



ASSESSMENT OF WASH INTERVENTIONS



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INTRODUCTION

Water, sanitation and hygiene (WASH) refers to a combination of technical (drinking water, hand washing, toilet and soap facilities) and human development components (activities that promote conditions and the practices of children that help to prevent WASH-related diseases) that are necessary to produce a healthy environment and to develop or support appropriate health and hygiene behaviour (**Sarkar *et al.*, 2013**).

India presents a good mix of development, yet under development too, where the issue in this era is not an astute lack of food, but a lack of toilets for its one-half population; at least 620 million people in our country, defecate outside. Hence, though India has made commendable improvement in tackling the communicable diseases, yet the vicious cycle of malnutrition and diarrhoea continues to plague not only it's rural but also the unorganized urban slum population. Diarrheal or gastrointestinal infection is often caused by a lack of clean water for drinking and proper hand-washing. A lack of toilets further exacerbates the problem as faeces on the ground contaminate drinking water and water resources in general (**Kar *et al.*, 2017**). It is seen that safe and hygienic sanitary practices affect the health outcomes of children, especially in areas of high population density such as India. Many community-level differences in child health outcomes in India were found to be affected by sanitation practices (**Nandi *et al.*, 2017**). With more than half of the population residing in suburban neighbourhoods due to the country's vast population growth and its limited accessibility to water, people in India have limited access to sanitation and hygiene in India (**Dopheide, 2019**). In India, sanitation remains the most neglected sectors whereas human sewage poses the highest threat to our rivers, lakes, ponds and the ground water table. Every river that passes through a city or town today becomes a stinking sewer (**Hazarika, 2015**).

In India, as per the NFHS-4 survey (**2015–2016**), though 10% of the households do not have access to an improved source of drinking water, half (52%) of the households do not use an improved sanitation facility, and 39% of the households practice open defecation. It showed that the situation is particularly worse in rural, poverty-stricken and backward regions of the country compared to urban regions (**IIPS, 2017**). The effects of poor sanitation seep into every aspect of life - health, nutrition, development, economy, dignity and empowerment (**UNICEF, 2012**). Multidimensional poverty of India, 2018 reveals, almost 46% population are living in severe poverty and are deprived in at least half of the dimensions covered in the

index that includes nutrition, health, sanitation, drinking water etc (**Chattopadhyay *et al.*, 2019**).

In Meghalaya for children under five years of age, 15.3% suffer from wasting and stunting is as high as 43.8% (**Ministry of Health and Family Welfare, 2016**). School sanitation and health education stimulate change in health behaviour and attitude towards the adoption of good habit during childhood. What children learn is likely to be applied within their families and will further lead to community development. The provision of safe water and sanitation facilities, as well as good hygiene education, will improve the health of children and may result in the lower dropout rate, especially among girl children. For many children, the school may be their first encounter with working toilets, running water, well-ventilated classrooms and clean surroundings. This can have a powerful impact on their vision of what is possible in their world and even in their communities (**Deivam, 2016**). Cognizance of the deleterious effect of lack of sanitation and hygiene on health NESFAS conducted WASH awareness program among the communities who are part of the Rural Electrification Corporation (REC) supported project “No One Shall Be Left Behind: Biodiversity for Food, Nutrition and Energy Security, Meghalaya and Nagaland, North East India”. These programs were attended by school children and other members of the community. Many of such programs were conducted in collaboration with the school. These programs happened at various points of time in 2019. A year on, NESFAS wants to assess the effectiveness of the WASH programs. This report will try to answer the question as to whether there has been any noticeable change in health outcomes of the community after NESFAS’s intervention on WASH.

STUDY AREA AND METHODOLOGY

Seven villages, viz., Dewlieh, Nongtraw, Laitthemlangah, Laitumiong, Laitsohpliah, Ladmawphalng and Mawmihthied, were selected from the Khatarshnong-Laitkroh block for the study. The selection criterion for these villages was based on the completing of WASH awareness programs which took place last year. Dewlieh and Nongtraw are located along the spurs that jut out from the Sohra plateau and are located at an altitude of 1300 m. The remaining villages are from the tableland itself situated at an elevation of 1700 m. Vegetation is subtropical to tropical evergreen forests in Dewlieh and Nongtraw, while grassland dominated the plateau. Around some of the patches, stunted subtropical evergreen and pine

forest are also found. Being close to Sohra, the area receives very high rainfall of more than 300 to 1000 cm per year. Summers are warm while winters are cold. Monsoon (June to October) is the main rainy season while dry season extends from November to February.

Out of the 310 households the study selected a sample of 179 households or 57.74% of the respondents. Disproportional sampling method was applied wherein 30 households were chosen from every village irrespective of the total household population of the village. However, since the total number of households in Laitthemlangсах and Laitumiong was less than 30 all the households were selected for the study. But since Laitumiong had seen an increase of one household from the 2011 census, all the 12 households were chosen and one household from Laitthemlangсах could not take part in the study, so 17 households.

Table 1 Number of households selected from the villages

Village	Total household population	number of households selected
Dewlieh	20	30
Ladmawphlang	88	30
Laitsohpliah	50	30
Laitthemlangсах	18	17
Laitumiong	11	12
Mawmihthied	88	30
Nongtraw	35	30
Total	310	179

Data for the study came through a household survey. A structured schedule was prepared which had questions on demographic profile, water, sanitation facilities and hygiene behaviour. The schedule was administered to the selected households and responses recorded. The analysis was done with the help of Microsoft Excel and SPSS.

LITERATURE REVIEW

Despite the importance of WASH, yet in a developing country like India, there is a high prevalence of water and sanitation-related diseases, especially among poor children, liver under unhygienic conditions, who are already at higher risk of health and nutritional problems. In a study conducted in Punjab of Punjabi school children, handwashing with soap, before and after a meal (42% each) was seen practised less as compared to hand washing after using the toilet (78%). Less than half of school children used to bathe (49%), brush their teeth (48%) and change their clothes (44%) daily. Slightly over half of school children were

cleaning ears (50%) and cutting nails (52%) every month. Regarding household WASH facilities, it was observed that the majority of the subjects had household piped water connections (63%) and improved (flush system) sanitation facility (64%). Most of them were not consuming potable water (73%) and reported throwing wastes in garbage pits/roads (71%). However, urban school children had better WASH facilities and household facilities than rural school children. Children from government schools of Punjab did not meet the basic hygiene standards (**Kaur et al., 2016**).

Early child deaths were due to conditions that could be prevented or treated with access to simple, affordable interventions. Leading causes of death in the world in under-five children are pneumonia, diarrhoea, and malnutrition. About one-third of all deaths of children are linked to malnutrition (**WHO, 2016**). A significant proportion of deaths can be prevented through safe drinking water, adequate sanitation, hygiene, immunization, proper infant feeding, and enabling environments (**WHO, 2016**). Therefore, interventions in the first five years of life can have a significant impact on the prevention of childhood morbidity and mortality (**Census of India, 2011**).

