Analysis of basic sanitation in Brazil and its impact on water resources and health

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ABSTRACT: Integration of basic sanitation, water resources and health is paramount for sustainable development. The basic sanitation in Brazil is analysed, along with its impacts on water resources and health, and perspectives for addressing problems. Reflections are based on applicable documents and ruling texts. Some of the unsolved basic sanitation issues may be dealt with through instruments and the framework of water resources management. Moreover, the river basin can be used as a reference unit for planning the Federal Basic Sanitation Policy, and basic sanitation plans must be compatible with the river basins plans of the corresponding region. Improvements in the water supply and sewerage service should also take into account innovative solutions which depend upon the health framework in place. Outcomes are expected to promote the intersectoral efficiency in Brazil and Latin America and also faster actions aimed at the improvement of basic sanitation.

KEYWORDS: basic sanitation; water supply; sewerage service; water resources; health.

RESUMEN: Integración de los servicios de saneamiento básico, los recursos hídricos y la salud es primordial para el desarrollo sostenible. El saneamiento básico en Brasil se analiza, junto con sus impactos sobre los recursos hídricos y la salud, y las perspectivas para abordar los problemas. Las reflexiones se basaron en los documentos aplicables y los textos gubernamentales. Algunas de las cuestiones sin resolver del saneamiento básico podrán ser objeto a través de instrumentos y el marco de gestión de recursos hídricos. Por otra parte, la cuenca hidrográfica se puede utilizar como una unidad de referencia para la planificación de la Política Federal de Saneamiento Básico, y los planes de saneamiento básico deben ser compatibles con los planes de las cuencas hidrográficas de la región correspondiente. Las mejoras en el abastecimiento de agua y el alcantarillado también deben considerar soluciones innovadoras que dependan de la política de salud. Se espera que los resultados fomenten la eficiencia intersectorial en Brasil y América Latina y también acciones más rápidas para la mejora de los servicios de saneamiento básico.

PALABRAS CLAVE: saneamiento básico; abastecimiento de agua; alcantarillado; recursos hídricos; salud.

CONTEXT

The integration of basic sanitation, water resources and health were referred to in the National Environment and Health Action Plan, developed as the Brazilian contribution to the Pan American Conference on Health and Environment in Sustainable Human Development, which took place in Washington, in 1995 (Ministério da Saúde, 1995). This Conference, a consequence of the United Nations Conference on Environment and Development - UNCED 1992, emphasised the importance of the definition of policy frameworks and laws in member states to ensure the accomplishment of commitments from UNCED 1992, with consideration for health and the environment in sustainable development (Pan American Charter, 1995). Therefore, the integration of sanitation, water resources and health is perceived as necessary for sustainable development in Latin America by combining economic growth with protection and preservation of the environment, and response to social claims.

Moreover, the World Health Organisation – WHO's – concept of environmental health highlights its relation to the practice of assessment, control and prevention of physical, chemical and biological factors, and also those of behaviour origin, which potentially affect health (WHO, 2010). This conceptualisation is based on an integrated vision of environmental sanitation and other sectors.

With regards to basic sanitation there is a lot to do, not only in Latin America, but also worldwide. For this reason, the United Nations has established a Millennium Development Goal – MDG – to promote sustainable access to safe drinking water and sewerage (PNUD, 2008). In 2008, when 2.6 billion people were estimated to be without a safe and clean

toilet option, the promotion of the International Year of Sanitation had the objective of raising awareness and of accelerating progress towards the MDG target to reduce the proportion of people without access to sewerage by 2015 (IYS, 2008).

In view of the relevance and urgency of this theme, the objective is to analyse basic sanitation and its implications for water resources and health in Brazil, emphasising the most relevant aspects and perspectives for a proper solution.

METHODS

In results and discussions are initially presented the main legislation milestones for basic sanitation in Brazil, including the Federal Constitution and the Federal Law 11.445, from 5 January 2007 which establishes the guidelines for National Basic Sanitation and for the Federal Basic Sanitation Policy.

