33rd WEDC International Conference, Accra, Ghana, 2008

ACCESS TO SANITATION AND SAFE WATER:
GLOBAL PARTNERSHIPS AND LOCAL ACTIONS

The risks of a technology-based MDG indicator for rural water supply.

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The MDG indicator for access to safe water equates technology with water quality based largely on designed rather than observed capacity to block routes of faecal contamination. This is a useful driver for donor and government investment in rural water supply, but breeds donor dependency as generally accepted technologies are unaffordable to consumers. Sparse data on water quality suggest a need for greater data collection and more objective assessment of the real improvements being achieved for the donor-dependent investments being made, which are leading to very slow rates of progress. Broadening technology options to include progressively improved household access and water treatment may increase rates of progress, and cost-effectiveness and improve the lot of many more consumers without jeopardising water quality.

Introduction

Target 10 for MDG 7 is 'to reduce by half the proportion of people without sustainable access to safe drinking water' and the indicator is 'sustainable access to an improved water source'. Each country sets its own standards of acceptable 'improved water sources' but with a general emphasis on water quality. Improved water sources are listed by the JMP (van Norden 2007) as being -:

Improved	Unimproved
• Piped into dwelling, plot or yard	• Unprotected dug well
• Public tap/standpipe	• Unprotected spring
• Tube well/borehole	• Cart with small tank/drum
• Protected dug well	• Tanker truck
• Protected spring	• Surface water (river, dam, lake, pond, stream, canal, irrigation canal)
• Rainwater collection	• Bottled water

For fear of poor water quality 40% of sub-Saharan countries (SSA) and many donors limit acceptable technologies to those with handpumps or higher levels of service[i]. Most of the rest include fully lined and protected hand-dug wells with pulleys or windlasses, and a few, lined wells with a rope and bucket (e.g. Niger). As a result, overall in the region just over 16% of the rural population have access to handpumps/ boreholes[ii] and about the same proportion use open hand-dug wells with pulleys or windlasses. Over 30% use traditional groundwater sources and a slightly lesser proportion use surface water sources. The remainder use protected or unprotected springs or other supplies. With average unit costs mostly in the range of $3,-10,000 (not including software) accepted improved options are too expensive for users to construct at their own cost, and so rural water supply remains almost totally donor dependent. As a result of such dependency, improved access to rural water supply in SSA has been progressing at less than 0.5% per year, (JMP 2006) when the required rate was 2.8% from 2004.

This paper examines the track record of accepted technologies in delivering the assumed safety of supply, and so highlights the need to collect more relevant data. The lack of baseline data is making it very difficult to assess the cost-effectiveness of the very large donor investments being made, or to test some of the assumptions which form the foundation of technical aspects of rural water supply strategy. It raises the fundamental question of whether accepted technologies are bringing about a consistent and absolute change in water quality which justifies a global strategy which provides such technologies to a few, rather than looking more for a wider range of incremental improvements in access and quality for all.

Performance in water quality

There appear to be few systematic studies of water quality which include both protected and unprotected supplies to show a) the relative performance and cost-effectiveness of different technologies in improving water quality, b) the sustainability of water quality improvements with consumer operation and management. The WHO Rapid Water Quality Assessment study for six countries remains to be published. It will give a better picture of real water quality delivery from protected supplies and at the point of consumption. However it will not give any comparative picture of how much improvement the investment in such supplies has actually brought to consumers since it does not include water quality data for unprotected sources which such supplies replace. It will, however indicate the degree to which reduced water quality at the point of consumption may negate large investments in the source, unless such sources significantly reduce distances for water collection..

Baseline situations

Few countries are including baseline surveys of water quality with which to compare the protected supplies they are introducing, nor are they monitoring whether performance at the time of construction are being maintained over years of operation. Surveys in Zambia (Sutton 2002) and Mali (Maiga 2006) provide fairly similar results in terms of baseline water quality (see Figure 1), both sampled during the rainy season.

