# Functioning and utilization of rural water supplies in Sarawak, Malaysia

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*A cross-sectional survey of 976 households in 41 villages covered by the Rural Health Improvement Scheme in Sarawak was carried out to determine the state of functioning and utilization of rural water supplies. The survey was carried out by inspection and interview.*

*About one-third of the systems were functioning well, one-third imperfectly, and the remainder were no longer functioning. The coverage of households by water supply varied with the type of water supply, the overall coverage being 81.3%. Usage varied with the type of water supply and access, the overall figure being 87.1%, and the overall utilization was 70.8%.*

*The study showed that it is important to account for water supply usage in impact evaluation because not all households have access and not all those with access use the water supply. It is also important to define water use, depending on whether the health outcome is a reduction in diseases that are water-borne or related to washing with water, because the percentage of households using the water for drinking is different from those using it for bathing.*

## Introduction

Now at the end of the International Drinking Water Supply and Sanitation Decade 1981–1990, it is important for each country to determine the actual functioning and utilization of water supplies in order to obtain a true picture of the coverage. This will improve programme planning as well as show how much still needs to be done.

In Sarawak, the Medical Department has been responsible for water supply and sanitation in the rural areas since 1967 (*1*). Up to 1987, 3326 villages had benefited from the programme: 66% of them had gravity feed, 19.3% had rain water tanks, 9.7% had dug wells, 4% had mechanical pumps, and 1% had hydraulic rams. However, these figures may not reflect the true coverage and utilization. This is because programmes tend to be measured in terms of the proportion of allocated resources spent and the achievement of physical targets (*2*). Such reports often overestimate the population served in that they assume that once a community system is installed it is used or operated by the consumers in the way the builders intended (*3*).

Recording the actual use of the facility (usage) is also important in the evaluation of impact of the water supply on health. It has been pointed out that one of the defects of many studies was the failure to record such usage (*4*, *5*).

The present study was therefore carried out to determine the proportions of the systems implemented which are still functioning, the proportions of households and populations actually covered, and the proportions of the households that use them.

## Materials and methods

The cross-sectional survey was carried out in Sarawak, Malaysia, between August and December 1989. It was based on a stratified cluster-sampling and only villages in the rural areas that had water supply and sanitation were included in the frame. Of the 2189 villages with gravity feed, 16 were selected; and eight villages were randomly selected from the 643 with rain water tanks, and eight from 321 with dug wells. From the 135 villages with mechanical pumps, nine were selected. The 41 villages selected were distributed over 13 of the 25 districts in the State.

The water supply systems were inspected to determine their functioning. Each household in the selected villages was also inspected to determine the presence of outlet taps from gravity feed and mechanical pumps, and the state of rain water tanks in villages with such tanks.

Information on the usage of the water supply, including dug wells, was obtained by interviewing an adult female (≥18 years old) in the 835 (85.5%) selected households. The remaining households were either closed or had no resident adult female.

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In villages with gravity feed and mechanical pumps, households were considered to have access to the water supply if they had an outlet tap in the home. In the case of rain water tanks, households were considered to have access only if they had such a tank. In villages with dug wells, households were considered to have access if the wells were nearer than the alternative water sources.

## Results

### *State of functioning*

Five of the sixteen gravity-feed systems were not functioning at all. The reasons were inadequate source (three systems) and blocked distribution lines (two systems). The remaining eleven functioned adequately for most of the year.

Three of the nine mechanical pump systems were functioning well. Another three were functioning imperfectly, mainly because the high-level storage tanks were leaking badly. The remaining three were completely non-functioning as the pumps were out of order.

Under the programme two rain water tanks (with a combined capacity of 360 gallons), each with a gutter, inlet sieve, down-pipe and outlet taps, were to be provided to each eligible household in the village. There were only two villages where 90% or more of the households were supplied with at least two rain water tanks. To be considered as properly installed each rain water tank had to be placed on a hardwood platform with a gutter, down-pipe, inlet screen and outlet tap; 71% of the 237 tanks were installed properly. At the level of the household, only 34% of the 178 households had at least two properly installed rain water tanks.

There were 45 dug wells in the eight villages and 40 of them were protected. Only 14 of the 40 hand-pumps that were provided were still functioning. The majority (38) of the wells continued to be used with or without the hand pumps.

### *Utilization of water supply*

In the villages with gravity feed, mechanical pump or rain water tanks, 74% of the households still had access to water from the systems (Table 1). In villages with dug wells, 47% of the households had access to the wells. The overall coverage (weighted on sample size and the inverse of the sampling fractions of each stratum) by water supply systems was 81.3% of the households.