What follows is a description of the basic sanitation situation in Brazil, at the end of the twentieth century, based on secondary data mostly supported by the National Survey of Basic Sanitation – PNSB developed by the Brazilian Institute of Geography and Statistics – IBGE – in 2002, by billing units and municipalities (IBGE, 2002). In this context, basic sanitation, following the definition of the Federal Law 11.445/07, encompasses the services, infrastructure and operational installations of: drinking water supply; sewerage service; urban sanitation and waste management; drainage and stormwater management. Policy, as quoted several times, is understood in the context of public policy, according to Philippi & Bruna (2002): guidelines established in the legislation framework aimed at improving the living conditions of society.

The basic sanitation situation is also illustrated with examples of the State of São Paulo and its Units of Water Resources Management – UGRHIs, established by the Decree of the State of São Paulo 32.954, from 7 February 1991, primarily UGRHI 5, the Piracicaba, Capivari and Jundiaí River Basins – PCJ focused by Marcon (2005).

In addition, there are discussions about the implications of the environmental sanitation, mainly regarding drinking water supply and sewerage service, for health in Brazil, based on Costa (2004). There is also mention of the Federal Constitution, specifically with respect to the National System of Health – SUS and the National Health Policy, established by the Federal Law 8.080, from 19 September 1990.

In final remarks the most relevant aspects of results and discussions are emphasised, in particular those related to the Federal Law 11.445/07, Ordinance 518, from 25 March 2004, of the Ministry of Health, and the Federal Law 9.433, from 8 January 1997, which establishes the National Water Resources Policy and sets the National System of Water Resources Management. Lastly, perspectives are discussed on dealing with the implications of basic sanitation for water resources and health in Brazil including the promotion of health and adoption of alternative and innovative solutions.

RESULTS AND DISCUSSIONS

Basic sanitation at the end of the twentieth century

The Constitution of the Federative Republic of Brazil establishes as the role of municipalities, Article 30: the organisation and delivery of public services of local interest. However, states may establish metropolitan regions, urban clusters and micro-regions with neighbouring municipalities, aimed at integrating organisation, planning and the execution of public functions of common interest. Castor (1996) states that metropolitan areas have existed since the 70s, based on the Complementary Federal Law 14, of 1973. In spite of the existing fundamentals for metropolitan planning, planned agencies and the conceptualisation of services for such areas, metropolitan regions have been only indicative. An explanation for this is based on the fact that while the responsibility for the use of the land and other planning instruments had been kept within the functions of the municipality, investments had been dependent upon sectoral policies, "(….) metropolitan agencies (….)" (Castor, 1996, p11) had been controlled by states, and services of regional interest had been allocated either to states or municipalities.

In this context is important to mention the Article 21 of the Brazilian Constitution when it refers to the federal sphere and its competence in establishing guidelines for urban development, including dwellings, basic sanitation and transport. The Article 23 defines as a common competence of the federal sphere, states, federal district and municipalities the promotion of programmes of dwelling building and improvement of living conditions as well as basic sanitation, which demands the co-operation of federated entities to be defined by complementary law.

Then the Federal Law 11.445/07 was passed, clarifying the fundamental principles of the basic sanitation national guidelines, responsibilities, provision of basic sanitation by regional public services, planning and regulation, besides economical, social and technical aspects, and also the participation of collegiate agencies within the social control and the Federal Basic Sanitation Policy. It is important to highlight, as a responsibility of basic sanitation providers, the elaboration of basic sanitation plans, the direct delivery of services or the authorisation of delegation, along with the corresponding definition of the responsibility for its regulation and enforcement etc. It is also relevant to mention, in addition to the provision of basic sanitation by regional public services, the definition of responsibilities and possibilities of regional configuration of entities, companies and municipalities involved. Furthermore, aspects of regulation are relevant mainly regarding their objectives: the establishment of standards and norms of service, the assurance of the accomplishment of conditions and targets, prevention and rebuke of the abuse of economic power, and the definition of adequate economical, financial and social tariffs.