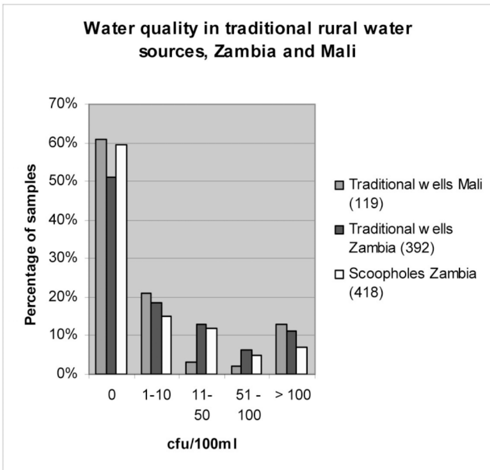

Figure 1. Baseline water quality in unprotected rural water sources

Culturally and physically the study areas differ widely. Mali has high numbers of livestock, a dry savannah environment and a largely Muslim population. The regions sampled in Zambia have very few animals, relatively high rainfall (1300mm), and a largely Christian population.

82% of unprotected traditional wells in two areas of Mali had less than 10 cfu/100ml whilst in Zambia the number was lower, at 70-75% for traditional wells and scoopholes, but in both cases it appears that relatively few sources present very high risks. The proportion significantly contaminated (>100cfu/100ml) was from 7-11% in Zambia and 12% in Mali. However in other countries, sometimes perhaps in less rural environments, higher levels of contamination are found. Comparing with results from protected supplies in Ethiopia and Mozambique (Table 1), it can be seen that certainly in some countries protected supplies may be providing lower water quality than unprotected wells in other (even neighbouring) countries. This suggests that a first step might be to look more at practices and less at technologies, in improving water quality, and to focus more on sources most at risk. Our present perceptions of 'risk' seem to condemn many sources providing good water and accept many sources which are not.

Several studies have shown that relatively inexpensive changes to traditional wells and scoopholes can improve water quality significantly. Zimbabwean studies have shown that up-grading of traditional unlined family wells to include a windlass and brick lining reduced contamination by almost two-thirds, while adding a low cost pump reduced mean faecal counts by a further two-thirds (Morgan 1991). 80% of these investments were paid for by families themselves. In Luapula province of Zambia, recent testing with H_2S

vials (Ministry of Health data 2007) found that 80% of traditional wells had some level of contamination, but when well-head protection was provided (apron, drainage and top slab/cover) 75% of wells were free of contamination (sample size – 54), even though in both cases water was still drawn with a bucket and rope. Thus small changes can cause significant shifts in quality as was also found in the wider action research study undertaken in Zambia from 1998-2001 (Sutton 2002, 2005). This also showed that in the study areas, large investment in high specification shallow wells did not significantly reduce the proportion of contaminated wells, but did reduce those with above 100 cfu/100ml from 10-5%. This brings into doubt the cost-effectiveness of some interventions, and suggests that small-scale interventions may also have a part to play.

Table 1. Protected rural water supplies and water quality

Country	Supply type	Percentage samples with >10 cfu/100ml	Percentage >100 cfu/100ml	Sample numbers
Guinea Conakry[i]	Lined well +Bucket and windlass	23%	6%	35
Ethiopia	Mechanised pump/ borehole	23%	6%	290
	Lined well with handpump	34%	13%	155
	Protected spring	47%	18%	319
Mozambique	Lined well + Rope pump	42%	n/a	109
	Lined well + Afridev	38%	n/a	97
	Lined well +Bucket and windlass	53%	n/a	60
Zambia Northern + Western Prov	Lined well +Bucket and windlass	17%	11-12%	1798
Kenya	Lined well with rope pump	10%	7%	26
Eritrea	Protected water sources (H2S vial test)	39.5% contaminated		215
Malawi	Borehole with handpump	40% contaminated	3% >25 cfu/100ml	300
South Africa/Zimbabwe	Protected supplies	12%		188

Data Sources listed in Notes[iii]

Absolute quality of delivery

Few countries can afford regular monitoring of different supply types in rural areas, although protected supplies may be sampled at time of construction. There are many small studies which added together may improve the picture, but which may have low statistical significance on their own. A few examples are given in Table 1, and a request is made for participants to send in any good data that they have available to broaden the data base which the Rural Water Supply Network is seeking to establish.

The sites in Table 1 are almost all in rural areas. They mainly reflect point contamination due to poor completion, abstraction practices and site management/ maintenance, - factors which great efforts have been made to avoid through construction supervision, sensitisation and training, but which still seem to be common features. Higher counts tend to be found in more urban environments, sometimes as a result of aquifer contamination from latrines, but often from poor water abstraction practices and higher numbers of users. In some rural towns with low density housing, aquifer contamination is regarded as less of a problem as in Niassa, Moçambique (Cronin et al 2006)) but available results tend to suggest that cultural, hydrogeological and technological issues cause such wide variation in both rural and urban areas that surveys should be carried out to characterise each area, rather than making assumptions which can be unduly alarmist or sanguine.

