Consumer involvement in bacteriological testing of well water in Kibwezi, Kenya

by Melvin Woodhouse

The Divisional Wells Committee in Kibwezi, Kenya, embarked on a self-evaluation exercise to help them plan for the future. The close involvement of the committee helped to emphasize the links between bacterial presence and pollution.

AFTER A SIX-YEAR involvement with a community-based water-supply project in Kibwezi Division, Kenya, a local management body called the Divisional Wells Committee evolved. They embarked on an evaluation exercise which would help to plan for the future and consolidate the existing knowledge of the project.

The nature of the project dictated that it should be a self-evaluation, as the local people themselves would use the information and implement the change. The Minimum Evaluation Procedure (MEP) of the WHO was used and modified to include a bacteriological assessment of both the well-water and of the drinking-water in the homes of well-users.

Methods

In order to enable the fullest involvement of the committee, field techniques for the bacteriological analyses were used. Two techniques for analysis were chosen: membrane filtration using disposable 37mm filters where the culture medium was membrane-enriched Teepol broth, and disposable coli-count dipslides. Both of these techniques evaluate faecal coliforms.

Using the framework developed from the MEP it was determined that a minimum of 30 wells should be tested and that at one well domestic samples from 15 homes would be taken. In order to reflect the actual conditions, water at the wells was sampled from the pumps without flaming the pump spouts or first emptying the rising main, since this is how water is drawn in practice. Similarly for the home samples the sampler asked for a drink of water and sampled direct from the vessel they were offered.

After sampling 29 wells using both a filter and dipslide under supervision, the field team then went on to sample, unsupervised, 15 homes served by the same well. All samples were transported at controlled temperatures using cool boxes and incubated at 44.5°C for 24 hours.

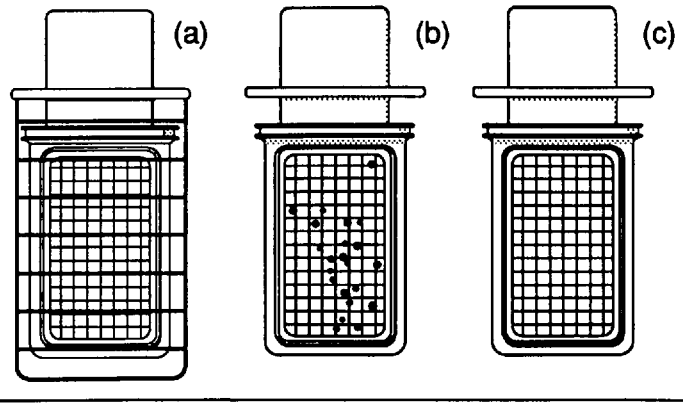
At wells where there were visible pollution risks, photographs were taken to illustrate the possible cause of the anticipated result of the bacteriological test. Cultures were retained after incubation for subsequent comparison with photographs.

As part of the evaluation, the committee carried out a sanitary survey of nine wells which were being studied in detail. This survey involved awarding one mark each for up to 10 observations which would safeguard water quality. The method had been field-tested with the Divisional Wells Committee to ensure consistent judgements were being made. The 10 observed points were:

- A good seal between the pump base and well head.
- Well head in good condition.
- Apron in good condition.

The coliform dipslide technique

A dipslide consists of a sterile paddle on which is fixed a filter pad pre-coated with a growth medium. The paddle is housed in a graduated clear plastic container. The paddle is removed from the container and the container is filled to the mark with the water sample, then the paddle is replaced and left for a specified time while the filter absorbs part of the water sample. After the set time has elapsed the paddle and container are separated, shaken dry and put back together again. The complete dipslide is then incubated, after which colonies formed can be counted directly and may exhibit a particular colour dependant upon the growth medium used.



The paddle is housed in a graduated clear plastic container (a). After the filter has absorbed the water sample and the dipslide has been incubated, colonies may have formed (b) or the sample may have been clear (c).

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- ○ Good spillway and drainage.
- ○ A good fence around the well.
- ○ The soil around the well is stable.
- ○ No latrines or animal faeces near the well.
- ○ Paths lead to the well from the downhill side.
- ○ The pump is working.
- ○ A good overall appearance.

