From this definition, we can identify maternal deaths, based on their causes, as direct or indirect. Direct maternal deaths are those resulting from obstetric complications of the pregnant state (pregnancy, childbirth and postpartum), interventions, omissions, incorrect treatment or a chain of events resulting from any of the above. Deaths due to, for example, obstetrical bleeding or hypertensive disorders during pregnancy, or those due to anesthesia complications or cesarean section are classified as maternal death. Indirect deaths are those resulting from pre-existing disease, or disease that developed during pregnancy and were not related to direct obstetric causes but aggravated by the physiological effects of pregnancy (WHO *et al.*, 2012). Since the late 1980s, Brazil has developed initiatives in order to improve the coverage and quality of maternal deaths information. The main is the implementation and structuring of maternal mortality committees and the institutionalization of monitoring of maternal death. Civil registration systems provide accurate data about maternal mortality level and maternal deaths causes. In countries with incomplete civil registration systems, it is difficult to accurately measure maternal mortality levels. In the first place, it is a challenge to identify maternal deaths precisely, secondly, even if those deaths were recorded, the pregnancy state or the cause of death may not have been known and deaths therefore not been reported as maternal deaths. Finally, in most developed countries, where medical certification of cause of death does not exist, the precise allocation of the death of a woman as a maternal death is difficult. In the absence of complete and accurate civil registration systems, MMR estimates are based on data from a variety of sources - including censuses,

household surveys, reproductive age mortality studies and botched autopsies. Each of these methods has limitations in estimating the true levels of maternal mortality (Who *et al.*, 2012). According to the Municipal Department of Health to reduce maternal mortality, the municipality maintains research 100% of deaths in women of childbearing age (Ribeirão Preto, 2011).Ribeirao Pre to presented a maternal mortality indicator of 24.6 deaths per 100,000 live births, this research categorized as intermediate level. This indicator, even though the worst performance in theme, is much higher than that found for Brazil, which was 56 deaths per 100.000 live births in 2010, reaching the same year peak of 85 deaths per 100.000 live births and a value of 36 deaths per 100.000 live births (Who *et al.*, 2012). Reducing maternal mortality was the fifth Millennium Development Goal (MDG), with reduction target by three quarters between 1990 and 2015, which is less than or equal to 35 maternal deaths per 100 thousand live births. To achieve this goal, the annual RMM reduction in Brazil should be 5.5% (Brazil, 2012). The values for Latin America and Brazil, according to the report *Trends in Maternal Mortality: 1990-2010*, based by WHO, UNICEF, UNFPA and World Bank, expressed in Figure 3, relates the evolution of the indicator for these two spaces, compared with the Ribeirão Preto value in 2010.

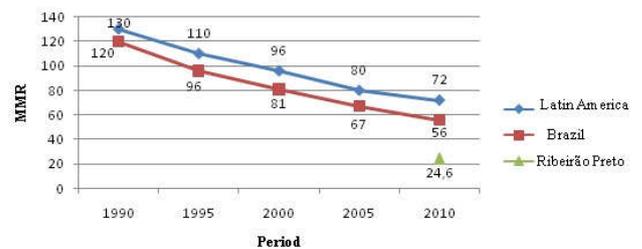


Figure 3. Categories of countries according to their RMM in 2010 by WHO et al., 2012

These findings can be compared to metrics in some countries. The Brunei nations, known as the State of Brunei Darussalam, localized in Southeast Asia, Saudi Arabia, the Middle East and Grenada, the Caribbean component, had a maternal mortality indicator similar to that found for the city of Ribeirão Preto, in the amount of 24 deaths for every 100,000 live births (Who *et al.*, 2012). With approximate values are the countries of Fiji (26 deaths per 100.000 live births), island country in Oceania, Chile (25 deaths per 100.000 live births) and Lebanon (25 deaths per 100.000 live births) Country Mediterranean eastern (Who *et al.*, 2012). Figure 4 demonstrate the categories according to the MMR 180 countries and territories considered in *Trends in Maternal Mortality report: 1990-2010 in 2010*.

