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SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

Assessing impacts of improved hygiene

Rodney Dyer, Bangladesh

A COUPLE OF decades ago, hardly anyone bothered about measuring the impacts of development activities. A project economist would make some creative assumptions about the expected benefits and, as if by magic, the economic rate of return required to satisfy the funding agency would be forthcoming. Only more recently has it become at all normal for the agencies responsible for those original decisions to check out what really happened, so it took some time for us to begin to learn from experience.

In the case of water supply, we had been clear that everyone needed access to water to stay alive, clean water if they were to stay healthy, so we set out to provide it for them. That was simple to measure. X water points, each serving Y people, meant a population of X times Y was served.

What actually happened was neither simple nor expected. The powerful decided where the water points should be installed, to suit their convenience. The poor and vulnerable were restricted in their access, or excluded altogether. Nobody saw it as their responsibility to repair the equipment when it failed. Even those who did get improved access still suffered from waterborne diseases. Some people swapped one hazard for another, where chemical toxicity of groundwater (e.g. fluoride, arsenic) became apparent.

The most important realisation was that people's behaviour was more significant than hardware, in achieving the expected benefits from water supply schemes. And the most important behaviour was that associated with defecation. So the water supply sector became the water and sanitation sector. We now became preoccupied with another piece of hardware, the sanitary latrine, and many agencies fell into the same trap again, of simply providing and counting coverage.

Within Bangladesh, the CARE Bangladesh Sanitation and Family Education Resource (SAFER) Project[1] adopted a radical approach to avoiding that trap. It focused solely on hygiene behaviour change, without offering any hardware directly through the project. Nevertheless, it resulted in a 130% average increase in the use of hygienic latrines in the project areas, associated with a 70% average decrease in childhood (under-five) diarrhoea prevalence[2]. UNICEF reported[3] a steady to deteriorating situation for these parameters in the project district over the same period.

Also in Bangladesh, the government's Department of Public Health Engineering (DPHE) has just started implementing a Rural Hygiene, Sanitation & Water Supply Project, with assistance from UNICEF and funding from DFID, eventually to cover 38 of the 64 districts of the country. The project goal, as expressed in the logical framework, is "to reduce mortality, morbidity and malnutrition due to diarrhoea and other poor sanitation related diseases, especially among poor women and children". The purpose is "to improve standards of hygiene practices and behaviour, particularly for the poor, on a sustainable basis". Outputs include ensuring access to sanitation and water supply hardware, but this comes only after participatory hygiene awareness-building activities and community action planning, facilitated by local NGOs. The project therefore represents a further important step by government away from the old hardware driven approaches.

Now that we are expressing our project objectives in terms of outcomes for people, rather than in terms of hardware coverage, monitoring progress against these objectives has become much more complex. Clearly, the most important outcome we are looking for from water supply, sanitation and hygiene promotion interventions is a reduction in ill health. A reduction, for instance, in the prevalence of diarrhoea might seem an obvious indicator of success.

However, epidemiologists caution us against trying to establish that a health impact is attributable to a particular intervention. There are too many random variables to gain reliable information from statistics-based surveys. Better results come from observing practical outcomes such as the use and maintenance status of facilities, or improvements in hygiene practice[4]. The linkage between these proxy indicators and actual health benefits is then taken as already established through more rigorous studies[5].

Diarrhoea prevalence has some other weaknesses as an indicator of the effectiveness of water supply, sanitation and hygiene interventions. Surveys tend to focus on the number rather than severity of cases, and generally depend upon the respondents' recall over e.g. the preceding two weeks. Several of the ill effects of poor hygiene do not manifest themselves in diarrhoea at all (e.g. tapeworms and other worms).

On the other hand, reliance on the use and maintenance status of facilities or improvements in hygiene practice as indicators has its weaknesses too. Usage may not be consistent, and access alone is certainly no guarantee of usage. As the agenda broadens from sanitation to environmental sanitation (including solid waste and sullage disposal etc), the number of factors to be monitored increases, and the relative significance of each is hard to gauge. An outcome

indicator that somehow captured the impacts but avoided the weaknesses would be a very powerful tool.