There is hope that this piece of legislation contributes to clarifying and improving basic sanitation actions in Brazil. The basic sanitation situation, in terms of drinking water supply and sewerage service at the end of the twentieth century is described ahead, as well as its implications for water resources and health. Differences in water supply and sewerage service coverage are primarily based on the size of population of municipalities and Brazilian Major Regions - BMRs.

As established by the Brazilian Constitution, municipalities, along with the federal sphere, states and the federal district, are autonomous entities and encompass the national political-administrative organisation. Municipalities are the autonomous entities at the lowest level of hierarchy in this structure (IBGE, 2003). The BMRs are formed by the clustering of federated entities and are named North, Northeast, Centre-West, South and Southeast (IBGE, 2003).

IBGE (2002) describes the evolution of basic sanitation actions, with emphasis on water quality and, in turn, protection of health and preservation of environmental quality. In 1981, The National Sanitation Plan – PLANASA – had as goals for population coverage for that decade: 90% for water supply and 65% for sewerage service (IBGE, 2002). Over local and municipality interests, the National Dwelling Bank – BNH, which managed the resources of PLANASA, prioritised state companies. In this way, states were benefited by the resources of the Plan. Despite the fact that other basic sanitation services had not been considered in the scope, such as general waste collection and urban drainage, PLANASA struggled to reach its targets.

Provision of drinking water is strategic for the risks it can cause to human health if improperly supplied or even absent. A significant amount of the Brazilian population was supplied and this can be verified by the proportion of municipalities with drinking water supply through a general network: 97.9% in 2000. This number was 95.9% in 1989. In both cases, "(....) the fact that a municipality having a network of drinking water supply in place implies its inclusion in the group of municipalities with a distribution network, independent of the coverage, efficiency and number of dwelling connections to such network." (IBGE, 2002, p31). With respect to municipalities, there were differences according to the size of their populations,: those which with less than 20,000 inhabitants owned only 32.1% of the distributed treated water, whilst others with more than 100,000 owned basically all distributed treated water. In Figure 1, it is possible to observe the situation of water supply coverage of billing units per population stratum of municipalities. Also, the larger population a municipality had, the higher the water supply coverage of billing units was. Bearing in mind that approximately 90% of municipalities in Brazil had less than 45,000 inhabitants, as depicted in Figure 2, the highest coverage of distributed treated water as well as of billing units with water supply was noticed in the most populated urban centres. The BMRs with the lowest coverage were "(....) in urban suburbs of large centres, in small urban clusters and in the poorest regions." (Bittencourt, 2003, p287).

Another factor to be considered was the inequality in the coverage of drinking water supply in Brazil. While in the BMR Southeast 5.6% of the distributed water was without treatment, this rate was 32.4% for the North.

The privileged situation of large urban centres in terms of drinking water supply was exemplified by the largest economical centre of Brazil: the Metropolitan Region of São Paulo - RMSP – which was already reliant upon an inter-basin transfer through the Cantareira System, for drinking water supply to approximately 8 million people, about half of its population. The drinking water supply, in turn,

was dictated by urban growth, requiring agreements between the UGRHI 5, where the transferred water was from, and the UGRHI 6, Alto Tietê Basin, where the RMSP was located. Besides the basin committees of these two UGRHIs, the Sanitation Company of the State of São Paulo - SABESP - also participated in the agreement aimed at renewing the water entitlement of Cantareira System in 2004, maintaining the inter-basin transfer. SABESP was the basic sanitation service operator for the Municipality of São Paulo.

The water entitlement is defined by the Federal Law 9.433/97, which among others, also establishes water price, watershed as planning and management unit and a network of entities sharing responsibilities over water resources of federal domain, named National System of Water Resources Management – SNGRH. Allowing for the obvious relationship with water resources, the basic sanitation sector has been represented by service providers and associations in SNGRH entities, such as basin committees and state water resources councils.