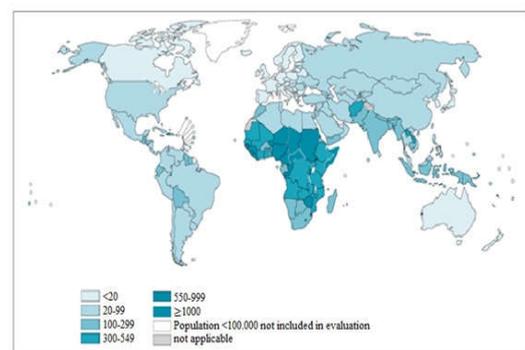


Figure 4. Categories of countries according to their RMM in 2010 by WHO et al., 2012

Globally, maternal mortality fell 47% between 1990 and 2010, this means that the Goal Five, which is part of the Millennium Goals, which propose a reduction of 75%, is very unlikely to be achieved by 2015, unless noted reductions 2011-2015 (WHO *et al.*, 2012). The current commitment is Agenda 2030. By 2030, the overall maternal mortality rate is expected to be reduced to less than 70 per 100,000 live births (Un, 2016). In the best placement in Health and Population dimensions was Hospital Beds indicator (coefficient per 1.000 inhabitants).

In 2011, considering the municipalities representing the Administrative Regions of the State of São Paulo, Ribeirão Preto had lower values than Santos, Sorocaba, Bauru, São José do Rio Preto, Araçatuba, Presidente Prudente, Marília and Barretos. It means that most municipalities that represent their administrative regions are in accordance with law system from Health Ministry (Ibge, 2010). The Itapeva Region did not provide data for the period surveyed. Figure 5 relates the values distribution of the indicators in 2008-2011 time series.

Table 2. Structure for findings processing

Theme	Indicators	Source and reference for the preparation of Performance Scale	Information year
Health and Population	Population growth rate	Source: SEADE (2012). Performance scale elaborated to inspired by Ibge data for Brazil (IBGE, 2010), and criteria used by Kronemberger <i>et al.</i> , 2008.	2012
	Child mortality rate	Source: Performance scale elaborated by infant mortality rates that are classified by the World Health Organization - WHO in high (50 per 1,000 or more), medium (20-49 per 1,000) and low (less than 20 per 1,000) (IBGE, 2010).	2011
	Rate of children under one year with vaccination cards up to date	Source: Millennium Development Goals established by UNDP (MDG, 2012). Target established in this search 100% of children under one year with day vaccination records to be considered sustainable.	2011
Health and Population	Immunization against childhood infectious diseases	Source: Ribeirão Preto (2011). Target established in this search 100% coverage as ideal.	2011
	Percentage of children under five years old with underweight for age	Source: Ribeirão Preto (2011). Benchmark for the performance scale development according to Kronemberger (2003).	2011
	Percentage of beneficiary families with profile health scholarship "Bolsa Família" program accompanied by primary care	Source: Ribeirão Preto (2011). Ideal value should be 100%.	2011
	Mothers who had seven or more prenatal visits	Source: SEADE (2010). Health Ministry recommends at least six prenatal visits during pregnancy. Ideal target for this research is 100% of the mothers have access to seven pre-natal consultations.	2010
	Maternal mortality rate (per 100 thousand live births)	Source: Millennium Development Goals (MDG, 2012) objectives established by UNDP. Maximum Maternal mortality rate recommended by the Pan American Health Organization - PAHO is 20 cases per 100 thousand live births.	2010
Health and Population	Psychosocial Attention Center coverage rate per 100.000 inhabitants	Source: Ribeirão Preto (2011). Performance scale was adopted with parameters according to Health Ministry: very good coverage (above 0.70); good coverage (between 0.50 and 0.69); regular / low coverage (between 0.35 to 0.49); low coverage (0.20 to 0.34); insufficient / critical coverage (below 0.20) (Brazil, 2012).	2011
	Hospital beds (coefficient per 1,000 inhabitants)	Source: SEADE (2011). Best performances are in the states of Goiás, Rio Grande do Sul and Rio de Janeiro (2.9) and the worst is Amapá (1.3) data 2005 according to IBGE (2010). According to Ordinance nº 1101 / GM 2002 the Health Ministry, the needs for total hospital beds is 2.5 to 3 per 1 000 inhabitants. (IBGE, 2010).	2011
	Density of people per bedroom in appropriate situation	Source: IBGE (2010). References used performance scale elaboration from SI 2010 (IBGE, 2010), with the results of the federation units.	2010

