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SUSTAINABILITY OF WATER AND SANITATION SYSTEMS

Sustainability of rural sanitation in Venezuela

Dr David Holmes, Venezuela

TODAY, SANITARY CONDITIONS in rural Venezuela are typical of those to be found in most developing countries in the tropics. Major infectious diseases, such as malaria, hepatitis, river blindness, leishmaniasis, tuberculosis, Chagas, and cholera, are all present, and in some cases on the increase. The majority of the population lacks access to clean drinking water and adequate facilities for excrement disposal contributing to high morbidity rates due to parasitic diseases.

Ironically, in the two or three decades following WW II, a veritable revolution in rural sanitation was achieved under the direction of Dr. Arnaldo Gabaldon (1909-90), the internationally- known physician and academic, who created and led an exemplary anti-malaria and rural sanitation program which became a model for public health administrators all over the world.

Under Gabaldon's tutelage, Venezuela became the first tropical country to apply DDT for malaria control on a massive scale. A newly created army of professional sanitary inspectors and hygienist fanned out, often on mule back or in dug-out canoes, to bring a message of hope and a kit bag of the latest public health measures to the remotest corners of the country.

Initial results were rapid and dramatic. The mortality rate from malaria dropped from more than 100 per 100,000 population to less than 10 within a decade. This same figure was reduced to 0.5 by 1955 (Ramirez, 1987). The combination of this technological breakthrough and Gabaldon's administrative and organizational genius enabled the country to practically eradicate malaria by the 1960's. The same spray that killed mosquitos also killed flies thereby reducing the transmission of intestinal parasites.

The sanitary engineers soon followed to supervise the construction of latrines, sewers, water supply systems and even low-cost, rural houses. The net result of these and other measures was to reduce the crude death rate from 10.2 per thousand in 1950 to 5.5 in 1980. This, coupled with a rise in the birth rate, triggered a demographic explosion which caused the annual average intercensal growth rate to rise from 1.7% in 1936 to a peak of 4% in 1961, one of the highest in the world.

Institutionalization of rural sanitation

To assure continuity and adequate logistic support, Gabaldon backed up his "army" of sanitary inspectors and engineers with an elaborate institutional infrastructure including the famous Malaria School in Maracay, and an efficient information network on all important aspects of rural sanitation. Nearly every village and town was endowed with its own resident sanitary coordinator.

The Malaria and Rural Sanitation Service was given a privileged status within the Health Ministry. Its nucleus was a group of well-paid and well-trained, public health professionals which constituted an elite corp within the public administration. Gabaldon insisted that even the lowest secretary and field worker be indoctrinated in the organization's values and sense of mission.

Collection and treatment of sewage

In 1962, a separate division, called the "Section for the Control and Disposition of Waste Water" was created within the Malaria Service to manage sewer and latrine construction in the rural areas. Its specific objective was to "achieve an improvement in health by means of the construction of systems for the collection of waste water, designed and constructed in the rural setting, to avoid the propagation of diseases derived from the incorrect disposal of excrement" (Romero et al, 1985). According to the first national census in 1936, 64% of rural houses did not contain any system of excrement disposal. As a result of the efforts of the Malaria Service, by 1981, this figure had been reduced to 34%.

Sewer construction

In 1960, only 34 out of the approximately 5000 towns and villages (of less than 5000 inhabitants) in Venezuela had a sewer system (Censo, 1990). The coverage of the target population was probably no more than 1% and certainly less than 5%. With the impetus provided by the new institutional support, from 1962 to 1985, 509 new systems were constructed by the Malaria Service, many with associated oxidation ponds, raising the estimated coverage of the eligible population to around 30% (Romero et al, 1985).

Latrine building

As a complement to the sewer program, pit latrines were constructed for the dispersed rural population (see Graph 1). Initially, residents were expected to pay for the latrine by means of long-term, low-interest loans. Most proved to be uncollectable and were eventually forgiven by subsequent governments.

Potable water supplies

As a complement to the improved means of excrement disposal, rural water systems were constructed begin-

ning in the 1940's. Starting from a base of near zero, the coverage of the population living in settlements of less than 5000 had risen to 70% by 1985 (Romero et al, 1985).

Sustainability

Despite these promising beginnings, which set Venezuela apart from most developing countries and seemed to promise the eventual triumph of modern technology and organization over the traditional plagues of the tropics, a process of decay began in the 1980's which reversed many of the earlier gains and seriously called into question the long term viability of this development model.

Sewer usage

As mentioned, sewer construction advanced very rapidly, extending the potential coverage to 30% of the eligible population by mid-1985. However, only 26% of the houses adjacent to the sewer lines were actually hooked up by this date (Romero et al, 1985) meaning that in reality, less than 8% of the eligible population actually took advantage of the service. Thus, in terms of any health benefit, a large proportion of this huge investment was simply wasted.

