



## Health impact of WSS projects in Northern Pakistan

*Dr Tameez Ahmad and Dr Karim Alibhai, Pakistan*

IT IS WELL established that lack of access to safe water, inadequate sanitation, and poor hygiene practices are responsible for the high prevalence of preventable diseases in developing countries. According to WHO/UNICEF, 4 billion cases of diarrhoea are reported in the world every year, with 2.2 million deaths annually, mostly among children under five. However, it has always been a major challenge to quantify the extent of impact of water, sanitation, and hygiene education interventions due to methodological complexities and confounding variables (Briscoe, Feachem, and Rahman, 1985; Cairncross, 1990; Esrey *et al.*, 1991; Gorter and Sandiford, 1997). Major methodological flaws identified included the problems of (i) comparability of treatment and control groups, (ii) sample size required, (iii) misclassification bias, and (iv) recall bias in ascertaining disease status amongst others. Measurement of the impact of water, sanitation, and hygiene interventions becomes even more difficult, when implementing agencies set objectives/targets based on health impact e.g., reduction of water and sanitation related diseases. These difficulties stem from lack of resources both human and financial, operational difficulties, time limitation, and inability in implementing proposed plans due to factors falling beyond organisational control. The Water and Sanitation Extension Programme (WASEP) of the Aga Khan Planning and Building Service (AKPBS) is one implementing agency in Pakistan whose major objective is to reduce diarrhoeal diseases. WASEP has been implementing water and sanitation projects in northern Pakistan since 1998. This paper will describe how health impact is being measured at WASEP, and share issues and problems encountered in the process.

### Description of Interventions

Northern Areas, and Chitral (a district of North West Frontier Province) is a mountainous region consisting of over 1200 villages scattered throughout the region. Sizes of these villages vary from few households to 1000, mostly in the range of 60 to 150 households. Average family size range from 7 to 10 per household. Traditionally each village has a separate identity in terms of water sources, and village geography. Majority of these villages still do not have access to safe water and adequate sanitation facilities and therefore heavily rely on the traditional sources of water. Traditional systems that provide drinking water include nallahs, springs, rivers, man made channels, and watercourses arriving from distant sources. Water is either collected directly from these sources or conveyed to

individual or communal traditional water pits for storage and subsequent use. These traditional sources are grossly contaminated as far as bacteriological quality of water is concerned (Raza *et al.*, 1996). Common defecation practices include open defecation, usage of cattle sheds for defecation by women, and traditional latrines without safe disposal.

WASEP interventions include implementation of water supply and sanitation projects in close partnership with communities; provision of intensive hygiene education both at community and school levels, establishing and building capacities of water and sanitation committees. Hygiene education starts with the selection of villages for intervention, while implementation of projects take about 9 months. Mostly tap water is provided to communities through household connections by gravity flow water supply systems connected to springs located at the base on mountains. As a result of latrine promotion by WASEP, on average 80 % of households build improved latrines at programme level while individual coverage in partner villages ranges from 50% to 100%.

### Methodology

The methodology used to evaluate the health impact is given below in terms of data collection, analysis, and approaches:

#### Data Collection

With the selection of a village for intervention, WASEP through its female HHPs (Health and Hygiene Promoters) collect baseline information at household level covering the whole population i.e., census approach. Data collected during baseline surveys include information on weekly incidence (i.e., recall period of one week) of diarrhoeal diseases, and various domains of hygiene behaviours such as water storage practices, cleanliness of houses and general environment outside houses, handwashing practices, presence of faeces around the houses. In addition information is also collected on knowledge of diarrhoeal diseases. Following baseline surveys, monitoring data on the same parameters are collected from every household in the partner villages at intervals of 4 to 6 weeks.

#### Data Analysis

For measuring direct impact of water, sanitation, and hygiene interventions on reduction of diarrhoeal diseases, two methods are adopted (i) pre and post comparison or internal comparison and (ii) with and without intervention comparison or repeated case controlled studies. In case of

the former, diarrhoeal incidence after completion of interventions is compared with the baseline data for matching months of the year for each intervention village e.g., baseline data collected in a village in July 99 is compared with post intervention data collected in the same village in July 2000. Diarrhoeal incidence in villages with intervention is compared with those of villages without intervention located in the same vicinity thought to have more or less similar communal characteristics such as economy, topography, weather, and sectarian composition. The population in non-intervention villages is apparently exposed to the same risk factor as thought to be existing in villages with intervention prior to intervention.