The renewal of the water entitlement of the Cantareira System in 2004 was based on the Resolution of the National Water Agency – ANA – 429, from 4 August 2004. It resolved that the responsibility for granting water entitlement from water bodies owned by the federal sphere, tributaries of the Cantareira System, would be that of the Water and Electric Power Agency – DAEE as a participant entity in the water resources management in São Paulo and also the Minas Gerais's Institute of Water Management – IGAM – in the State of Minas Gerais. The inter-basin transfer, in this particular case, meant that the UGHRI was driven to relinquish influence over the economical development and the quality of life of its people that this volume of water would be associated with (Marcon, 2005).

From Figure 1, the necessity of making a stronger effort on drinking water supply, coherent with the particularities of the country, including the less populated municipalities and BMRs with lower coverage such as the North and Northeast, was clear.

It was also necessary to reduce the rate of water loss in systems of drinking water supply. In the State of São Paulo, this rate was at average 38% (SRHSO-DAEE, 1999), whereas in the UGRHI 6, this figure was 40%, and in the UGRHI 7, Baixada Santista, achieved 47%. Clearly, this situation reflected the need for better understanding of the relationship between water resources management and drinking water supply.

It is also relevant to outline the lack of promotion of the rational use of water resources. Although SABESP, in the State of São Paulo, charged rising tariffs to residential customers as their consumption of water mounted, the situation was the opposite for consumers of more than 5,000 m^3/month opting for fixed demand contracts: the price of the cubic meter was lower, for sequential zones of cubic meters, as the consumption augmented. Although this behaviour can be justified from the perspective of the allocative efficiency for companies of drinking water supply, it is reasonable to infer that lower prices per cubic meter had been a counter balance to the promotion of the rational use of water.

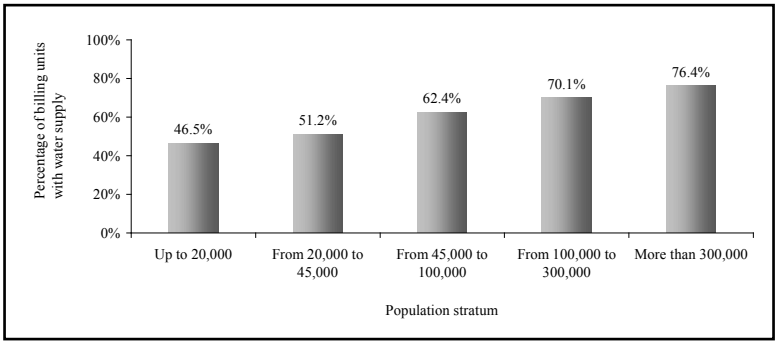

FIGURE 1. Billing units with water supply in Brazil per population stratum of municipalities. Source: Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saneamento Básico 2000. Rio de Janeiro; 2002. http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pnsb/pnsb.pdf. [2008 Sep 14].

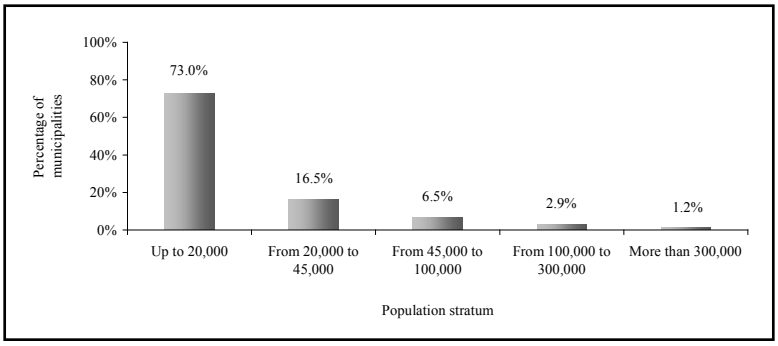

FIGURE 2. Distribution of municipalities in Brazil per population stratum.
Source: Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saneamento Básico 2000. Rio de Janeiro; 2002. http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pnsb/pnsb.pdf. [2008 Sep 14].