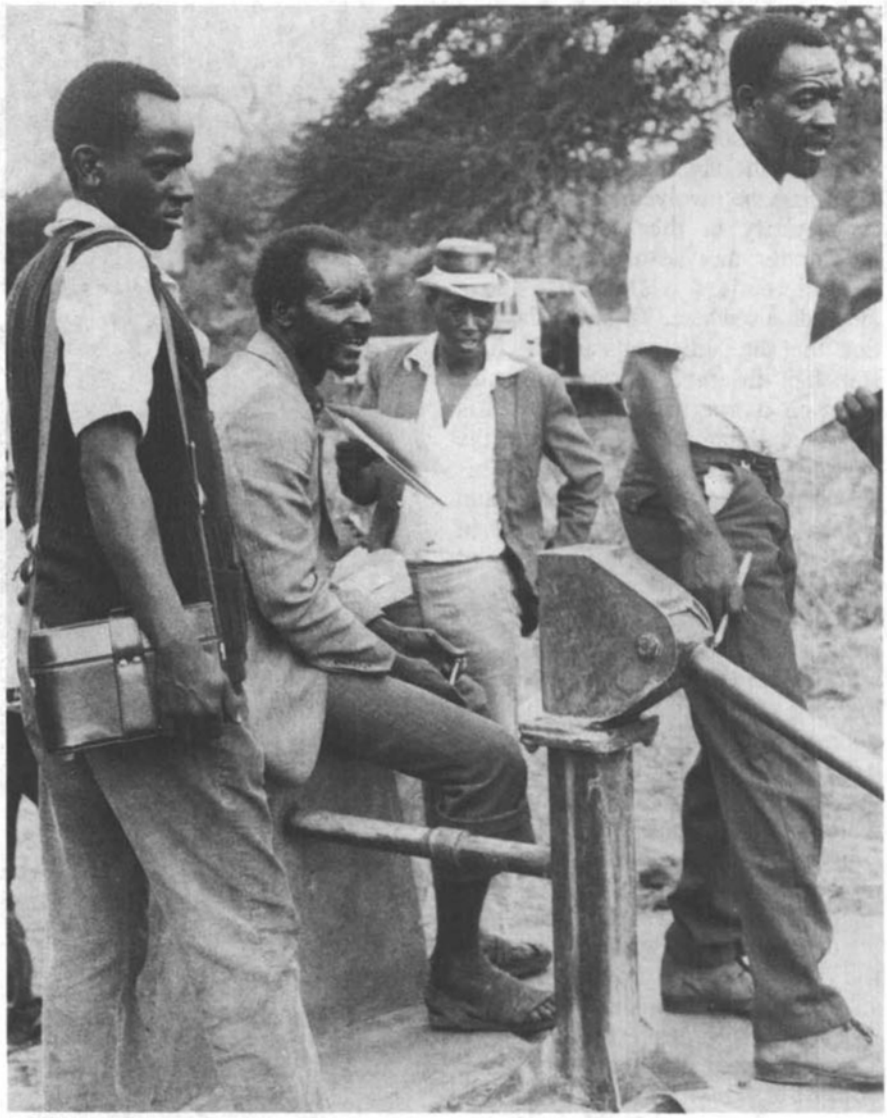
After all the data had been collected the results were discussed with the committee. Here cultures were examined together with photographs, sanitary survey results and other evaluation data relating to the functioning of the wells. From this and other meetings the committee made plans for the future activities of the project.

Results

Table 1. Tests on 29 wells

faecal coliforms per 100 ml	membrane filter	dipslide
<10	22(76%)	21 (84%)
10 or more	7 (24%)	4 (16%)

note: 4 dipslide tests were rejected as invalid.



The Kibwezi Divisional Wells Committee field testing the sanitary survey.

The 11 observations of coliform counts of 10 or more were made at 10 wells. Of these wells 7 were found to have well-head problems which constitute a pollution risk. Of the 9 wells on which a sanitary survey was carried out, 7 wells scored 5 or more points, the highest score being 9. A score of 10 indicates a low pollution risk.