Within Bangladesh, Progotir Pathey provides the most comprehensive information of interest for the sector. Mean percentage figures are compiled for each of the 64 districts, for a range of parameters of water supply and sanitation access, hygiene behaviour and health outcomes. An attempt has been made for this paper to find correlations between some of these parameters for the years 1994 and 2000, and between the incremental changes in these parameters from 1994 to 2000[6]. The selected parameters, with explanatory details where appropriate, are as follows:

- **Clean Water Access** – drinking water drawn from tube well, tap or ring well
- **No Access to Water Seal Latrine** – the "approved" standard sanitary latrine
- **No Access to Water Seal or Pit Latrine** – a pit latrine is also regarded as hygienic
- **Use of Hanging Latrine** – unsanitary, as it discharges into the open or into water
- **Open Defecation** – again unsanitary, but usually away from the settlement
- **No Fixed Place for Under Five Faeces** – these are hazardous if left exposed
- **Under Five Faeces not in Latrine** – the latrine is the safest place for them
- **Hand Washing Only with Water** – after defecation, this is traditional but inadequate
- **Not Hand Washing with Soap** – after defecation, soap is the best, if affordable
- **Not Hand Washing with Water & Agent** – an agent (soap, ash or soil) is essential
- **Under Five Malnutrition, Boys** – mid-upper arm circumference (MUAC) < 12.5 cm
- **Under Five Malnutrition, Girls** – ditto
- **Under Five Malnutrition, Boys & Girls** – ditto
- **Poor Housing** – main bedroom not of brick/tin with tin roof, a measure of poverty
- **Under Five Diarrhoea** – three or more episodes per day within last 15 days

The results of these investigations are summarised in Table 1. Under five diarrhoea and malnutrition were checked against each of the other parameters in turn, to see whether one showed a more robust correlation than the other.

First of all, it has to be acknowledged that none of the correlations is sufficiently robust to establish the existence of an empirical relationship, perhaps in part due to adjustments made in the treatment of the survey data between 1994 and 2000, and explained in the 2000 volume. However, a number of observations can be made as follows:

- The most consistent hygiene behaviour/practice correlation is that between hanging latrine use and under five malnutrition.

Table 1. Correlation coefficients for selected parameters from Progotir Pathey

	Under Five Diarrhoea			Under Five Malnutrition		
	1994	2000	1994-2000 Change	1994	2000	1994-2000 Change
Clean Water Access	-0.041	0.004	-0.135	0.122	0.219	0.037
No Access to Water Seal Latrine	-0.052	0.053	0.149	0.016	0.156	0.035
No Access to Water Seal or Pit Latrine	0.112	-0.03	0.063	0.001	0.204	-0.009
Use of Hanging Latrine	0.356	-0.019	0.267	0.456	0.216	0.171
Open Defecation	-0.285	-0.018	-0.227	-0.463	-0.056	-0.192
No Fixed Place for Under Five Faeces	NA	0.077	NA	NA	0.256	NA
Under Five Faeces not in Latrine	NA	0.105	NA	NA	0.284	NA
Hand Washing Only with Water	0.257	-0.237	0.15	0.341	0.013	0.371
Not Hand Washing with Soap	-0.231	0.026	-0.148	-0.087	0.234	-0.08
Not Hand Washing with Water & Agent	0.142	-0.227	0.022	0.172	0.009	0.215
Under Five Malnutrition, Boys	0.291	0.392	0.255	NA	NA	NA
Under Five Malnutrition, Girls	0.372	0.379	0.232	NA	NA	NA
Under Five Malnutrition, Boys & Girls	0.36	0.442	0.269	NA	NA	NA
Poor Housing	-0.088	0.109	-0.168	-0.359	0.02	-0.348

NA - data not available or case not applicable

- Some correlations seem perversely counterintuitive, e.g. the negative correlation between open defecation and, especially, under five malnutrition in 1994. Possibly under fives are not affected by open defecation, which takes place well away from the home. Even then, however, a zero rather than negative correlation might be expected.
- Where the correlations are reasonably in line with expectations (hanging latrine use, under five faeces disposal, hand washing only with water, not hand washing with water and agent), the relationship with malnutrition tends to be stronger than that with diarrhoea prevalence.
- There is a very consistent correlation between malnutrition and diarrhoea.
- Insofar as there are any correlations between poor housing and diarrhoea and malnutrition, they are counterintuitive, suggesting that the two relationships above do not derive simply from economic factors, i.e. it is not simply a matter of children from poor families both having poorer hygiene practices and behaviour and tending to be less well-fed.

Steven Esrey[1] also found that anthropometry[2] (in his case principally height for age rather than MUAC) correlated better than diarrhoea prevalence, with incremental improvements in water and sanitation access. So it seems that anthropometry may have the potential to provide the powerful outcome indicator that we are looking for. It captures the cumulative effects of severity of illness, rather than the number of individual cases, as well as non-diarrhoeal impacts of poor environmental sanitation and hygiene behaviour, such as worms.