Sewage treatment

An additional and related problem arose with respect to sewage treatment. A large number of the originally constructed oxidation ponds failed after a few years of service because of poor design, inadequate maintenance, and incorrectly estimated sewage flows.

According to Lansdell (1987, p 56), the principal problems were:

- Vegetation invaded the banks and floor causing smells and vector breeding. Maintenance budgets would not cover the expense of clearing and the lagoon was left to its own devices.
- Initial sewage flow was insufficient to combat evaporation, the lagoon never filled, dense vegetation took hold, increasing losses through evapotranspiration.
- The inlet sewer was badly designed or vulnerable to washout by floods.
- Unplanned urban expansion reached to within 10 m of the lagoon water's edge. The lagoon became overloaded, and smells and insects affected the nearest house.

Latrines

The latrine construction program declined markedly toward the end of the decade and was all but abandoned by the 1980's. This was due in part to the relatively high cost of the program (Romero, 1985) and in part to a tacit recognition that latrines came to be regarded by many potential users as ugly, malodorous sources of disease and symbols of underdevelopment.

However, another unstated factor was also present. In the 1980's, the Health Ministry began massively dosing the rural population with low-cost, anti-helminth drugs, such as mebendazol. At a cost of around US $1 per child per year for drug treatment vs. a construction cost for latrines of between US $100 and US $200, it is clear why many health officials viewed this approach as a more cost-effective method for attacking the problem of intestinal parasites (Cutting, 1991).

Unfortunately, subsequent research in Venezuela and elsewhere (Maraven, 1990) has shown that medication, while certainly effective in treating patients with intestinal parasites, provides only transitory relief. Unless accompanied by additional measures such as health education, latrines, and improved water supplies, reinfection takes place very rapidly, completely nullifying the initial results in a matter of a few weeks (Tanner, et al, 1987). Thus, drugs do not represent a panacea but rather one more tool in an integrated approach. Also, promiscuous use of drugs enhances the risk of developing resistant strains of the pathogen.

Potable water

Venezuela's rural aqueducts, which once set the standard in Latin America, also have deteriorated substantially in the past 15 years. Common problems are:

- Capricious and unreliable water treatment; over and under-dosing with chlorine are common. Water testing frequently reveals the presence of coliforms.
- Most rural water systems rely on diesel pumps which are notoriously difficult to maintain in rural areas, resulting in considerable downtime.
- Administration of rural water systems is deficient. Workers do not get paid on time, supplies arrive late, routine maintenance is not regularly performed, and there is little or no effort to collect water bills.
- Water rates are ridiculously low or nonexistent.

Non-sustainability of the model

Why did the rural sanitation campaign in Venezuela, which showed such promise in its initial stages, prove not to be sustainable in the longer term? Part of the answer lies in the vast shift in the population from rural to urban areas in response to new economic opportunities created by the burgeoning petroleum industry (see Graph 2). This phenomenon forced the government to shift priorities away from the problems of rural development toward the more pressing problems of urban slums. But there is more to the story.

Institutional factors

During the decade of the 1970s, Gabaldon progressively relinquished management and control of the Malaria Service with various adverse consequences for the organization, especially in the area of merit promotion. Increasingly, as in almost all other areas of the public administration, the Service became less and less professional and more and more politicized. This coincided

with increasingly stringent budget restrictions which tended to undermine pride and dedication to duty.

Financing

The national economy began to suffer substantial reverses in the mid-1980's which led to reduction in the relative importance of the health sector in general, and the rural sanitation program in particular. Health as a proportion of the national budget declined from a high of 8.6% in 1970 to a low of 6.1% in 1980. Whereas the Malaria Service received nearly 16% of the overall Health Ministry budget in 1960, this figure was reduced to only 4% in 1980 (Gali, 1986).

Added to this problem was the progressive impoverishment of the rural population. According to FIDA (1993), the percentage of rural dwellers in Venezuela living below the poverty line rose from 36% in 1965 to 58% in 1988. Thus, at the same time that public investment was declining, the population had less and less financial capacity to solve its own problems.

Paternalism

Oil riches, a marked, cultural affinity for paternalism and an elaborate system of party-based, political patronage, have accustomed the Venezuela population to turn to the government or to the political parties to solve virtually all problems. This has tended to stunt incipient moves toward greater community organization and cooperation which have provided the traditional underpinning for boot-strap programs throughout the developing world. Thus, both the will and the means for mobilizing self-help schemes to fill the gap left by the retreating public sector have been wanting.