Many communicable diseases can be effectively managed by improving the sanitation, hygiene and water usage practices (**NICED, 2014**). A study conducted in rural Chennai reported that around 45% of the participants were not using any methods of water treatment (**Kuberan et al., 2015**). A community-based cross-sectional study in rural Kerala among 103 mothers of under-five children found that nearly 96.1% of the mothers used boiled water for drinking (**Divya et al., 2016**). Whereas in a study conducted in a tribal district of Andhra Pradesh, a majority (84.8%) of the household members of the study children were practising open field defecation and 83.6% of their under-five children were also practising the same, which increased the risk of waterborne diseases. Around half of the mothers used to leave stools of their under-three children uncovered (**Reddy et al., 2017**). Diarrhoea prevalence drops substantially only if open defecation is completely eliminated (**UNICEF, 2013**). Unfortunately, the toilets that have been built in India have sometimes gone unused or have been used to store tools, grain, or building materials. Changes in social norms and behaviours must change too (**Dean Spears, 2013**).

India continues to lag in proper drinking water, sanitation and hygiene facilities. Parliament constituencies in Bihar, Odisha, Jharkhand and Madhya Pradesh shared the highest burden of

unsafe child stool disposal in the country. Unsafe child stool disposal has received limited attention in sanitation policy making in India, with the country's historic focus on household toilet infrastructure. Sanitary facilities were very poor in parliamentary constituencies in northern and eastern India. Budaun (90.69%) and Ambedkarnagar (89.80%) in Uttar Pradesh and Bhagalpur (87.14%) in Bihar were the constituencies with the highest prevalence of poor sanitation facilities. On the other hand, constituencies in Lakshadweep (0.19 %), Sikkim (0.91%) and Idukki (0.96%) and Alappuzha (0.97%) in Kerala had the lowest prevalence of poor sanitation facilities. Parliamentary constituencies in Northeastern and southern India particularly in Manipur, Meghalaya, Andhra Pradesh and Telangana shared the highest burden of poor drinking water source (**Kapil, 2019**).

The Government of India has designed the Clean India movement, "*Swachh Bharat Abhiyan*", by comprehending the need for extolling policies that address structural and mechanical causes of morbidities. There has been a threefold increase in investment (from Rs. 28,500 million to 90,000 million during 2014-17) in the allocation of funds for the Clean India movement (Swachh Bharat Abhiyan, Gramin) programme, which was launched by Prime Minister, Mr Narendra Modi in 2014. Thus, the government has prioritized sanitation in terms of policy attention as well as resource allocation (**Ministry of Drinking Water and Sanitation, 2015**). Despite such a large investment, awareness creation and various social movements, more than half of the rural population (52.1%) of the country still defecates in open (**NSSO, 2016**). Almost 60% of open defecators in the world reside in India, mostly in rural parts (**WHO-UNICEF, 2014**). Open defecation is a traditional behaviour in India, especially in rural areas Open defecation is a traditional behaviour in India, especially in the rural areas (**Gosh & Cairncross, 2014**).

Improvement of sanitation facilities in rural areas has made Northeast India one of the best performing regions in the *Swachh Bharat Abhiyan*, though the urban performance is yet to reach the scale of success witnessed by rural Northeast India. Seven out of eight Northeastern states have rural sanitation coverage above 90%. Tripura remains the only underperformer with 78% sanitation coverage. Urban sanitation remains an area of concern across Northeastern India. Sikkim was declared one of India's first open defecation free states. The Northeastern states collectively boast of sufficient sanitation coverage, and the rural areas of three Northeastern states of Meghalaya, Mizoram and Arunachal Pradesh have been declared open defecation free (**Swachh Report Card, 2018**). Investments alone cannot be held

responsible for the reduction in unsafe sanitary practices. The strong political will of the administration, person to person social pressure and favourable political ecology are considered to be the “toilet tripod” that can accelerate successful adoption of health sanitation practices in India (O’Reilly & Louiss’, 2014).

ANALYSIS

Demographic Profile

The mean age of the respondents was around 40 and more than 70% are women. Because women are generally tasked with household work their responses give a much more reliable account of the challenges households may facing in terms of WASH. In Ladmawphlang, Laitthemlangisah and Nongtraw almost 90% or more than 90% of the respondents were women. And the fact that they are middle-aged means that they will have greater decision making powers than their younger counterparts. They also have a lot of influence in the family. A lot of WASH is about behavioural change and the role of elderly women in the house will be very important in this regard.

The mean size of the household was over 5 persons-1 household. This means a household has around three children, which is very close to the fertility rate of Meghalaya (Niti Ayog, n.d.). The State has the third-highest fertility rate in the country and this is one of the reasons for its high population growth. This becomes very evident, such as in the case of some villages like Laitthemlangisah which has an average household size of nine persons in one family. Ladmawphlang and Mawmihthied had 6 persons-1 household which is more than the average size. What this also means is that the water demand for WASH-related activities will also be quite high in the villages. Lack of it could prove very deleterious to households in terms of health outcomes. This is particularly worrisome since an individual household has more than 2 children (below 15 years of age). Laitsohplich is the only village that has an average of fewer than two children in a household. Significantly it also has an average of four persons in one household. It appears that the bigger the size of the household, greater is the number of children, i.e., higher the dependency ratio, almost 50%, closer to the Indian average (World Bank, 2019). It could have been higher but for the fact that the number of elderly members in the family is very low (one in every five households). This can be interpreted in two ways: firstly, these villages and Meghalaya, in general, could stand to reap the ‘population

dividend' soon, provided investments are made in the human resources sector. The lack of investment though could spell disaster for the state. Secondly, the few elderly members found in the villages have to do with a low life expectancy. Data for Meghalaya is not available but those of neighbouring state of Assam is lower than the national average, indicating that it might be similar for Meghalaya as well. Poor health infrastructure is an important factor and is again important in terms of WASH-related illness.

One of the other important sector which requires socio-economic infrastructure is education. The villages seem to lack that as well. The highest educational attainment for more than 1/3rd of the respondents was only primary level. This was followed by middle school. The number of graduates was very less. No respondent in Ladmawphlang, Laitsohplich, Laitumiong and Nongtraw had completed their graduation. Unlike in the rest of the country where low educational attainment among women (more than 70% of the respondents in this study are women) can be explained to gender discrimination, this is not an important factor for Meghalaya where gender relations are very progressive. Instead, poor socio-economic infrastructure is the reason for poor educational attainment. Low educational attainment and poor socio-economic infrastructure can have a negative impact on WASH outcomes.