Table 2. Tests on water samples taken from 15 homes

faecal coliforms per 100 ml	membrane filter	dipslide
<10	2(13%)	2 (13%)
10 or more	13 (87%)	13 (87%)

As the quality of water in the homes would depend firstly upon the quality of the water at source it was essential to examine the well-water quality throughout the period of home sampling. Well-water was sampled by both techniques on three separate days, the day before, the day of and the day after samples were taken from the homes. On all of these occasions the well-water contained no faecal coliforms.

Discussion

The correlation between the two methods, dipslide and filter, proved poor. This may in part be a result of the fact that the samples were taken on-line as water came from the pump, and samples may not have been homogeneous. The choice of a single method for testing would depend to a large extent upon funds available. Dipslides cost US $8 each, while the disposable filters cost US $3.60 each, not including necessary media and sampling equipment. The dipslides however do have the added advantages of convenience and easier use, and they do not require ancillary equipment other than an incubator; thus dipslides are suitable for one-off assessments. The dipslide samples 1ml of water, the filter 10ml.

For all of the positive coliform results from well samples, possible sources of pollution could be determined from visual inspection or may have resulted from non-disinfection when sampling. The marked difference between well samples and domestic samples almost certainly results from the methods of transportation, storage and use.

Of the 15 homes sampled, 11 stored their water in the same container which they used to collect it. The carrying containers were plastic 20- or 25-litre jerry cans of a variety of colours and translucency. Not decanting the water did not appear to influence quality in this investigation. The remaining four homes all decanted water into storage vessels: two homes used plastic jerry cans with the tops cut off, one home used a clay pot and one home used a 220-litre oil drum. These aspects of water storage undoubtedly influence domestic water-quality and would be worthy of detailed investigation.

Due to the techniques used, the committee have a much clearer understanding of the origin and risks of bacterial pollution of water. The

exercise also helped the committee to identify tangible activities which they could carry out to improve their water supplies. It is not the intention of this article to discuss the bacteriological results of the investigation per se, but to discuss the involvement of the local community in the testing. Some comments may be useful however, should readers wish to use these methods elsewhere. This was the first time that the participants and the field staff had observed bacterial colonies through a magnifying lens. This clearly and dramatically illustrated the messages of hygiene education. This lesson provided the ideal introduction to then clarify the links between faecal contamination, water pollution and illness.

The committee was quick to suggest remedial actions and as a whole decided to modify its well-visiting meetings to highlight how poor well maintenance could lead to bacteriological pollution. They made copies of relevant photographs of wells and corresponding cultures to educate well groups about the need to protect and maintain their sources.

The committee was also alarmed at the deterioration of water quality from the well to the home. Several suggestions were made for practical measures to improve the situation. These included disinfection of water containers on a regular basis and continuous chlorination of wells. The committee called for an investigation into the types of containers used to transport water and how this influenced quality. Overall the need for better extension of hygiene education was urgently called for and it was felt that an approach should be made to the consumers directly.

Water storage influences domestic water quality.

Conclusions

The outcome of the self-evaluation as a whole has been the development of practical and tangible work plans to improve the present activities of the project and to develop its future. By far the greatest achievement of the bacteriological testing has been the realization of the nature and implications of bacterial water-pollution and the subsequent stimulation to action of consumers. The strength of the exercise is now apparent, as well-groups are applying their new knowledge to improve well design and maintenance.

The exercise of involving local people and untrained technicians in bacteriological water-quality testing gains more from its qualitative understanding than it does from its quantitative assessment. By making visible the relationship between pollution risk and the presence of bacteria through their own experience, consumers gain the confidence to speak about water pollution and the awareness to act. With a realistic understanding and the will to make practical changes the messages of hygiene education can be absorbed and used.

The exercise highlighted for consumers not only the need for protection of the water sources but the need for preserving water quality in the home.

The involvement of consumers in bacteriological testing of water supplies is a powerful educational tool and should be encouraged, particularly in community-run projects. The method presented here can be carried out with relatively low input for considerable benefit. Such an application should be considered as domestic water-quality becomes a more tangible problem as Decade water-projects reach maturity. ■

AMREF supports the project through two full-time staff, a driver/technician and a mason, neither of whom were familiar with bacteriological water-testing. This team works through the Divisional Wells Committe.
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FURTHER READING

Hutton L., *Field Testing of Water in Developing Countries*, Water Research Centre, U.K. 1983.

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