Technology

No sanitation system can be effective without user collaboration. Lack of attention to consumer concerns and preferences in the case of latrine design led to a widespread prejudice against the device which now inhibits its revival in a more appropriate guise.

In the case of water disinfection, a number of technological and human factors came into play. Most village water systems incorporated a mechanism for chlorination based on the use of calcium hypochlorite, although this chemical was not produced in Venezuela.

Importation was not a problem during the years of the oil boom, roughly 1973 to 1982, but in the following period of prolonged economic stagnation, calcium hypochlorite supplies became scarce. There was no provision for the use of sodium hypochlorite, which was available domestically, as an emergency substitute. This weak link in the chain meant that water quality could not be guaranteed. Some consumers responded by applying home remedies, such as boiling water, particularly when there were advertised epidemics of parasitic disease or cholera scares, but most simply adopted a callous, fatalistic attitude toward the risk of waterborne disease.

Even when supplies of disinfectant were adequate there was a problem of dosage control. Modern dossifiers were usually installed initially but the combination of lack of maintenance and timely replacement meant that most had a very short life. The low-level, on-site operator was then left to devise his own, improvised substitute. This usually consisted of a bucket, a piece of plastic tubing and a clothes pin. The crudest solution was to pour chlorine into the water source itself, next to the pump intake, thereby killing all aquatic life in the stream in the immediate vicinity.

Inevitably this kind of improvisation produced both overdosing and underdosing. In the former case, consumers usually rejected the water because of its disagreeable taste. In the latter case, which was more common, the amount of residual chlorine was insufficient to provide contingent protection.

An alternative model

One consequence of the rural exodus was that large numbers of unskilled, rural migrants clustered in squatter settlements surrounding oil company installations. In an effort to escape this problem, the companies isolated themselves behind chain link fences, in self-sufficient enclaves, featuring all of the conveniences of modern urban life.

Following nationalization of the industry in 1975, a new policy was promulgated obliging these oil "camps" to be integrated with the surrounding communities.

It was quickly realized that this integration, if taken literally, would impose on oil workers an unacceptable deterioration in living standards. Therefore, a program was devised for upgrading basic services in neighbouring communities and rural areas.

When the Orinoco Bitumen Belt was opened for exploration in 1980, the new community assistance model was expanded to include water and basic sanitation for rural villages and towns. This approach was characterized by the use of appropriate technology (improved oxidation ponds, rainwater collection systems, individual, water-monitoring and purification systems), community participation (auto-construction with volunteer, community labour), and technical advice offered by oil company employees resident in the area.

An integrated approach to the problem of parasite infection, reminiscent of Gabaldon's original design, was devised which included four basic elements:

- VIP latrine construction (self-help)
- improved water supplies
- health education
- diagnosis and treatment of infected patients with appropriate drugs

The success of this effort prompted the industry to create, in 1992, the Zumaque Foundation, a private, not-for-profit, NGO to carry on and extend this work to other

areas of the country. Accordingly, the Foundation has been helping campesino and indigenous communities in selected areas to take more responsibility for their own welfare and to upgrade sanitary conditions to the level they can afford and maintain, with limited outside assistance from the oil industry and other sources.

Summary and conclusions

Venezuela represents an interesting case of a tropical developing country which was an early pioneer in utilizing modern technology and advances in the science of public health to effect a revolution in rural sanitation. Thanks to these efforts, the country made rapid and even dramatic progress in health and sanitation in its rural areas in the decades following WW II.

This success proved to be a mixed blessing as it contributed to a subsequent, explosive growth of the urban population. Even in the rural areas, these early gains proved to be transitory, with sanitary conditions largely reverting to their earlier state. Helminth and other intestinal parasite infections are still present in the majority of the population. Major infectious diseases, such as malaria, hepatitis, and tuberculosis are on the rise and there have been sporadic outbreaks of cholera. Safe water and adequate excrement disposal are still only available to a privileged minority.

Clearly, the obstacles, such as poor communications, illiteracy and lack of infrastructure were of far greater proportions when the program began back in the 1940s than at a later date when the economic and social development of the country had proceeded to a more advanced stage. Why them was this programme initially so successful?

Much of the credit must go to Arnaldo Gabaldon who almost single-handedly built a rural sanitation empire which was unique in the developing world at that time. The coincident development and commercialization of DDT was also crucial. Oil provided the public sector with the extra resources to finance the program on a the massive scale necessary to produce a genuine impact at the national level. The Rockefeller Foundation and the World Health Organization also provided key outside support and international endorsement.

In hindsight, it is clear that Gabaldon´s faith in his own ability to protect the Malaria Service from the normal processes of bureaucratization and politicization was naive. In his haste to produce results, he underestimated the importance of building an adequate base of support for rural sanitation at the community level; a flaw which he recognized late in life (personal communication with the author's wife).