The necessity of proper water resources management was clear due to the low availability water/inhabitant/year in some regions, among them the most economically developed in the state of São Paulo: UGRHI 6, at 201 m^3/inhabitant/year and UGRHI 5, at 408 m^3/inhabitant/year. Azevedo et al. (2000) highlight that 1,000 m^3 *per capita* per year is often related to a situation of water stress, where Carrera-Fernandez & Garrido (2002) state that the world average is around 2,500 m^3/inhabitant/year.

On the other hand, according to data from Company of Water Supply and Sanitation SA – SANASA - (Marcon, 2005), the volume of water originated from alternative sources, for commercial, industry and public use, including some hospitals, was approximately 59% of the total consumption of the municipality of Campinas. Other data which indicated a likely movement of consumers towards alternative sources of water in this municipality were obtained from the comparison between 1996 and 2002, category commercial: while the number of connections in 1996 was 22,578 and in 2002 was 24,332, the total consumption changed from 1,349 to 1,184 thousands of m^3, respectively. This dynamic of numbers justified the adoption, according to SANASA, of fidelity and minimum demand contracts, as an attempt to replace consumption flow (SANASA 2003a, 2003b). The Ordinance 518/04 of Ministry of Health established alternative sources of water provision for human consumption: those distinct to drinking water supply which include, among other possibilities, spring, community well, distribution through transporting vehicle, and horizontal and vertical condominium. Probably the search for such alternative sources influenced the favouring of cheaper prices per cubic meter, which was understandable from the market perspective and represented a new opportunity for dialogue between the basic sanitation, water resources and health sectors.

Also it was a concern that the Areas of Protection and Recuperation of Headwaters – APRMs, instituted by the Law of the State of São Paulo 9.866, from 28 November 1997, and even the Areas of Environmental Protection – APAs – already created, such as those located in the Cantareira System, previously quoted, and responsible for water production for around half of the population of the RMSP were being implemented reluctantly. The deterioration of water quality in such headwaters, as discussed by Marcon (2005), should have been understood as a wake-up call for attention to be made to this water resources management.

However, the protection of water resources should not be limited to water production areas. The densification of urban areas, mainly metropolitan, and other basic sanitation considerations also represent a potential implication for water resources.

To support a better understanding, there are some conceptualisations based on IBGE (2003):

- Districts are administrative units of a municipality.
- An urban area is located within the urban perimeter, defined by the municipality law of a city or village.
- The city is constituted by the urban area of the headquarter district, is delimited by the urban perimeter, and contains the municipality prefecture headquarter. Villages are composed of urban areas of districts which are not the municipality headquarter.
- Urbanised areas are those "(….) legally defined as urban, characterised by buildings, streets and intense human occupation, along with

> areas affected by transformations attributable to urban development and those reserved for urban expansion (....)" (IBGE, 2003, p224).

The soil impermeabilisation for streets and buildings should be taken into account, among other factors, as impacting on water resources. The arising flow of stormwater in the drainage network of urbanised areas may cause flooding and escalate the carriage of sediments and general waste, improperly disposed of, into water bodies, resulting in risks to population health and compromising riparian ecosystems. In metropolitan regions, this phenomenon is likely to be amplified because of the clustering of urbanised areas.

The analysis of Marcon (2005) on the largest municipalities of UGRHI 5 showed gaps to be filled regarding both compatibility of master plans with law of use and occupation of the land, and definition of internal municipality areas according to their suitability, including those for sustainability of water resources.

When comparing the evolution of sewerage service coverage just before and after the 90s, a marginal rise is observed: while in 1989 47.3% of municipalities were provided with this service, this number increased to 52.2%, in 2000. Even allowing for a 24% growth in the number of municipalities, the sewerage service did not develop at the same pace, with its increase rate being only 10% for the same period. In this context a municipality was considered to have a network for sewage collection when its network provided services to at least one district, "(….) independent of the extension of the network for sewage collection, number of connections or billing units with sewerage service (….)" (IBGE, 2002, p26). As illustrated in Figure 3, the percentage of billing units with sewerage service grew larger as the population stratum of municipalities augmented. Yet, it is worth mentioning the poor condition of collection networks and of septic tanks (Bittencourt, 2003).