Source of water

Households collect water from a variety of sources. One of the most common classification schemes utilized to differentiate the various water sources is the identification of improved and unimproved sources (**Thompson, 2001; Howard and Bartram, 2003; Asare, 2004; Ministry of Rural Development, 2010**). Water sources protected from the possibility of contamination, especially faecal matter, are known as improved sources; otherwise, they are identified as unimproved sources (**WHO and UNICEF, 2000**). This is a very important distinction, especially, in a developing country such as India where a significant proportion of the population, particularly in the rural areas lack access to the formal water supply network and are compelled to depend on potentially unsafe sources. Currently, about 72% of the rural households in India are reported to be fully covered with the rest being partially covered, or have drinking water sources that are chemically contaminated (**Planning Commission, 2002**). So, the identification of the types of water sources, whether improved or unimproved, on which households depend is very important in assessing the vulnerability of households to the various water insecurity problems, particularly in terms of safety of domestic water.

The water sources for domestic consumption in the study area are identified based on ‘point of collection’. The location of the water source concerning the household (accessibility) is a very important attribute in assessing source reliability. This feature is captured very efficiently by the criterion. In some cases, water is available closer to the household premise, e.g. common standpipes, though the source is a stream/river located far from the settlement. On the other hand, water is sometimes collected directly from the source, stream/river, springs, ponds, etc., located at varying distances from the household. Reliability of the water source (which includes a measure of accessibility) being essential to the attainment of household water security, the criterion ‘point of collection’, thus, provides an insight into the prospect of the achievement of household water security.

Based on the criterion of ‘point of collection’ the water sources for domestic consumption in the Sohra Syiemship are as follows:

- i. Common tap/common standpipes (*Kor*) – improved source
- ii. River/stream (*Wah*) – unimproved source
- iii. Pond (*Pung*)/*Naula* – improved if covered and unimproved if uncovered
- iv. Spring (*Shyngiar*)/*Dhara* – improved if covered and unimproved if uncovered
- v. Rainwater (*Umslap*) - unimproved
- vi. Other sources of water include shallow wells and neighbours

Generally, people don’t collect water from only a single source (**Mawroh, 2017**). Instead, they depend on a combination of sources which may vary from the season. However, four out of the seven villages selected for this study viz., Laitsohpliah, Laitthemlangсах, Laitumiong, Nongtraw and Dewlieh have reported of collecting water from only a single source. This can have various implications. Collecting from different sources can be very time consuming but if some of the sources are unimproved, this can be an adaptation mechanism. Usually drinking water is collected from a specific source – spring, while water for other uses is collecting from sources, like a stream. But if households are dependent on only a single source and it is unimproved it points to lack of options and the threat of contracting water-borne diseases. All the respondents from Laitsohpliah and Laitumiong reported of depending entirely on the streams flowing through the village. A stream is an unimproved source. Households in these two villages are therefore highly vulnerable to water-borne diseases. But if the source is improved household water security is assured. Such villages are Laitthemlangсах (spring), and Nongtraw and Dewlieh (common tap), where more than 3/4th

of the households collect water from a single source. Then there are villages like Ladmawphlang and Mawmihthied who depend on more than one source. Households from these two villages depend on a combination of common tap+pond (improved) + rainwater (during the rainy season). Because the two sources, viz., common tap and pond are improved sources, households in these two villages are also assured of household water security. This is however only from the standpoint of type of sources.

According to **Howard and Bartam (2003)** household water security can be assessed using their 'service level descriptors in relation to hygiene' model. According to this model the water use of a household depends primarily on accessibility which is a measure of distance and the time taken for water collection. According to accessibility four categories of service, the level can be identified viz., no access, basic access, intermediate access and optimal access which would define the estimated amount of water collection by a household. The service level has been linked to the various domestic activities that can be performed and the degree of health benefits that would be assured. The relationship is unidirectional with the domestic needs met rising and health status improving with an improvement in the service level. The threshold distance has been taken to 1, 000 m or 30 minutes collection time over which the estimated amount of water collection is assumed to decline. In such a scenario i.e. no access, the amount of water collection would not exceed five lpcd (litres per capita per day) which is an indication of severe scarcity of water. Such a low amount would not allow any needs to be met except maybe for survival i.e., drinking. Other needs like hygiene would not be possible and along with the low quantity of water the vulnerability of the health of the household is very high as adequate quantity and the quality of water cannot be assured. The households in this service level have '*no household water security*'.

Access was found to be very good for all the villages. This was found to be true during both the dry as well as the rainy season. The average amount of time spent on collecting water was found to be highest in Laitthemlangah, more than 25 minutes, i.e., intermediate access (5 to 30 minutes) during the dry season. This is very close to the threshold of 30 minutes (no access). The number of households having access (optimal access+basic access+intermediate access) also gets reduced to less than half during the dry season. So while the spring on which Laitthemlangah depends is an improved source, during the dry season those closer to the settlement start drying up. People then have to travel farther to search for reliable sources. This consumes a lot of time and reduces the time that can be spent on other household duties,

rest or hinder livelihood activities. Optimal access is the most desirable status and three villages have reported enjoying it. These are Laitsohpliah, Laitumiong and Nongtraw. However, households in the first two villages depend exclusively on stream, an unimproved source. Therefore although access is good, the possibility of contracting water-borne diseases is very high and thus households in these two villages have 'no household water security'. Households in Nongtraw collect water from the common tap and thus can be categorised as enjoying 'optimal household water security'. Households in the remaining villages though enjoy only 'basic/partial household water security'. The situation can deteriorate or improve depending on future interventions or lack of it. Preferably, there should be water supplied through multiple sources continuously within a walking distance of 5 minutes or 100 metres. This will reduce the burden on the water carriers, who are mostly men (except in Laitumiong and Mawmihthied, and have an average age of around 30 years. This is prime working-age and time spent in water collection is time lost from other activities.

Water shortage

Laitsohpliah and Laitumiong also suffer from water shortage, especially during the dry season. The main source which is the stream dries up. The same happens to Laitthemlangсах (spring). With the alternative source being very far from the village, people thus have to suffer from inadequacy of water for domestic consumption. Some households in Dewlieh and Ladmawphlang also suffer from water shortage with the drying of main sources and less water storing capacity being identified as the important factors for the former and distance to a reliable source for the latter. Drying of the main sources is also the reason for water shortage in some of the households in Dewlieh. Nongtraw does not suffer from water shortages. For those households who suffer from water shortage, collecting water from farther sources is the most important coping mechanism. Very few purchase water in any of the village. Households in Dewlieh and Laitthemlangсах reduce water when they faced shortage problems. Since drinking and cooking is a priority, water is reduced for sanitation and hygiene. This exposes such households to the risk of contracting water-borne diseases. For households of Laitsohpliah and Laitumiong that is a constant possibility since they not only suffer from water shortage during the dry season but even during the rainy season, the source they depend on is an unimproved one (i.e., possibility of contamination is very high). So while the risk of water-borne diseases is present for all the villages, it is particularly very high for Laitsohpliah and Laitumiong.