For measuring impact using proxy indicators for change in hygiene behaviours, baseline line data collected at household levels is analysed at village, regional, and programme levels for individual indicators, and compared with those of post intervention. Using observation techniques during inspection of hygienic conditions at household level baseline and monitoring data was collected.

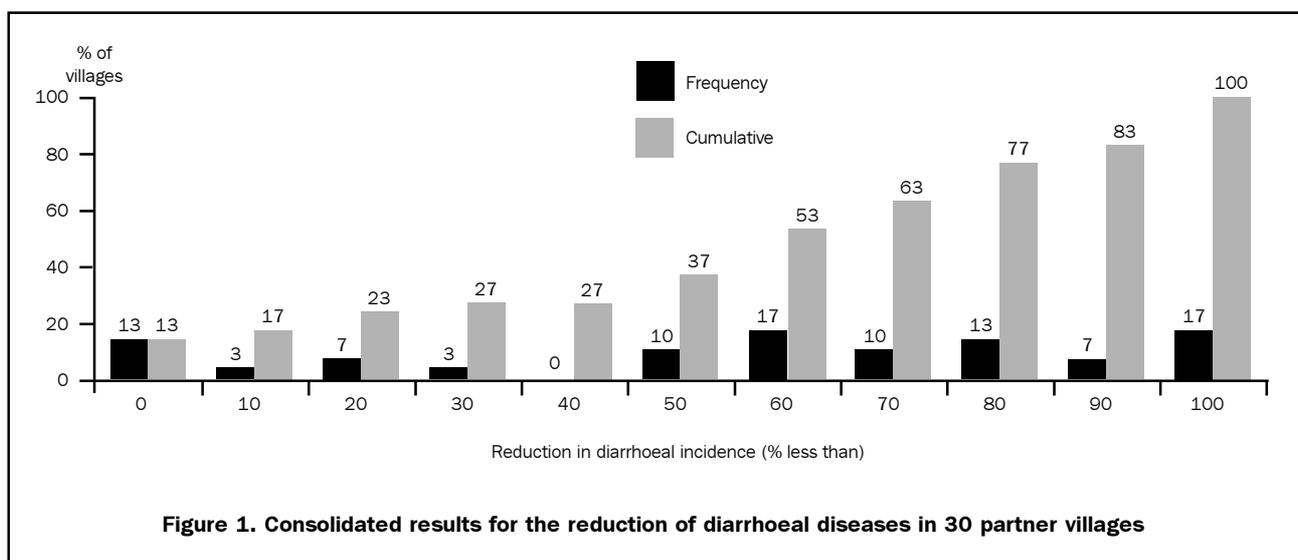
**Results and discussion**

It is beyond the scope of this paper to evaluate the overall impact of water, sanitation, and hygiene interventions in the context of social, economical, and health benefits. Health benefits could be reduction in diseases other than diarrhoeal e.g., worms infestation. It is also known that about 80% of diseases in developing countries are directly or indirectly related to water, sanitation, and hygiene practices (Cheesbrough, 1993). However, in the present study reduction in diarrhoeal diseases is used only as an indicator of the overall health impact. Whilst interpreting the results given below, it should be noted that WASEP provided safe tap water, to the whole population in partner villages, (mostly meeting WHO guideline values for bacteriological contamination i.e., E-Coli in the range of 0-10 per 100 ml is a suggested relaxation for small water supplies), helped in building household latrines leading to

an overall coverage of over 80 %, and implemented its full package of health and hygiene promotion.

**Pre and Post Comparison**

Pre and post comparison of diarrhoeal incidence in 30 partner villages revealed diarrhoeal reduction ranged from 0 to 100 % with median reduction of 58.2 % while mean average reduction and standard deviation were found to be 55.1 % and 33.1 respectively. In case of 4 partner villages, analysis of data revealed no reduction at all despite improvement in water and sanitation facilities showing either complex nature of relationship between diarrhoeal diseases and water, sanitation, and hygiene behaviour or possible shortcomings of data collection methodology in registering diarrhoeal incidence at household level. Figure 1 shows the pattern of diarrhoeal reduction for 30 villages. This figure shows the cumulative percentage of villages having a reduction less than a given value shown along the x-axis. For example, 23 % of villages have experienced a reduction of less than 20 % for diarrhoeal diseases. This also means that in 77 % of villages the impact was more than 20 %. As WASEP’s hardware component of interventions (water supply and sanitation projects) are more or less the same as far as the quality of water and construction are concerned, the large variation of results among the villages may be attributed to differences in critical hygiene behaviours, methodological faults, and/or compounding variables such as living conditions, nutrition, poverty, and education etc. In addition, the variations may also be due to temporal movement of the target population in the region. This may include taking unsafe food and water while paying short visits to relatives in nearby non-intervention villages, drinking unsafe water while working away from the village (for work or schooling) during the day. In order to establish possible link of all these factors with pattern of diarrhoeal reduction, WASEP plans to carry out rigorous study of the impact in close collaboration with the Aga Khan University, Karachi, in summer 2001.