The treatment of the collected sewage also reflected the inequality among municipalities, in accordance with their population stratum: while in municipalities up to 20,000 inhabitants the daily volume of sewage treated was 17.8%, in municipalities with more than 300,000 inhabitants this proportion was 48% (IBGE, 2002).

There were also differences in the country in relation to sewerage service. Whilst in the BMR North, 92.9% of municipalities did not own collection, in the Southeast this figure was only 7.1% (IBGE, 2002).

When the total number of dwellings researched by IBGE is observed, only 33.5% owned general network of sewerage service, again with contrasts. In the BMR North, the rate was 2.4%, whereas in the Southeast this number reached 53% (IBGE, 2002). In general, the larger the population of the municipality, the higher the rate of dwellings served with general network of sewerage service was: "(….) the municipalities with more than 300,000 inhabitants own almost three fold dwellings connected to the general network of sewerage service in comparison to municipalities with populations up to 20,000 inhabitants (….)" (IBGE, 2002, p43), which reflected the fostering of larger urban centres, as already mentioned for drinking water supply.

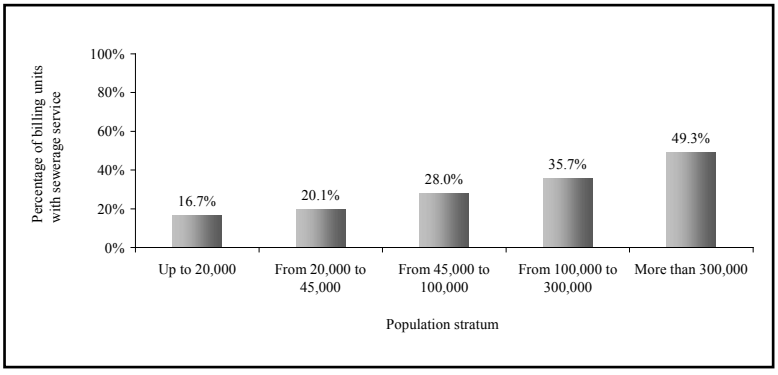

FIGURE 3. Billing units with sewerage service in Brazil per population stratum of municipalities.
Fonte: Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saneamento Básico 2000. Rio de Janeiro; 2002. http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pnsb/pnsb.pdf. [2008 Sep 14].

The boost in the proportion of collected sewage treated between 1989 and 2000 in Brazil was 77.4%, reflecting the effort of service suppliers. This meant an additional 35.3% of collected sewage was treated. The highest rate of increase, 169.4%, was in municipalities of between 45,000 and 100,000 inhabitants. Although in municipalities with larger populations this improvement was also significant, 84.6%, this proportion did not match even half of the sewage collected.

The conditions of sewerage service in Brazil were characterised in the following ways: 47.8% of the municipalities did not collect, 32% only collected, and just 20.2% collected and treated their sewage.

In UGRHI 5, in particular, the untreated or not properly treated sewage had impacted on the Dam of Salto Grande. CBH-PCJ (1996) reported the existence of cyanobacteria in this locality, in which toxins, not being necessarily removed with conventional treatment, may have posed serious health risks for the population supplied with this water.

This situation of water pollution could motivate urban centres to search for more remote headwaters from which to deliver drinking water to the population, raising the costs of access to water. Apart from that, this pollution degrades aquatic ecosystems, making other uses of water resources difficult, such as recreation and fishing, and in some cases causing discomfort for nearby localities because of odours.

Having described results and presented discussions on basic sanitation and its implications for water resources, from this point on the impact on health of inadequate environmental sanitation is shown, including data on deaths and hospitalisations, as well as comparisons between the BMRs.

IMPACTS OF ENVIRONMENTAL SANITATION ON HEALTH

Some diseases are due to inadequate environmental sanitation caused by deficiencies in not only drinking water and sewerage services, but also a wide range of environmental sanitation, including waste management and housing conditions, among others. As such, they are entitled Diseases Related to Inadequate Environmental Sanitation - DRSAI.