Quality at point of consumption

It is now widely understood that providing safe water at the source does not imply that safe water is consumed. Gundry et al have demonstrated that around 40% of safe water is significantly contaminated before it is consumed. A (CERE 2005) survey for UNICEF in Guinea showed that while 78% of 35 sources were of low risk at the source, (despite proximity of latrines in many cases), only 17% of these retained their low risk at point of consumption. In the Ethiopian Rapid Assessment more than half of houses showed post-collection contamination of stored water, but not necessarily a link to source technology. The surveys in Mali and Zambia both showed much lower contamination in transit and storage, also suggesting that again practice rather than technology may be a major factor.

Point of use water treatment, has been shown by many practical studies to have a significant effect on water quality and health, especially in under 5's and other vulnerable groups. For example the meta-analysis by Fewtrell et al (2005) notes that "improving the microbial safety of water immediately before consumption seems to be very effective in reducing diarrhoeal disease", identifying an average of 34% reduction, and concludes that " a water quality intervention at point of use should be considered for any water supply programme that does not have 24 hour access to a safe source of water" (i.e. a safe household water connection). This suggests that household water treatment is necessary almost regardless of the type of rural water supply technology, and therefore unless the technology is also improving access/ convenience and reliability, its cost-effectiveness is limited.

User priorities

The objective of improving water quality has often over-ridden the other factors for which consumers value water supply. In particular the accepted technologies are too expensive to be made available at any but communal levels. This may bring water nearer to some especially in areas where groundwater is difficult to access, and in this case it is highly valued, but for its relative convenience as much as its quality. However many millions of people in rural Africa strive to have their own supply or benefit from one developed by a neighbour or the community itself (commonly called Self Supply since most if not all investment is by the users- WSP 2005), and these offer additional alternatives which can provide added benefits at a fraction of the cost, especially where communal protected supplies are inadequate or non-existent. Where consumers view the protected alternatives as inadequate or less acceptable, they will not be discouraged from using other supplies (see WHO Framework 2006) and so their preferences need better understanding. Such supplies are developed despite the lack of government support in subsidies or loans and technical advice, and of private sector capacity, because users put special value on convenience, ownership, reliability and potential for income generation , which may sometimes be less well-addressed by communal supply technologies. These supplies offer an additional asset for low cost development and improvement if incremental improvements were included in rural strategies.

Conclusions

There is a lack of good data on how much long- term improvement to water quality is being brought with different types of supply technology. Better and more extensive data is necessary for analysis of cost effectiveness of the very major investments being made through policies which standardise on high cost options.

'Safe' technologies are shown not to be providing safe water for as much as a quarter of supplies and additionally 40% of consumers may be drinking water contaminated after it leaves the source. Much further improvement can be brought about by household water treatment, but this creates a dilemma between saying that a protected supply is preferable because it is safe, and promoting treatment because it isn't.

Comparison of water quality within specific technology types suggests that social and physical factors in site management and water abstraction and storage have as much effect on water quality as does the technology itself. In addition small, inexpensive changes in traditional source protection may provide significant quality improvement, without disturbing convenience, income generation and ownership which many private well owners value as much as, or more highly than water quality. Thus low cost behavioural and technology

changes need to be explored and perhaps offered as options alongside those more expensive alternatives promoted at present.
Sector professionals/ donors are driving strategies which reflect their priority for providing safe water through technologies which require large (average $40-50 per head) subsidies. This is leading to standards which exclude protected wells with bucket and windlass in some countries and in almost all results in exclusion of incremental improvements and progressive risk reduction which are possible in many areas and could be affordable to users at far lower per capita costs, significantly speeding up supply improvement. Data available so far suggests that empirical evidence may not support the theoretical basis of such technology-based strategies, and so an objective assessment of the effects of a high emphasis on water quality and the resultant limited technology options and slow progress towards the MDG target should be made. This is not to say safe water is not important, but simply that translating it into acceptable technology options may be misrepresenting their ability to deliver safe water to consumers and negatively influencing the rate of progress for rural populations to have access to improved supplies.

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Keywords
rural water quality, technology, MDG indicator

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