**Figure 1. Consolidated results for the reduction of diarrhoeal diseases in 30 partner villages**

Although the present results suggest that a significant impact has been achieved, we can not be 100 % sure that these are due to WASEP intervention alone. However, it may help to mention that, as a result of WASEP's intervention, the bacteriological quality of drinking water at system level, i.e. at tapstand, significantly improved. More than 80 % of samples matched WHO guidelines for developing countries (below 10 Ecoli per 100 ml) as compared to 20% at pre intervention. Similarly sanitary inspection in all partner villages revealed that the overall score of sanitation status (e.g., presence, usage, and cleanliness of household latrines etc.) increased from a baseline value of 5.25 to 20.24 in a scale graduated from 0 to 25.

**Case Controlled Studies**

Results of diarrhoeal reduction as mentioned in the previous section provide limited information about the situation of diarrhoeal incidence in villages with no intervention. Therefore, case-controlled studies were carried out to compare incidence of diarrhoeal diseases prevailing in non-intervention villages (control) to those villages having WASEP intervention (case). Analysis of 40 sets of data revealed that relative risk (i.e. ratio of disease incidence in exposed group to non-exposed group) ranged from 0.8 to 30 giving an average value of 6.5 with standard deviation of 6.4 while median value of relative risk came out to be 4.3. These results again show significant impact has been achieved in intervention villages as compared to non-intervention villages. For example, a median risk of 4.3 means that population in non-intervention villages are 4.3 times more likely to have diarrhoeal diseases as compared to those in villages with intervention. It should be noted that cross-sectional studies were repeated 2 to 3 times for some cases, in most of cases giving consistent results.

**Analysis Using Proxy Indicator**

Comparison of pre and post intervention data collected from about 1500 households located in 25 partner villages

revealed a significant change in hygiene behaviour at a grass root level as a result of intensive hygiene education. Adoption of healthier behaviour is thought to be an indirect indicator of health impact of water and sanitation projects. Figures 2 and 3 shows the typical change in hygiene behaviour with time for two of the indicators- cleanliness of utensils and presence of human faeces in courtyard in partner villages located in Gilgit region only (11 partner villages). It can be seen from Figure 2 that prevalence of clean utensils increased from 34 % to almost over 90%. The drastic change of 35 % to 65 % (at visit four i.e., V#4) is due to the fact that hygiene education on domestic hygiene was conducted during the 3<sup>rd</sup> round of visits to communities by HHPs. Similarly a small reduction in the presence of human faeces from 8 % at visit 2 to 4 % at visit 3 also shows immediate adoption of healthier behaviour as a result of hygiene education on topic of transmission routes and prevention of diseases during visit 2. It should be noted that hygiene education on latrine promotion and safe human faeces handling, and transmission routes and prevention of diseases are conducted during the 1<sup>st</sup> and 2<sup>nd</sup> rounds of visits (Ahmad and Alibhai, 2000). Cleanliness of water storage container increased from 44 % to 85 % and provision of cover on storage container to prevent dust and flies increased from 23 % and 70 %. Figures 4 shows pre and post comparison for other selected indicators in 25 partner villages in all three regions (i.e., 11 villages in Gilgit, 6 village in Baltistan, and 8 villages in Chitral). As can be seen presence of human faeces in the courtyard of houses and outside houses decreased from 37 % and 65% to 2.5 % and 7 % respectively. . It should be noted the presence of human faeces in courtyard in Gilgit region only, was significantly less than the overall situation in the programme area (see Figure 4). However, similar reduction in presence of animal faeces in courtyard was not achieved (i.e., reduced from 90 % to 72) because of close location of cattle sheds to houses, suggesting that without tackling the enabling factors (i.e. currently beyond WASEP's mandate) sustain-