As already noted above, both diarrhoea and MUAC seem surprisingly unrelated to poverty as indicated by quality of housing. Clearly, however, MUAC must be strongly related to individual levels of dietary nutrition, which may have nothing to do with water supply, sanitation or hygiene behaviour.

Figures 1 and 2 are scatter diagrams of 1994 to 2000 increments in under five diarrhoea prevalence and MUAC respectively against use of hanging latrines. In this instance the correlation is actually weaker for MUAC than for diarrhoea. The trend lines are also indicated, although with such weak correlations they need to be treated with caution. Nevertheless, the intercepts on the vertical axes (-5% in the case of diarrhoea and –6% in the case of MUAC) can be taken as representing the general reductions in diarrhoeal disease and malnutrition respectively, after eliminating the impact of changes in hanging latrine use.

The slopes of the trend lines may then conceptually be regarded as representing the impacts of changes in hanging latrine use alone. The slope of the line for MUAC is rather flatter than that for diarrhoea prevalence, which might be taken as indicating a lower sensitivity for the former. However, it must be remembered that malnutrition is more rare and severe a health impact than diarrhoea alone. Accordingly, the overall incidence of under five malnutrition in rural areas fell from 10.6% in 1994 to 4.7% in 2000, whilst diarrhoea prevalence fell from 23.5% to 16.9%.

In conclusion, this paper has been able to point towards malnutrition (under five mid-upper arm circumference in particular) as a promising indicator in assessing the impact of water supply, sanitation and hygiene promotion interventions. However, further work is needed before firm conclusions can be drawn. It is suggested that such work should include an investigation of other possible indicators including, for instance, monthly expenditure on the treatment of sickness.

Footnotes

[1] Funded from 1996 to 2001 by the European Union and the UK Department for International Development (DFID)

[2] SAFER Report on Final Evaluation, CARE Bangladesh, March-April 2001

[3] Progotir Pathey (On the Road to Progress) compilation of Multiple Indicator Cluster Surveys published annually

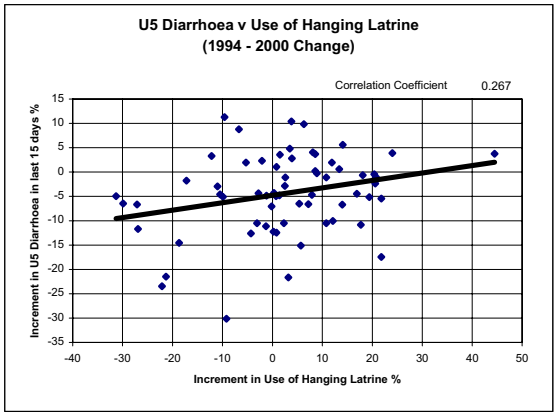

Figure 1.

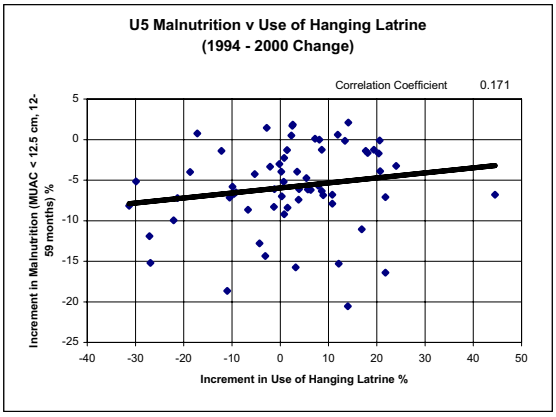

Figure 2.

(1993 to 2000) by the Bangladesh Bureau of Statistics and UNICEF

[4] DFID Guidance Manual on Water Supply and Sanitation Programmes, London School of Hygiene and Tropical Medicine (LSHTM)/WEDC 1998

[5] e.g. Esrey, S.A., Potash, J.B., Roberts, L., and Shiff, C. (1991), Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis and trachoma, WHO Bulletin, Vol.69 No.5, cited in 4.

[6] Measured as the simple difference "percentage for 2000" minus "percentage for 1994"

[7] Water, Waste and Well-Being: A Multicountry Study, American Journal of Epidemiology, Vol.143, No 6, 1996

[8] Measurement of the human body

RODNEY DYER, Manager WATSAN, DFID, Bangladesh.