The next paragraphs present data on death and hospitalisations due to DRSAI between 1996 and 2000, based on Costa (2004). The emphasis is on diarrhoea, as among all DRSAI, this was the disease most related to inadequacies in drinking water and sewerage.

According to Costa (2004), between 1996 and 1999 there were 59,979 deaths due to DRSAI: of those, 32,817 were the result of diarrhoea, 54.7% of the total. Among deaths attributable to diarrhoea in this period, 17,719 were of children younger than 1 year of age, representing a rate of 14 deaths per day. With the exception of 1998, deaths caused by diarrhoea plummeted, starting with 9,252 in 1996 and reaching 7,309 in 1999. From the total of these deaths caused by diarrhoea, 63% were of children younger than 5 years old and 25% in people older than 65 years of age. Among children younger than 1 and younger than 5 years old, the BMRs Northeast and North presented the highest rates of proportional deaths due to diarrhoea, in general above the national rate between 1996 and 1999. While in 1996 the national rate was 7.91 for younger than 1 year of age, and 7.87 for younger than 5, in 1999 these figures were 6.19 and 6.32 respectively.

If in 1999 all BMRs had the same death rates attributable to DRSAI as the South, which among them presented the lowest proportion for that year, the number of deaths that could be avoided in Brazil would have been around 6,103. Based on the fact that the number of deaths caused by diarrhoea was 53.5% of the total DRSAI in 1999, the estimated number of deaths that could have been avoided due to this particular disease in Brazil would be 3,265. Yet, even the death rate in the BMR South was not ideal, as many of the identified deaths were attributable to avoidable causes (Costa, 2004). Avoidable causes include improvements in the basic sanitation of the BMR South, considering the low rates of collection and treatment of sewage, mainly in the states of Santa Catarina and Rio Grande do Sul.

Again, according to Costa (2004), among DRSAI, a fall in the hospitalisations was observed between 1996 and 2000 from 712,982 to 565,560. In terms of rate of hospitalisations, there was a reduction from 373 to 333 per 100,000 inhabitants, which represented a reduction of 11% in this period. The largest reduction was in the BMR Southeast, of approximately 40%, whilst the smallest in the North was about 15%. In this period diarrhoea was the cause of 92.69% of hospitalisations attributable to DRSAI on average in Brazil, from 662,927 in 1996 to 515,469 in 2000. 52% of hospitalisations due to diarrhoea in this period were in children younger than 5 years old, and from 1997 the age group with

the highest occurrence of diarrhoea began to change from children younger than 1 year of age to those between 1 and 4 years.

The federal spending on hospitalisations caused by DRSAI rose 35% between 1996 and 2000, comprising around 3.2% and 2.3% respectively of the total federal hospital expenditure on diseases. Among hospitalisations attributable to DRSAI between 1996 and 2000, the highest expenditure was on diarrhoea: approximately 90% of the total (Costa, 2004).

The same author also suggests that if all BMRs in 2000 were at the same rate of hospitalisation due to DRSAI as the Southeast, which had the lowest proportion among them in that year, the number of hospitalisations which could have been avoided in Brazil would have been 318,724. In this same context more than 80% of these hospitalisations which could have been avoided would have been in the BMRs North and Northeast. Taking into account that in 2000 diarrhoea was the cause of 91.14% of hospitalisations due to DRSAI, the conclusion is that 290,485 of these cases of diarrhoea could have been avoided.

The analysis above confirms once more the importance of drinking water and sewerage treatment for health and the differences that exist among BMRs with respect to basic sanitation coverage. As a result, it is relevant to emphasise the constitutional attribution mentioned by the Article 200, referring to the participation of SUS in the formulation of policy and the execution of basic sanitation actions. The National Health Policy outlines that the actions and services of SUS must be executed by a decentralised and hierarchical structure, including federated entities and other institutions. This Law also foresees the creation of intersectoral commissions not covered by the SUS, among these, sanitation and environment. In this particular context, sanitation refers to environmental sanitation.

