Sanitary surveillance in Costa Rica's municipalities

by Carmen Valiente and Stephen Pedley

Costa Rica has made great strides in increasing water supply coverage, but until 1996, had no procedures for carrying out water surveillance. How did they start from scratch?

THE CENTRAL AMERICAN country of Costa Rica is completely tropical, lying between latitudes 11°13'N and 8°N, and longitudes 82°33'W and 85°58'W. To the north, it borders Nicaragua, while, in the South, it shares borders with Panama. Costa Rica's current population stands at 3 600 000.

Costa Rica has one of the most developed and stable economies in Central America. This is reflected in the proportionally high level of central government spending on social infrastructure, in particular, social welfare, education and health. The water sector has also benefited from operating within this environment and, according to 1995 statistics, over 90 per cent of the population now has access to safe drinking-water supplies and sanitation.[1]

Many areas of the country receive regular, heavy rainfall which maintains a substantial reserve of freshwater in the form of both groundwater and surface water. Groundwater is the principal source of water for drinking, but abstraction from surface waters, mainly rivers, is used to supplement supplies. The latest water-supply statistics show that 70 per cent of drinking-water supplies comply with the national water-quality standards. Surveillance is carried out on 80 per cent of drinking-water sources and supplies.

Who will provide?

The responsibility for water management in Costa Rica is shared between four organizations:

● *National Water Supply Institute — Instituto Costarricense de Acueductos y Alcantarillados (AyA)*
AyA is the principal national institute for water supply and surveillance. Its main functions are to design and develop drinking-water supplies, and to collect and dispose of sewage and industrial liquid wastes. It manages 158 water systems supplying drinking-water to a total of 2 125 000 people; 116 of the water supplies are treated with chlorine. In addition, AyA is responsible for the maintenance and protection of water catchment areas, and for the surveillance of municipal water systems supplying water to a further 750 000 people.

● *Municipalities*
Costa Rica's 37 municipalities are government-dependent organizations, responsible for the management of local services, including: rubbish disposal, street maintenance and lighting, taxes, and supplying water to approximately 750 000 people.

The majority of the municipalities lack the money to develop and improve their water supplies. Serious problems

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Over 90 per cent of Costa Ricans now have access to safe drinking-water and sanitation.

Sean Sprague/Panos Pictures

Without adequate laboratory facilities, how can municipalities hope to carry out routine testing?

are now beginning to develop in the water systems, and these are being compounded by the poor quality of the source waters in some areas. Some of the problems could be dealt with by addressing the issue of cost recovery, through a combination of improved debt recovery and the development of appropriate price structures. With time, the municipalities would accumulate a reserve that could be reinvested into improving the water systems.

● *Community Committees (CAARs)*
These are small, rural water systems which are operated and maintained by the local community. There are 1625 CAARs in Costa Rica, supplying water to approximately 707 000 people. Most of these water systems rely upon surface water sources, frequently of a poor quality, which is distributed to the community without treatment or disinfection. Many communities also use groundwater taken from boreholes, dug wells, and springs.

● *Private*
The communities that have developed around the large banana, sugar-cane, and coffee plantations are frequently supplied with water from privately owned systems which are operated and maintained by the plantation-owners.

The rich and varied natural history of Costa Rica attracts a large number of tourists who expect a high standard of services, even in some of the most remote areas of the country. Hotels and other tourist facilities have installed their own, private water supplies.

Water-surveillance programmes have been introduced only recently into the country. AyA recognizes that the surveillance and quality control of water supplies are essential prerequisites for the protection of public health. There is some monitoring of the supplies operated by AyA, which includes both microbiological and chemical parameters. Routine testing is carried out in the main water supplies, including San Jose, by the water-quality section of AyA, and the results are analysed in the laboratories of the major treatment works by trained staff. As we write, no routine sanitary inspection has been carried out, but this is being considered seriously.

In the municipality-operated water supplies, and those run by communities or private suppliers, water-quality monitoring is not yet routine, although some ad hoc testing has been carried out by the Ministry of Health. The managers of these supplies lack laboratory and other testing facilities, so routine testing is unrealistic. The Ministry of Health did carry out some surveillance activities, including sanitary inspection and water quality analysis of small rural supplies and some municipalities, but only on a small scale and not for some years.