Table 2 Demographic profile of the respondents

Village	Mean age of respondent	Gender of the respondent		Mean households size	Mean number of children (less than 15 years age)	Mean number of elderly member (above 60 years)	Educational attainment of majority of respondents
		Female	Male				
Dewlieh	37.70	80.0%	20.0%	4.80	2.40	.13	Primary school
Ladmawphlang	37.33	93.3%	6.7%	6.67	3.37	.00	Primary school
Laitsohpliah	39.22	61.3%	38.7%	4.03	1.69	.21	Primary school
Laitthemlangсах	43.59	88.2%	11.8%	9.00	2.76	.35	Primary school
Laitumiong	44.08	66.7%	33.3%	5.33	2.40	.00	Primary school
Mawmihthied	44.72	56.7%	43.3%	6.23	2.57	.28	High school
Nongtraw	42.50	83.3%	16.7%	5.90	2.37	.38	Primary school
Total	40.83	75.6%	24.4%	5.83	2.51	.20	Primary school

Table 3 Source of water in the study area

Source	Village							Total
	Dewlieh	Ladmawphlang	Laitsohpliah	Laitthemlangсах	Laitumiong	Mawmihthied	Nongtraw	
Common Tap	73.3%	0.0%	0.0%	0.0%	0.0%	13.3%	100.0%	31.1%
Common Tap+Pond+Rain	0.0%	86.7%	0.0%	0.0%	0.0%	36.7%	0.0%	20.6%
Common Tap+Spring+Pond+Rain	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%
Pond	0.0%	0.0%	0.0%	11.8%	0.0%	0.0%	0.0%	1.1%
Pond+Rain	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	0.0%	5.0%
Private	26.7%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	5.0%
Rain	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	.6%
Rain+Other	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	.6%
Spring	0.0%	0.0%	0.0%	88.2%	0.0%	3.3%	0.0%	8.9%
Spring+Pond+Rain	0.0%	3.3%	0.0%	0.0%	0.0%	6.7%	0.0%	1.7%
Spring+Rain	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	.6%
Stream	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	23.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4 Time taken to collect water and status of access

Village	Dry Season		Rainy Season	
	Mean Time (In Minutes)	Access (Within 30 Minutes)	Mean Time (In Minutes)	Access (Within 30 Minutes)
Dewlieh	11.77	90.0%	13.57	90.0%
Ladmawphlang	9.10	90.0%	11.10	86.7%
Laitsohpliah	.00	0.0%	.00	0.0%
Laitthemlangсах	27.65	47.1%	7.89	100.0%
Laitumiong	.00	0.0%	.00	0.0%
Mawmihthied	14.13	83.3%	18.33	83.3%
Nongtraw	.00	0.0%	.00	0.0%
Total	8.44	48.3%	7.91	52.8%