FINAL REMARKS

It is expected that water pricing will motivate suppliers of drinking water to focus on lowering rates of water loss and, in turn, wastage of water.

Drinking water supply tariffs based on contracts of economy of scale do not necessarily lead consumers to use water more rationally, aimed at by the water pricing. This issue should be analysed in the context of each watershed in view of, among other aspects, Article 30 of the Federal Law 11.445/07 referring to categories of consumers in Item I and, mainly, Item III, which is related to the guarantee of the following social objectives: the preservation of public health, adequate services to consumers with low incomes and the protection of the environment. Another aspect to be considered in calculating these tariffs is the subsidies that need to be made in order to deliver coverage to consumers and localities of low income, based on the Article 31, including their operation between localities. This discussion is necessary taking into account the quest for a price composition for final consumers that is in line with the requirements of rational water use, defined by basin committees, in accordance with the Federal Law 11.445/07. This law establishes the necessity of compatibility of basic sanitation plans with river basins plans.

The movement of consumption towards alternative sources, probably motivated by cheaper prices, is not a negative aspect in itself for water resources management and health, as long as the extraction of water follows the terms of water entitlements and is also in accordance with procedures and responsibilities related to control and water quality surveillance for human consumption, based on the Ordinance 518/04 of the Ministry of Health.

It is recommended that actions aimed at protecting headwaters areas, fundamental for drinking water supply, be established based on the watershed as the planning unit, according to the Federal Law 11.445/07, and their basin committees. This condition is reinforced, based on the same law, by the necessity for contemplation of basic sanitation public services delivered in articulation with other sectoral policies, including those of urban and regional development and environmental protection.

Besides, the Federal Law 9.433/97 defines the need for municipalities and the federal district to integrate local policies for basic sanitation, use, occupation and preservation of the land and environment with federal and state policies for water resources.

The above reflections, along with the adoption of urban sanitation and waste management, urban stormwater drainage and management, and the compatibility of master plans and laws of use and occupation of the land, are paramount for urbanised and mainly metropolitan areas.

Differences within BMRs regarding drinking water supply coverage and between municipalities based on the size of their population were identified, even involving cases of water entitlements for inter-

basin transfers in favour of large urban centres. The data on sewerage service coverage contained not only differences among BMRs based on the population of municipalities, but also in the treatment of collected sewage and, potentially, in relation to the adequacy of the treated sewage. Apart from the large amount not collected, there was also the collected, but not treated, sewage which, therefore, could cause dilapidation of aquatic ecosystems where it was disposed of, as well as discomfort in the surrounding areas and impact on the costs for obtaining water from other headwaters.

The participation of SUS in the formulation of the policy and execution of basic sanitation actions could also be performed in basin committees, as was observed in many examples throughout the country. This participation could also be described in basic sanitation plans as they were developed, in terms of the watershed. It is natural to conceive that this participation should be proportional to the death and hospitalisation rates attributable to DRSAI, and that such actions should be prioritised in BMRs and states most impacted, with the aim of improving conditions of drinking water and sewerage coverage.

It is also understood that the enhancement of conditions of drinking water and sewerage in municipalities with low population stratum is not trivial, in view of not only the cost of installing treatment plants, but also their operational costs. Besides states and federal funding, it is expected that water pricing will support, at least partially, investments and financial aid. It is necessary to think about the promotion of health and the adoption of alternative, innovative and safe solutions. Approaches such as the use of rainwater (ENHEALTH, 2004), slow-sand filters (Lantagne et al., 2008) and dry toilets (CERES, 2008) require support from government structures such as SUS, entities related to the control and surveillance of water quality and, in particular, the National Health Foundation – FUNASA – for dissemination and implementation.

In conclusion, interfaces of the basic sanitation, water resources and health mechanisms and institutions in Brazil can and should be developed to promote better results for the society.

It is intended that this analysis contribute to better intersectoral efficiency in Brazil and Latin America, and the sustainable development and acceleration of actions to achieve the MDGs related to sewerage and permanent and sustainable access to drinking water.

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