These defects in an otherwise outstanding model can only be corrected by a painstaking effort in health education at the grassroots level, using the services of NGOs, such as the Zumaque Foundation. By diversifying the sources of financing, relying more on international support in the form of soft loans, the risk of interruptions in the program due to the ups and downs of domestic politics can be minimized. Finally, more attention to the appropriateness of the technology for the particular setting will help guarantee greater user involvement and cooperation.

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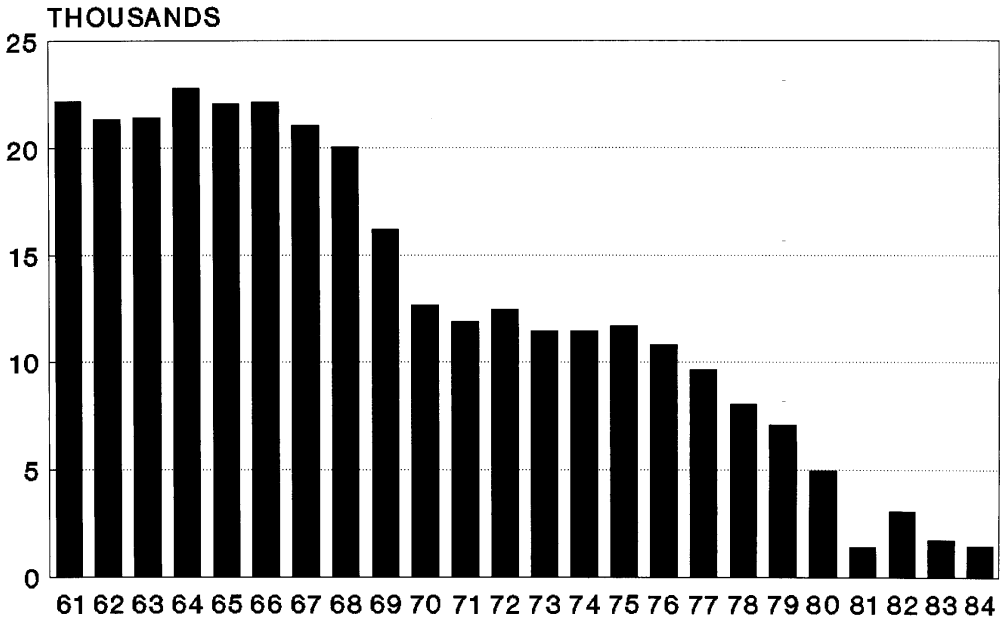
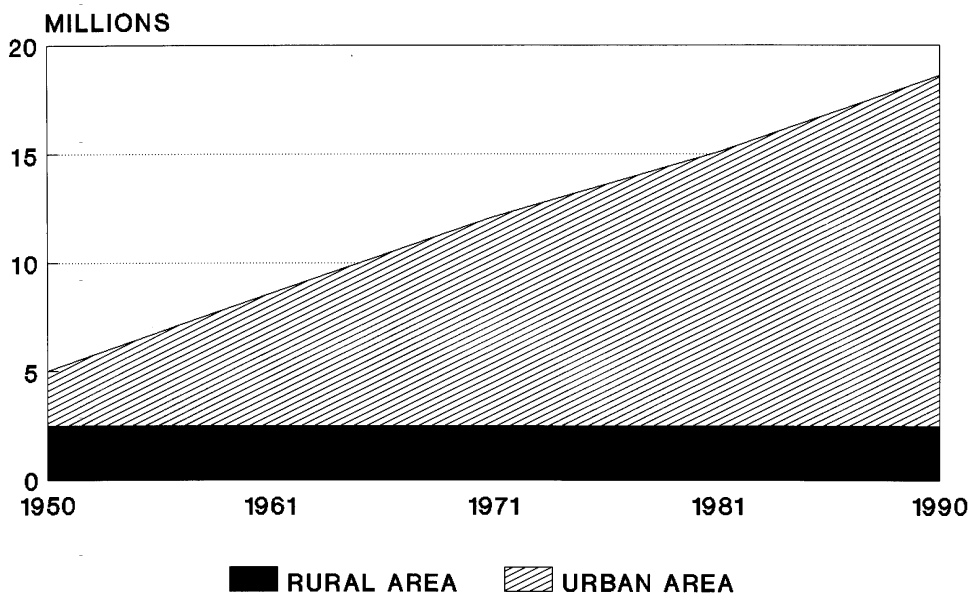


SOURCE: VENEZEULAN HEALTH MINISTRY, MALARIA DIVISION, 1985

Graph 1. Venezuela latrine construction



SOURCE: NATIONAL CENSUSES

Graph 2. Total poblation