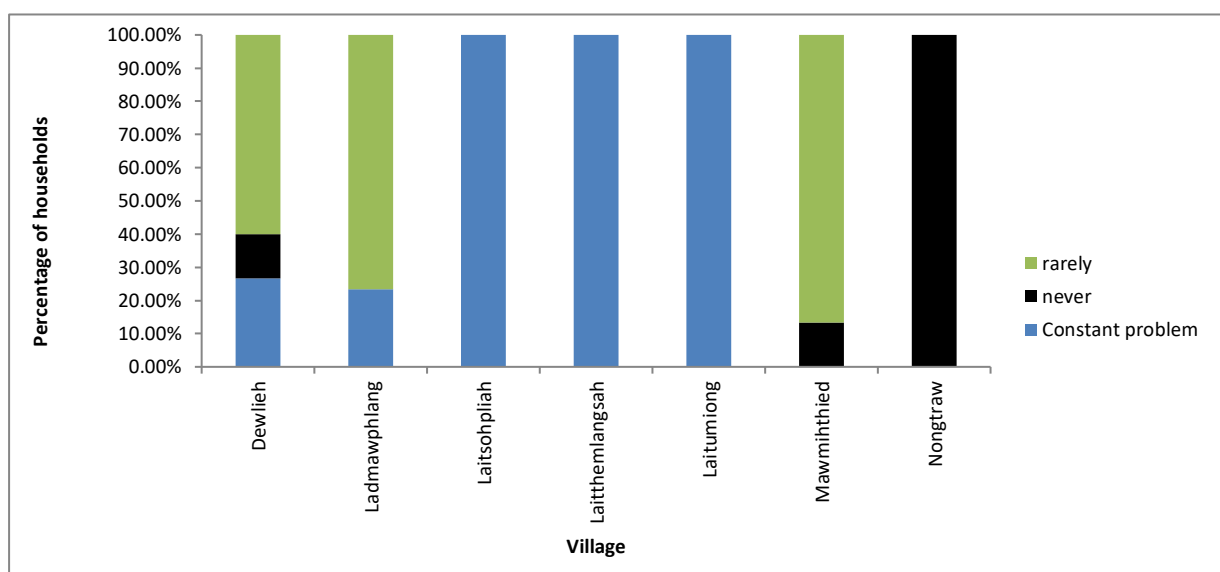


Figure 1 Experience of water shortage

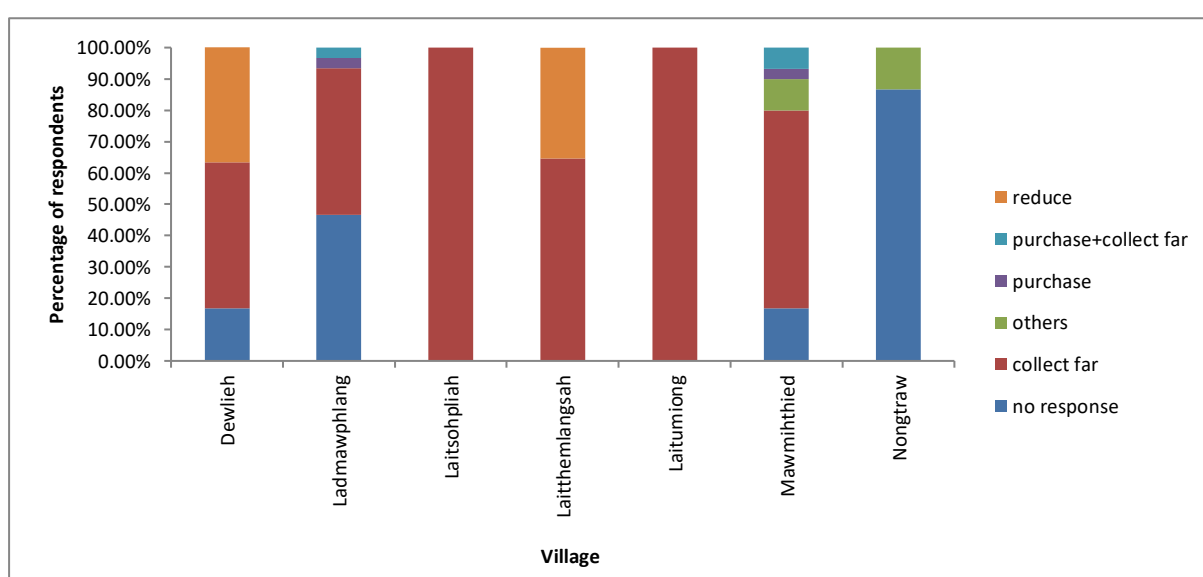


Figure 2 Coping strategy during water shortage

Table 5 Reasons for water shortage

Reasons	Village							Total
	Dewlieh	Ladmawphlang	Laitsohpliah	Laitthemplangseh	Laitumiong	Mawmihtied	Nongtraw	
No response	40.0%	0.0%	0.0%	0.0%	0.0%	13.3%	100.0%	25.6%
Distance	0.0%	0.0%	0.0%	100.0%	8.3%	0.0%	0.0%	10.0%
Distance+electricity	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%
Distance+high demand+electricity	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Distance+high demand+less storage	0.0%	13.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%
Distance+less storage	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%
Distance+less storage+electricity	0.0%	13.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%
Distance+less storage+less time	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%
Distance+less time	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Distance+less time+electricity	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Drying of main sources	20.0%	0.0%	96.8%	0.0%	91.7%	53.3%	0.0%	35.0%
Drying+electricity	0.0%	0.0%	0.0%	0.0%	0.0%	13.3%	0.0%	2.2%
Drying+high demand+electricity	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%
Drying+high demand+less storage	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Drying+less storage	0.0%		0.0%	0.0%	0.0%	3.3%	0.0%	0.6%
Electricity	0.0%	3.3%	0.0%	0.0%	0.0%	6.7%	0.0%	1.7%
High demand+less storage	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
High water demand	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
High water demand+less storage	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Less storage	10.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	3.3%
Less storage capacity	0.0%	0.0%	3.2%	0.0%	0.0%	0.0%	0.0%	0.6%
Less storage+electricity	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Less time+electricity	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Less water	30.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 6 Cleaning of water sources

Village	Cleaning of source				
	Once a week	Once every three months	Once every six months	Once a year	No response
Dewlieh	0.0%	0.0%	0.0%	0.0%	100.0%
Ladmawphlang	36.7%	3.3%	3.3%	0.0%	56.7%
Laitsohpliah	3.2%	74.2%	9.7%	0.0%	12.9%
Laitthemlangsah	0.0%	0.0%	0.0%	0.0%	100.0%
Laitumiong	16.7%	58.3%	16.7%	0.0%	8.3%
Mawmihthied	20.0%	0.0%	0.0%	0.0%	80.0%
Nongtraw	0.0%	0.0%	100.0%	0.0%	0.0%
Total	11.1%	17.2%	20.0%	0.0%	51.7%

It is encouraging to note that almost all the households in all the villages reported of boiling the water. Some other methods of water treatment like straining with a cloth or filter are also employed by the households to make the water safe for consumption. These again are mostly done in combination with boiling. Treatment becomes important because there is a possibility of the source getting contaminated even though it might be improved. A leak in the pipe or lack of maintenance of the sources could easily lead to them getting contaminated. Regular cleaning of the sources is therefore highly recommended. The frequency as practised in the villages differs. Laitsohpliah and Laitumiong, the problematic villages reported of cleaning the source, the stream once every three months. The runoff in the streams is very much dependent on rainfall, increasing during the rainy season and reducing in the dry season. Despite the clean operations every three months, the possibility of contamination is very high because of the open-air nature of the source. The benefits of cleaning the source do not last long in this case. Ladmawphlang and Mawmihthied clean their sources, pond and common tap, once a week. This is a very good practice and the fact that both the sources of improved, it reduces the threat of water-borne diseases. Nongtraw also depends on an improved source, common tap, but clean their source only once every six months. The frequency has to be increased, especially during the rainy season, which starts from April and continues till October. During these months runoff from the surrounding area, especially when there are settlements around where open defecation is still practised, could contaminate the source. Regular cleaning of the source is therefore very important. Dewlieh and Laitthemlangsah did not respond to the question which means that the sources must be located outside the jurisdiction of the village. The responsibility of cleaning the source, therefore, lies with the village on which land the sources are located. Thus, only Ladmawphlang and Mawmihthied seem to be in a secure position as regards to prevention of contamination of sources.

Table 7 Status of the toilet

Village	Toilet functional: yes	Toilet water available: yes	Toilet electricity: yes	Toilet clean: yes	Separate toilet water tank: yes	Toilet place to wash hand: yes	Toilet located inside: yes
Dewlieh	83.3%	6.7%	3.3%	86.7%	36.7%	6.7%	6.7%
Ladmawphlang	90.0%	86.7%	3.3%	86.7%	86.7%	16.7%	3.3%
Laitsohpliah	83.9%	51.6%	6.5%	93.5%	3.2%	0.0%	0.0%
Laitthemlangсах	100.0%	100.0%	0.0%	100.0%	100.0%	0.0%	0.0%
Laitumiong	58.3%	66.7%	0.0%	83.3%	16.7%	25.0%	0.0%
Mawmihthied	93.3%	86.7%	6.7%	93.3%	13.3%	10.0%	0.0%
Nongtraw	100.0%	13.3%	0.0%	96.7%	76.7%	6.7%	0.0%
Total	88.9%	55.0%	3.3%	91.7%	46.7%	8.3%	1.7%

Table 8 Method of waste disposal

Village	Mode of disposal										
	No response	Burn	Burn+ Dump	Burn+ Dump+ Throw	Burn+ Throw	Dump	Dump+ Throw	Dustbin	Dustbin+ Burn	Dustbin+ Burn+ Throw	Throw
Dewlieh	0.0%	43.3%	3.3%			10.0%	0.0%	23.3%	0.0%	0.0%	20.0%
Ladmawphlang	0.0%	10.0%	10.0%	3.3%	50.0%	6.7%	3.3%	0.0%	0.0%	3.3%	13.3%
Laitsohpliah	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Laitthemlangсах	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Laitumiong	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Mawmihthied	0.0%	33.3%	0.0%	0.0%	3.3%	3.3%	0.0%	0.0%	0.0%	0.0%	60.0%
Nongtraw	3.3%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	30.0%	0.0%	
Total	.6%	43.9%	2.2%	.6%	8.9%	3.3%	.6%	9.4%	5.0%	.6%	25.0%