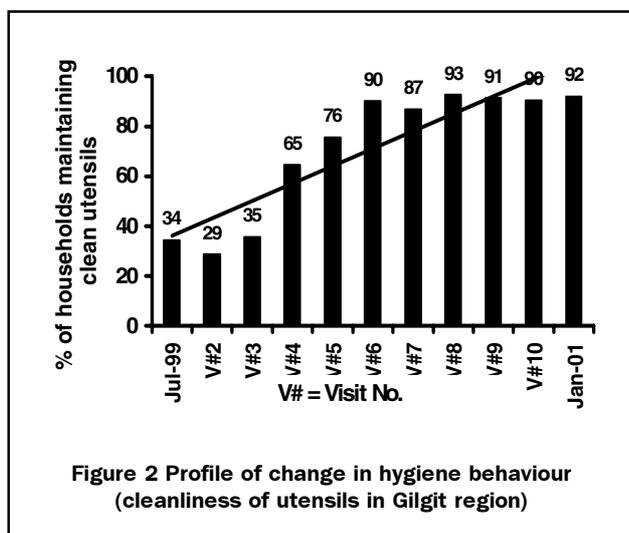


Figure 2 Profile of change in hygiene behaviour (cleanliness of utensils in Gilgit region)

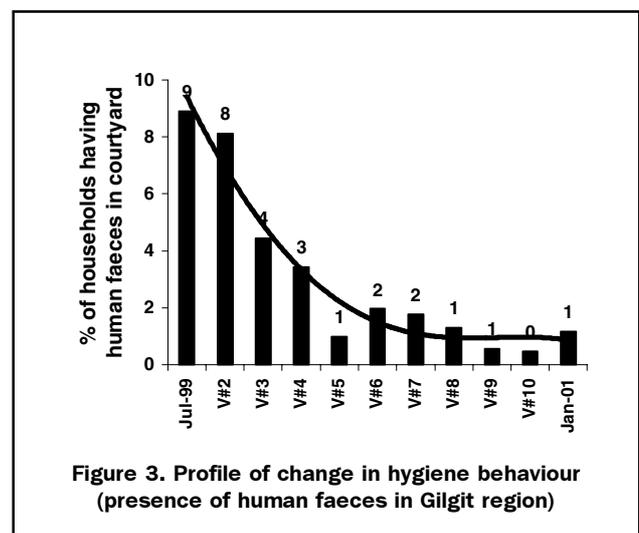
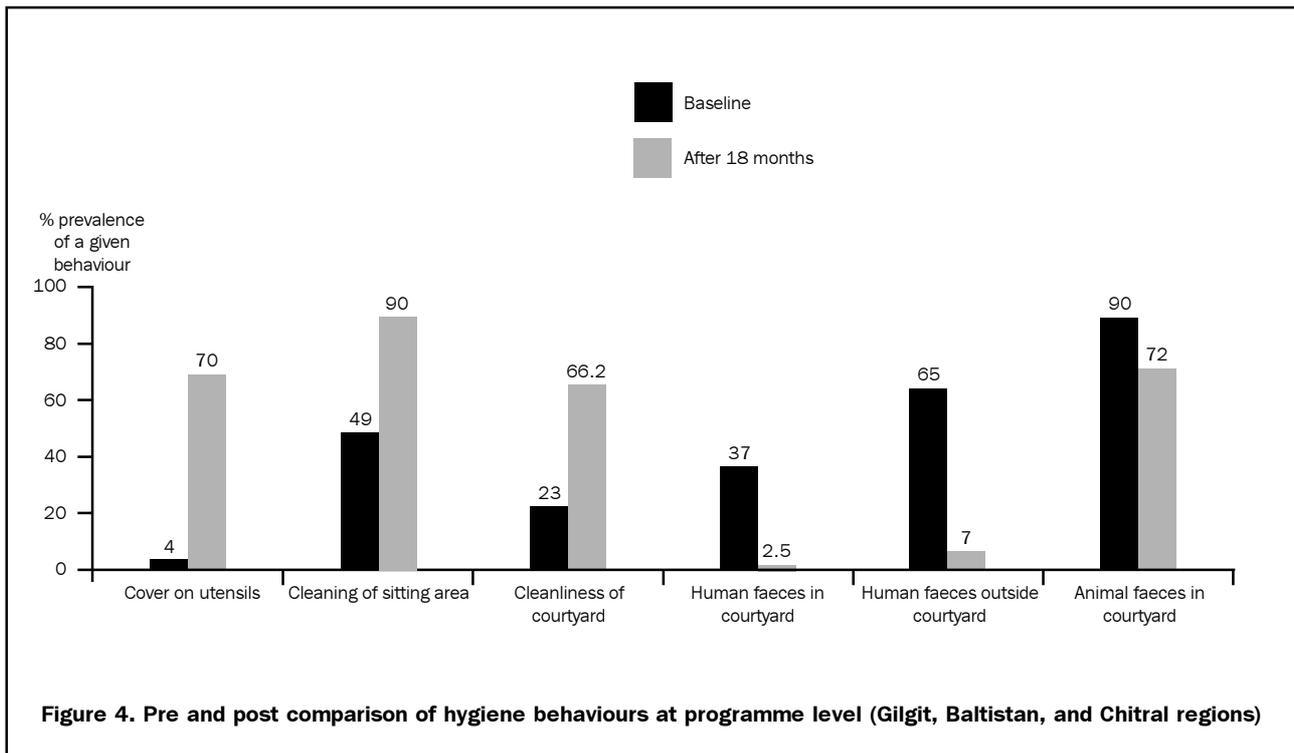