Training Programme

In 1994, a training programme in water quality management and surveillance, designed for Central American countries, was launched in Costa Rica by the University of Surrey in collaboration with CAPRE (the regional water services association), the University of Costa Rica, and AyA, with funding from the British Overseas Development Administration (recently renamed the Department for International Development). Soon afterwards, AyA undertook responsibility for surveillance and control of water quality in the municipalities as well as their own supplies.

Work in the municipalities started in January 1996. Surveillance is carried out by a work group composed of an engineer, a cartographer, a microbiologist, a chemist and a field technician. Each member of the group has specific responsibilities according to his or her individual experience and skills. This approach was adopted to ensure that all relevant data is collected and collated. The engineer is responsible for carrying out the sanitary inspection of the water supply, and works closely with the cartographer who prepares

Table 1. Classification scheme for bacterial contamination of Costa Rican municipality drinking-water supplies

Grade	Thermotolerant coliform density per 100ml	Risk classification	Code
A	0	No risk	
B	1 - 4	Low risk	
C	5 - 100	Intermediate risk	
D	101 - 1000	High risk	
E	>1000	Very high risk	

Table 2. Classification scheme for sanitary-inspection scores of Costa Rican municipality drinking-water supplies

Score	Risk classification	Code
0	No risk	
1	Low risk	
2 - 3	Intermediate risk	
4 - 6	High risk	
7 - 10	Very high risk	

detailed sketches of the water-supply systems. A technician then takes samples from the points suggested by the engineer, and liaises with municipality staff. The microbiologist and the chemist carry out the analytical work.

Prior to 1996, Costa Rica had no experience of drinking-water quality surveillance programmes, so many of the local procedures had to be developed from original principles, using the published experience of workers in other countries. Sanitary-inspection forms were designed for springs, rivers, wells, reservoirs, treatment plants, and distribution networks. Each form lists ten questions which can be answered with a simple 'yes' or 'no'. In line with other sanitary-inspection forms, the water system is scored on a scale of one to ten; the higher the value, the greater the sanitary risk. The basic sanitary-inspection forms are supplemented by a general-information form to provide a complete inventory of the water systems.

Once work on the inspection forms had been completed, surveillance teams began visiting each municipality. First, they collected general information on particular aspects of the water supply, such as pipe design, the number of people served, the volume of water provided, and the continuity of supply. It soon became very clear, however, that there was little available information on the design of the systems — this being confined to a few workers, mainly local plumbers who knew about individual sections.

The team was also faced with other major obstacles. Each municipality was served by several different water systems, but no one knew how many people were supplied by each system; only the total number of inhabitants in the municipality was recorded. The percentage of the population at risk from poor-quality water supplies could not be ascertained, and the individuals could not be identified. In many municipalities, this presented the surveillance teams with a problem, as the water quality frequently varied from system to system.

So, to build up an accurate picture of each system, design the sampling network, and carry out sanitary inspections, the surveillance team also included a cartographer to produce draft sketches of the water-supply systems. S/he accompanied the field technician and local staff around the villages, identifying pipeline locations and mapping them; as a result, the team ended up with a clear idea of which water source served which people. Armed with this information, the team was able to carry out far more focused sanitary inspections, and water samples could be taken from strategic locations on the supply system — including the source, reservoirs, and vulnerable points in the distribution system, such as low-pressure points and dead-ends. The samples were then sent to the laboratory for analysis.