Toilet

Proper sanitation thus not only means clean toilets but also a healthy environment for the citizens, as there is proper disposal of physical and microbiological agents causing diseases. It has been estimated that less than 48% of urban and just about 3.15% of the rural population in India have access to toilets (**Hazarika, 2015**). Fortunately, almost all the households in the study area have a toilet. Invariably these are septic tank toilets excepting Laitthemlangсах where households use pit latrines instead. A few households in Dewlieh and Ladmawphlang also do the same. Open defecation is absent from all villages which is a good sign of improving sanitation. Almost all of the toilets are functional except for almost half of the households in Laitumiong who don't have a functional toilet. Problems are compounded by the fact that most of these toilets again suffer from the unavailability of water. In fact, except Ladmawphlang, Laitthemlangсах and Mawmihthied many of the households (more than 30%) do not have any water in the toilet. In Nongtraw and Dewlieh less than 15% of the households have water in their toilets. Lack of water makes cleaning of toilets difficult and this can give rise to a host of sanitation and hygiene problems. At the same time, almost all the households report of the toilet being clean. Toilets are cleaned every day except for households in Dewlieh who do it once a week. This is difficult to believe especially with the lack of water being cited as a recurring problem. Perception is an important factor in cleanliness and it appears that there is still a need to improve the perception of the community. What they might consider clean may not be clean enough. Of course, this could be an adaptation to the lack of water. Still, the implications of household's health could be grave. Another problem is the unavailability of electricity for the toilets. Almost none of the toilets have electricity which makes it difficult to use the toilet during the dark. At such times, a candle or torchlight comes in handy. The lack of visibility though could affect cleanliness.

Almost all the toilets are located outside the house. This is a very feature in villages. Houses are small and the number of rooms less. There is no enough for an indoor toilet. Except for households in Ladmawphlang, Nongtraw and Laitthemlangсах very few households have a separate water tank for the toilets. This means that those wanting to use the toilet have to carry the water from the house to the toilet which becomes difficult especially during the night. The regular trip to collect the required amount of water to clean the toilet after using it can be a tedious affair. It is much more convenient to have a separate tank for the toilet.

Again very few toilets have a designated place to wash had after using the toilet. The spillover from the washing just flows all over the place which is not sanitary.

Thus though most of the households have a toilet, the status is not very satisfactory, lack of water, no electricity, and separate water tank and place to wash hand is a recurring problem for many households. These can have a severe impact on the household’s health outcome.

Waste disposal

Proper disposal of waste is very important for sanitation and hygiene. Indiscriminate dumping not only ruins the aesthetic of a place but also acts as a breeding ground for diseases. Segregation of wastes into biodegradable and non-biodegradable is an important part of waste disposal. Biodegradable waste can still be useful by transforming it into for example manure for growing food plants in the kitchen garden. Non-biodegradable, other the other hand can be recycled. And even when they are set aside for final disposal care must be taken to make sure that harmful chemicals from the waste do not leach into the surrounding area during the process.

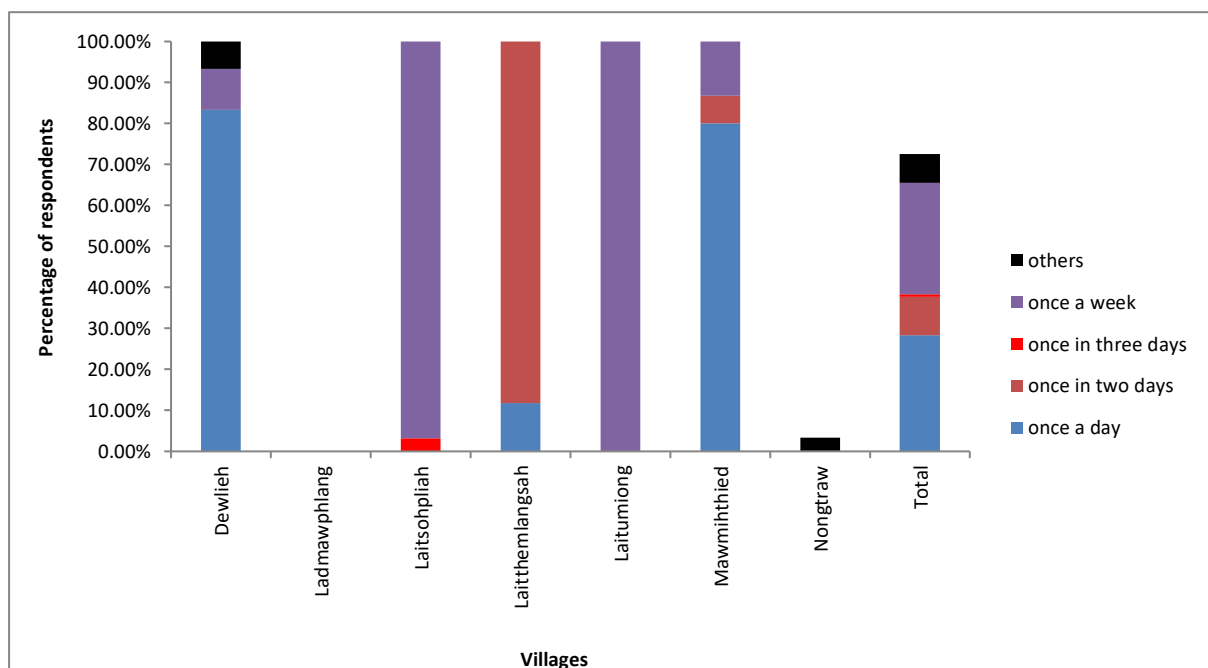


Figure 3 Frequency of collection of waste

Except for Ladmawphlang, households in the report of the remaining village of segregating their waste before disposal. Burning is the most common method of disposal. Wastes are collected in one location and set fire to. Sometimes the ash is used as manure for the plants.

In Ladmawphlang, a hole is dug where all the waste is dumped. After the hole is filled up, the waste will be set on fire. The other mode of disposal is to dump the waste in a public bin (less than 10%), and throw them into the river or out in the open. Although a majority of households in Dewlieh and Nongtraw burn their waste, a substantial number of households (>20%) would dispose their waste in the open. This should be discouraged.