Table 3. Values localized in performance scale

Indicators	Values	Barometer scale				
		0 - 20 Bad	21 - 40 Poor	41 - 60 Medium	61 - 80 Fair	81 - 100 Good
Performance scale for Ribeirão Preto's indicators						
Population growth rate	1,42	>4,1	4,0 - 3,1	3,0 - 2,6	2,5 - 2,1	2 - 0,1
Child mortality rate	9,7	>49	49 - 31	30 - 21	20 - 11	10 - 0
Rate of children under one year with vaccination cards up to date	95,7	≤79	80 - 84	85 - 89	90 - 94	95 - 100
Immunization against childhood infectious diseases	95	≤75	76 - 80	81 - 85	86 - 90	91 - 100
Percentage of children under five years old with underweight for age	3,7	100 - 41	40 - 21	20 - 11	10 - 6	5 - 0
Percentage of beneficiary families with profile health scholarship "Bolsa Família" program accompanied by primary care	56,94	0 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Mothers who had seven or more prenatal visits	82,52	0 - 60	61 - 70	71 - 80	81 - 90	91 - 100
Maternal mortality rate (per 100 thousand live births)	24,6	>40	40 - 31	30 - 21	20 - 11	10 - 0
Psychosocial Attention Center coverage rate per 100.000 inhabitants	0,74	<0,20	0,20 - 0,34	0,35 - 0,49	0,50 - 0,69	0,70 - 1
Hospital beds (coefficient per 1,000 inhabitants)	3,14	0 - 0,5	0,6 - 1	1,1 - 2	2,1 - 2,5	2,6 - 3,5
Density of people per bedroom in appropriate situation	88,11	0 - 25	26 - 50	51 - 60	61 - 74	76 - 100

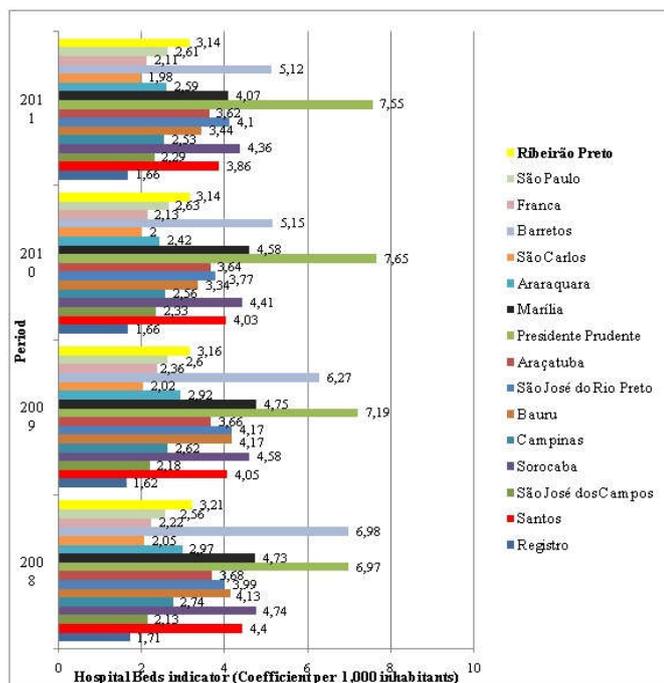


Figure 5. Hospital Beds indicator (coefficient per 1,000 inhabitants) of municipalities that represents administrative regions in São Paulo's State 2008-2011

Comparing Ribeirão Preto to with Brazil and São Paulo's State indicator, the value found for the municipality is higher than these, where presents results, respectively, of 2.7 Bed of Hospitalization indicator (coefficient per 1.000 inhabitants) (Kronemberger *et al.*, 2008), and 2.31 (Seade, 2011). For comparison at the local level, we can mention the values found for Teresópolis, Rio de Janeiro's State, which was 2.9 Hospital Beds indicator (coefficient per 1.000 inhabitants) (Silva, 2006), also lower than found to Ribeirão Preto.

Conclusion

The assessment tool Barometer of Sustainability was effective at the local level, because it contributed to the perception of the system's complexity, facilitating the understanding of the social phenomena regarding the dimension named Health and Population in municipal spatial area. Based on the findings it's possible to provide and monitor sectoral policies and contribute to decision making. The BS can contribute to the municipal government concerning the management process for different dimensions of analysis because it reflects on the information system, themes and indicators. The preparation of the Performance Scales is an important step of methodological process, because each sustainability degree is established part of the process and established in five sectors. In this stage were encountered difficulties in reconciling values and tolerable limits by the spheres involved in the research. Nevertheless, the academics, government, and the stakeholders engaged in public management in many geographical scales should be involved to contribute with ideas to dealing with the complex problems of sustainability in your dimensions (environmental, social, economic, institutional). By acting in a sustainability responsible manner, all sectors of society is able to exert significant influence on sustainable society.

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