About half of the households that ever had access to water from the water supply system were satisfied with the water quantity (Table 2). The main reason for dissatisfaction among the remaining households was the insufficient quantity of water from the system during the dry season. Of the households that ever used the water supply systems, 75% were satisfied with the physical quality of the water. However, the percentage (21.7%) was substantially lower in households that used dug wells because they did not like the odour of the water from the wells.

More than 60% of the households with access to a gravity feed system, a mechanical pump system, or rain water tanks used the water from the system for

Table 1: **Distribution of all households, by type of water supply and access to the system**

| Access to water supply | No. of households and type of water supply[a] | | | Total |
|---|---|---|---|---|
| | Gravity feed | Mechanical pump | Rain water tank | |
| Still have water from the system | 368 (82.1)[b] | 75 (52.8) | 127 (71.8) | 570 (74.3) |
| Had water from the system before[c] | 27 (6.0) | 47 (33.1) | 17 (9.6) | 91 (11.8) |
| Never had water from the system | 53 (11.8) | 20 (14.1) | 33 (18.6) | 106 (13.8) |
| Total | 448 (100) | 142 (100) | 177 (100) | 769 (100) |

[a] Of the 209 households in villages with dug wells, 99 (47.3%) had access to those wells.
[b] Figures in parentheses are percentages.
[c] Had water from the system when it was working.

Table 2: **Distribution of households interviewed, by type of water supply system and satisfaction with the water's quantity and quality**

| Usage and satisfaction | Type of water supply and number or percentage of households | | | | |
|---|---|---|---|---|---|
| | Gravity feed (388)[a] | Mechanical pump (116) | Rain water tank (144) | Dug well (187) | Total (835) |
| No. ever used system | 356 | 98 | 119 | 115 | 688 |
| *Satisfaction with quantity:* | | | | | |
| Always satisfied[b] (%) | 62.1 | 45.9 | 42.9 | 30.4 | 51.2 |
| Formerly satisfied[c] (%) | 5.0 | 37.8 | 4.2 | 26.1 | 13.1 |
| Never satisfied (%) | 32.9 | 16.3 | 52.9 | 43.5 | 35.7 |
| *Satisfaction with quality:* | | | | | |
| Always satisfied (%) | 92.1 | 58.2 | 88.3 | 21.7 | 74.9 |
| Formerly satisfied (%) | 6.5 | 37.8 | 7.5 | 17.4 | 12.9 |
| Never satisfied (%) | 1.4 | 4.0 | 4.2 | 60.9 | 12.2 |

[a] Figures in parentheses are the numbers of each type or system.
[b] Percentage of those who ever used the water for drinking.
[c] Was satisfied when the system was working well; currently dissatisfied as the system was no longer working well.

Table 3: **Percentage of households that used water from the system for various domestic activities, by type of water supply**

| Utilization and frequency | Type of water supply and percentage of households | | | | |
|---|---|---|---|---|---|
| | Gravity feed (344)[a] | Mechanical pump (62) | Rain water tank (106) | Dug well (148) | Total (660) |
| *Drinking* | | | | | |
| Always | 88.4 | 62.9 | 94.3 | 8.8 | 69.1 |
| Often | 6.7 | 22.6 | 5.7 | 4.0 | 7.4 |
| Never | 4.9 | 14.5 | 0.0 | 87.2 | 23.5 |
| *Washing plates* | | | | | |
| Always | 87.2 | 93.6 | 70.8 | 12.1 | 68.3 |
| Often | 7.9 | 6.4 | 27.3 | 4.7 | 10.1 |
| Never | 4.9 | 0.0 | 1.9 | 70.2 | 18.6 |
| *Washing clothes* | | | | | |
| Always | 45.1 | 67.7 | 9.4 | 12.2 | 34.1 |
| Often | 43.0 | 29.0 | 37.7 | 6.1 | 32.6 |
| Never | 11.9 | 3.2 | 52.8 | 81.8 | 33.3 |
| *Bathing* | | | | | |
| Always | 40.1 | 66.1 | 7.5 | 15.5 | 31.8 |
| Often | 48.3 | 30.7 | 30.2 | 4.1 | 33.8 |
| Never | 11.6 | 3.2 | 62.3 | 80.4 | 34.4 |
| *Flushing latrines*[b] | (251) | (52) | (83) | (40) | (426) |
| Always | 88.4 | 84.6 | 33.7 | 32.5 | 72.1 |
| Often | 8.8 | 11.5 | 27.7 | 7.5 | 12.7 |
| Never | 2.8 | 3.9 | 38.6 | 60.0 | 15.2 |

[a] Figures in parentheses are the numbers of each type or system.

[b] Only households which had pourflush latrines and access to the water systems were considered here.

drinking and washing plates. The highest percentage (94.3%) was among households with rain water tanks. In villages with dug wells, only 8.8% of those with access to the wells used the water from them for drinking and washing plates (Table 3). A common alternative source of drinking water was rain water that was collected in the villagers' own containers, and water from rivers and streams. In 99% of the households the water used for cooking was the same as the water used for drinking.