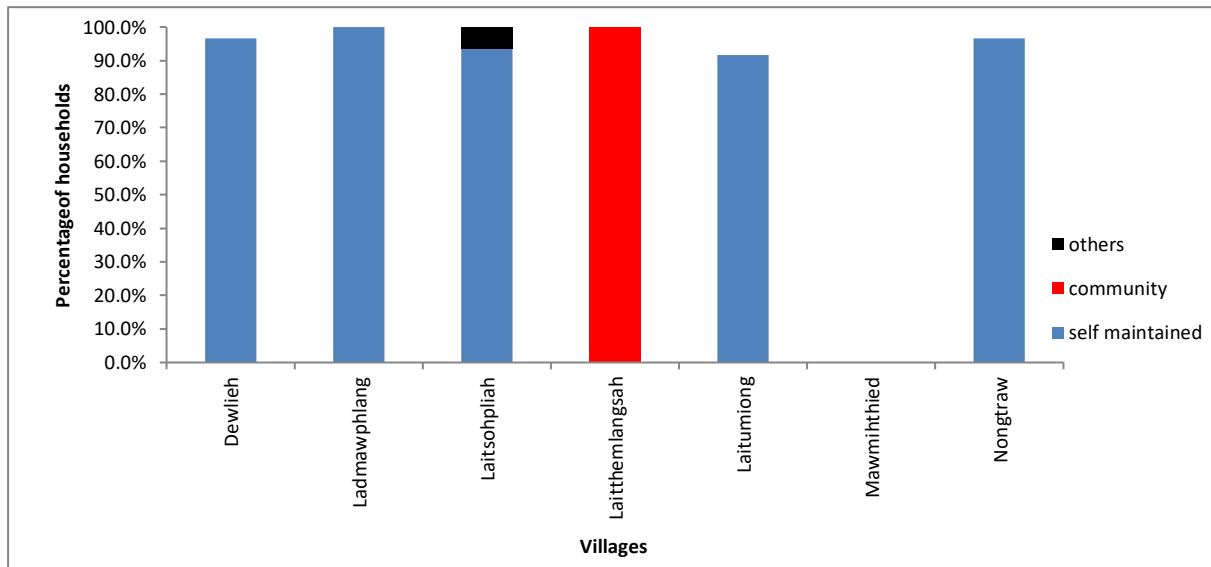


Figure 4 Maintenance of drainage

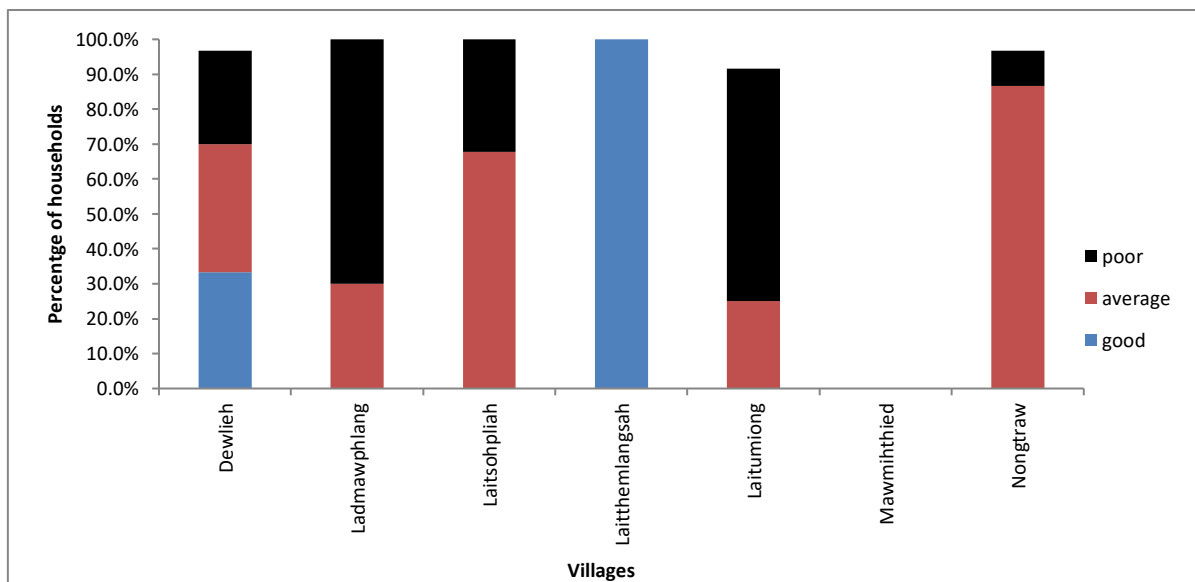


Figure 5 Condition of the drainage

Waste is collected at least once every two days in Dewlieh, Laitthemlangсах and Mawmihthied. In Laitsohpliah and Laitumiong it happens at once a week. Ladmawphlang

and Nongtraw have no specific timings for waste collection. It happens as and when required. The community thus is very aware of the importance of proper waste disposal and makes effort to keep the surrounding clean regularly. At the household level also, individual households are doing their bit which is an encouraging development. In terms of waste disposal, the status in the villages is good.

Drainage

Except for Dewlieh, Laitumiong and Mawmihthied majority of the households in the remaining villages have drainage around their house. Most of this is open drains. Only in Laitthemlangzah, the drain is covered. Open drainage can become a breeding ground for diseases. Covering the drain is very important to prevent the transmission of water-borne diseases. In Dewlieh, Laitumiong and Mawmihthied the situation is worse with no drainage at all. Here water is allowed to flow out of the house into the surrounding area. These three villages are problem villages and the possibility of an outbreak of water-borne diseases is very high in these villages. This is especially so since the majority of the households in Ladmawphlang, Laitthemlangzah, Laitumiong and Mawmitheid do not have soak pits.

Table 9 Availability of drainage and type

Village	Availability of drainage	Type		
		Open	Covered	Others
Dewlieh	3.3%	3.3%	0.00%	0.00%
Ladmawphlang	100.0%	96.7%	0.00%	0.00%
Laitsohpliah	64.5%	61.3%	0.00%	38.7%
Laitthemlangzah	100.0%	0.00%	100.0%	0.00%
Laitumiong	25.0%	50.0%	0.00%	50.0%
Mawmihthied	0.00%	0.00%	0.00%	0.00%
Nongtraw	93.3%	23.3%	70.0%	0.00%
Total	55.0%	34.4%	21.1%	10.0%

Maintenance of drains is the responsibility of the individual households except in Laitthemlangzah, where the community cleans the drain. This communal nature of the activity could also be the reason why the drains are covered in Laitthemlangzah and not in others. For improvement sanitation, community participation rather than individual responsibility could be the answer here. The benefits of community-based maintenance become more apparent in terms of the quality of the drainage. All the households in Laitthemlangzah are satisfied with the quality of the drainage and are happy with it. It is cleaned twice a month which is understandable considering that it's a community-backed initiative. In other villages, the level of satisfaction ranges from poor to average.

Ladmawphlang and Ladumiong are particularly worrisome villages regard the quality of drainage. This is although households in Ladmawphlang clean their drains every day. Cleaning is very irregular in Ladumiong, being done when the drains look dirty enough. Same is the case with Dewlieh. In Laitsohpliah drains are cleaned once a month while in Nongtraw it happens twice a week. Although it would be preferable if the drains are cleaned more regularly, the village of Laitthemlangсах with its community-centric drain maintenance can be a model for other villages to follow.