Figure 3. Profile of change in hygiene behaviour (presence of human faeces in Gilgit region)



able change in hygiene behaviour is not possible. On the other hand, handwashing before eating and after defaecation increased from always 69 % and 18 % to 99 % and 61 % respectively. The overall hygiene status (i.e., combined effect of 23 indicators) increased by 90 % at programme level. The significant reduction in diarrhoeal reduction may be attributed to the improvement in hygiene behaviour in partner villages.

### Conclusions and Recommendation

Although a strong impact of water, sanitation, and hygiene interventions on the reduction of diarrhoeal incidence was observed in partner villages (i.e., 58 % median reduction), a large variation in the range of 0-100 % reduction shows the complexity and uncertainty in quantifying impact in terms of health benefit. Therefore, assessment using this approach may underestimate the overall impact especially in a situation where methodological flaws may give rise to an apparent lack of reduction in diseases. Secondly, project implementation may start in a season where incidence of diarrhoeal diseases (e.g., October to April in northern Pakistan) would be negligible, in such cases there would be insufficient baseline data for measuring health impact. Use of proxy indicators that are observable and verifiable appears to be a better option for assessing indirect health impact.

### References

AHMAD, T. and ALIBHAI, K. 2000. "Health and hygiene education programme: northern Pakistan". Water, Sanitation and Hygiene: Challenges of the Millennium, 26<sup>th</sup> WEDC Conference, Dhaka, Bangladesh.

- BRISCOE, J., FEACHEM, R.G., and RAHMAN, M.M.. 1985. "Measuring the impact of water supply and sanitation facilities on diarrhoea morbidity: prospects for case-control methods". World Health Organisation.
- CAIRNCROSS, A.M., 1990. "Health impacts in developing countries: New evidence and new prospects". *Journal of the Institution of Water and Environmental Management*. No.4. pp571-577.
- CHEESBROUGH, M., 1993. *Medical Laboratory Manual for Tropical Countries*. Vol. 2 p206. Butterworth-Heinemann. University Press, Cambridge, UK.
- ESREY, S.A., POTASH, J.B., ROBERTS, L., AND SHIFF, C., 1991. "Effect of Improved water supply and sanitation on ascariasis, diarrhoea, draccunculiasis, hookworm infection, schistosomiasis and trachoma". *Bulletin of the WHO* No.69.
- GORTER, A. AND SANDIFORD, P. 1997. "A literature review of the health impact of water supplies, sanitation and hygiene on the incidence of diarrhoeal disease". Chapter 3, *Childhood Diarrhoea and its Prevention in Nicaragua*. Vormgeving en drukwerk, Uniigraphic, Universiteit Maastricht.
- RAZA, H., HUSSAIN, M., and AHMAD, K. 1996. "Seasonal investigation of drinking water quality in Northern Pakistan". WSHHSP, AKHSP, Gilgit, Pakistan.

DR TAMEEZ AHMAD, Programme Co-ordinator, WASEP, AKPBS, Pakistan

DR KARIM ALIBHAI, Director, WASEP, AKPBS, Pakistan