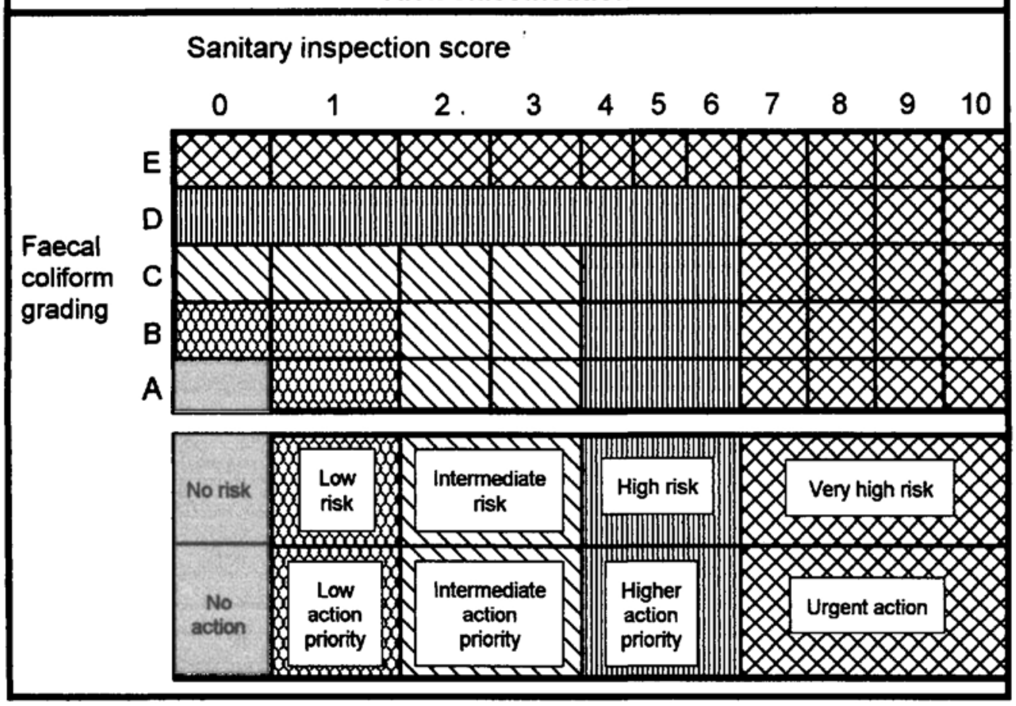
Classification

By collecting basic information on water quality in each municipality, the team was able to develop a classification scheme, based on a combination of the results of the microbiological analysis (of thermotolerant coliforms), and sanitary-inspection scores.[2] The five categories, or grades, established to cover different levels of thermotolerant-coliform contamination are shown in Table 1 (see page 7). Similarly, the sanitary-inspection scores have been sub-divided into five groups (see Table 2). Each category is then assigned a risk classification: 'no risk', 'low risk', 'intermediate risk', 'high risk', and 'very high risk'. Finally, each risk category is given a priority for corrective action, from 'no action required', to 'very high priority'.

To aid the rapid identification of risk classification for any water-supply system, and to assist people who might have difficulty drawing conclusions from analytical values, AyA has introduced a colour-coding scheme for the degree of microbiological contamination and sanitary-inspection scores. *(Editor's note: as we are unable to reproduce these colours, we have substituted patterns).*

Dark blue (grey shading) is used to show an absence of thermotolerant coliforms, and no sanitary risk; light

Figure 1. Municipality surveillance programme in Costa Rica: Risk classification



blue (meshing) indicates between one and four thermotolerant coliforms per 100ml, and low risk. Green (diagonal lines), yellow (stripes) and red (checks) are used to express increasing levels of risk (see Figure 1 on page 8). The colour-coding scheme has been fundamental, both to the process of educating Costa Rica's villagers about water quality, and for communicating risk simply and effectively.

As we write, all the municipal supplies have been visited at least once, and a routine programme is being established through which an AyA surveillance team will make an annual visit. As the programme develops, we hope that staff will be able to devote more time to looking at supplies run by CAARS and private owners; and that monitoring will be carried out on community-run supplies. Some of the private water supplies serving hotels and resorts already carry out some water-quality testing using private laboratories, but many of the suppliers of plantations and farms fail to do any testing, despite the strong likelihood of contamination. The long-term plan is to include all these supplies in the national surveillance programme.

Many of the community and municipality committees, with responsibility for the supply of drinking-water, do not have the financial resources to pay for laboratory analysis. The introduction of sanitary-inspection techniques into Costa Rica has, for the first time, provided these committees with the tools to evaluate risks in their water-supply systems, to identify the source of the risks, and to prioritize remedial action. AyA has assumed the responsibility for carrying out surveillance in the municipalities until the local drinking-water supply agencies have developed the infrastructure to support their own programmes.

Costa Rica is just beginning to appreciate the benefits of a co-ordinated analytical and risk-analysis approach to drinking-water quality management. At last, the water-supply agencies have the necessary information to make rational decisions about the priority areas for water-supply improvement. Ultimately, this approach will lead to improved water quality through the efficient and targeted use of available money.

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Now the different supply agencies have the information to prioritize their improvement programmes, Costa Ricans can look forward to cleaner, safer water.

References

1. WHO/UNICEF, 'WSS Sector Monitoring Report', WHO, Geneva, and UNICEF, New York, 1995.

2. Lloyd, B. and Helmer, R., *Surveillance of Drinking-Water Quality in Rural Areas*, John Wiley, New York, 1991.

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