Table 4: **Percentage access, usage and utilization of the water supply systems**

| | Type of water supply and percentage of households | | | | |
|---|---|---|---|---|---|
| | Gravity feed | Mechanical pump | Rain water tank | Dug well | All villages[a] |
| Percentage access(*a*)[b] | 82.1 | 52.8 | 71.8 | 47.4 | 81.3 |
| Percentage usage (*u*)[c] | 95.1 | 85.4 | 100.0 | 12.8 | 87.1 |
| Percentage utilization[d] | 78.1 | 45.1 | 71.8 | 6.1 | 70.8 |

[a] Percentages in this column were weighted using sample size and inverse of sampling fraction of each stratum.

[b] Based on all households in the village.

[c] Based on households that were interviewed.

[d] This is the product of *au* / 100.

The percentage of households which utilized the water supply was calculated as the product of the percentage of households with access to the systems and the percentage of those that used water from the system for drinking. The utilization of individual systems ranged from 6% in the case of protected wells to 78.1% in the case of gravity-feed systems (Table 4).

## Discussion

The findings of this study are consistent with the assertion of Burton (*6*) that as many as a third of the modern systems installed in the last two decades are no longer operating at all, and that a further number, at least a third, are operating defectively. Thus there is a need to determine the coverage and usage of the water supply system in rural areas because not all the households in the village are covered, and not all of those that are covered used the water for drinking and cooking.

Furthermore, this has to be done not just for the village as a whole but also for each type of water supply because the usage varied greatly with the type of water supply, being especially low in the case of dug wells. As expected, the usage was related to the people's satisfaction with the perceived quality of the water. The study showed that in the case of dug wells, it is important that the water from potential well sites be tested and found satisfactory before the wells are actually dug.

In order to minimize the percentage of non-functioning systems it is recommended that a preventive maintenance programme be implemented. This will enable problems to be detected early and corrected early before they become irreparable.

The usage of water supplies also needs to be specified for various activities because this study showed that they vary by type of water supply. Thus if reduction of water-borne diseases (*7*) is to be the health outcome, then the use of the water for drinking will have to be reported, but if prevention of diseases related to washing is the desired outcome indicator, then the utilization of the water supply for bathing and washing clothes may be more appropriate.

The percentages of households with gravity feed water supplies that used the water for drinking, cooking, bathing and washing laundry are all higher in this study when compared to a report by Roundy (*8*) of a study in a village with gravity feed in West Malaysia. In that report 70% of the households used

the water for drinking, 39% for bathing, and 22% for washing clothes and kitchen utensils. The main reason for the low utilization in West Malaysia was the inadequate quantity of water in households at the end of the distribution line and at high elevations. In Sarawak, the rivers and streams tend to be larger than in West Malaysia, so even an inadequate source is not as big a problem as in West Malaysia.

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## Résumé

### Fonctionnement et utilisation des systèmes d'approvisionnement en eau dans les régions rurales du Sarawak, Malaisie

Une enquête transversale portant sur 976 foyers de 41 villages couverts par le système d'amélioration de la santé rurale du Sarawak a été réalisée afin de déterminer le fonctionnement et l'utilisation des systèmes d'approvisionnement en eau dans les régions rurales. L'enquête a été réalisée par inspection et entretiens.

Environ un tiers des systèmes fonctionnait bien, un tiers imparfaitement, et le reste était hors d'usage. Le taux de desserte en eau des foyers variait selon le type d'approvisionnement, allant de 47,3% pour les puits à 82,1% pour l'eau courante. La couverture totale était de 81,3%. L'utilisation de l'eau pour diverses activités variait également selon le type d'approvisionnement et selon l'activité. Le taux d'utilisation de l'eau pour la boisson était élevé pour l'eau courante (88,4%) et les citernes d'eau de pluie (94,3%), moyen pour les systèmes avec pompe mécanique (62,9%) et faible pour les puits (8,8%). Le taux global d'utilisation des systèmes était de 87,8% et le taux global d'utilisation de l'eau pour la boisson de 70,8%.

L'étude montre qu'il importe de tenir compte de l'utilisation des systèmes d'approvisionnement en eau lors des études d'impact car tous les ménages n'y ont pas accès et tous ceux qui y ont accès n'y recourent pas. Il est également important de définir à quel usage l'eau est destinée, selon qu'on cherche à réduire les maladies transmises par l'eau de boisson ou celles transmises par l'eau de lavage, étant donné que les taux d'utilisation de l'eau destinée à la boisson et de celle destinée aux lavages sont différents.

Une telle enquête est utile pour déterminer le taux réel de couverture et d'utilisation de l'approvisionnement en eau aux fins de planification.

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