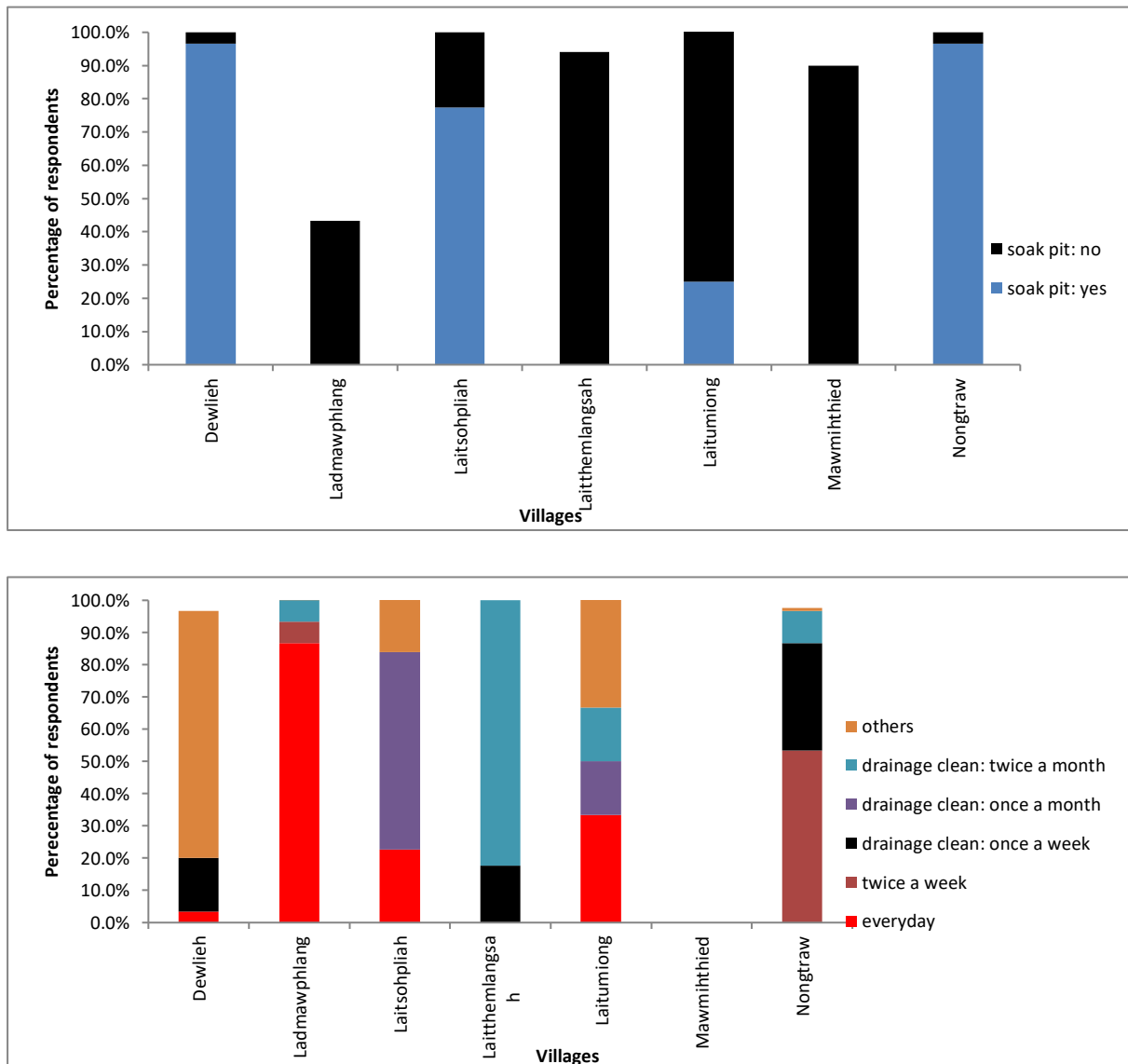


Figure 6 Frequency of cleaning of drains

However, it does not mean that community action regarding cleanliness is absent from the villages. Community cleaning is a regular feature of the villages in Meghalaya where everyone in the village is expected to participate. This is found to be the case for the villages

who took part in this study. The frequency, however, was found to differ. Laitsohplich, Laitumiong and Nongtraw have their cleaning drive once every six months, i.e., twice a year. Cleaning drive in Ladmawphlang and Laitthemlangasah happens once every three months. Dewlieh has once a month and Mawmihthied has once a week which is a very good practise. While once a week as practised by Mawmihthied is a good practice, it may not always be possible to bring people together at such a regular interval. Once every two weeks or once a month is a good practise and should be encouraged in Laitsohplich, Laitumiong, Nongtraw, Ladmawphlang and Laitthemlangasah where the frequency is low.

Household hygiene

In terms of hygiene, household members in all the villages are found to have good habits. Family members especially children always wash their hands before their meals. Children especially get their hands untidy while playing. Eating without washing could lead to the germs contaminating the food which when ingested causes illness. It is very heartening to note that family members always wash their hand after using the toilet. As already discussed above not many households have a separate water tank for the toilet. Despite this household members make sure that they always wash their hand. This is a very good habit. Washing of hands after touching the pet is not followed in all the villages. Households in Ladmawphlang and Nongtraw do it sometimes but not always. Pets especially if they are allowed to roam free can become very dirty. And when a person plays with them the dirt and the germs from the body of the pet can spread. Children especially are highly vulnerable to this. It is highly recommended that hands should be washed after handling the pets. Many times people wash hands using only water. While in some cases, if one is washing hands under running water for at least a minute, it may be sufficient, the use of soap is highly recommended. Almost all the households in the villages are found to wash their hands with soap. Nails if not cut regularly can become very dirty and even though one may wash hands, dirt accumulated in them can be a source of illness. Regular cutting is therefore important almost all the households in the villages are doing so.

In terms of hygiene, households follow good habits regularly. This bodes well for the prevention of water-borne diseases in the household. All the villages have received awareness on WASH except for the majority of the households in Mawmihthied who reported not receiving any awareness. This awareness is mostly given by ASHA, ANM and Anganwadi workers in the Anganwadi/ICDS and the Community Sub Centre. In some cases, doctors

would also advise the household members regarding WASH. Apart from the community health workers, organisations like ISRO, NESFAS have also given awareness on WASH to the communities. Some of these awareness programs are given to the SHG who then give it to the community. After such an awareness program while in some cases, no change was observed in many, important lessons have been imbibed by the community. These are washing hand, segregating and proper storage and disposal of waste, cleaning the surrounding, clean water and eating good food, especially vegetables. Households have realised the importance of following these lessons for staying healthy and prevention of diseases. For the households in Mawmihthied WASH awareness must take place as soon as possible.

Problem villages

From the discussion, three villages emerge as being problem villages in terms of WASH. They are Laitsohpliah, Laitumiong and Dewlieh. This stems from Laitsohpliah and Laitumiong depending on an unimproved source, stream. The possibility of contamination is very high for this source and therefore the households in these two villages are highly vulnerable to water-borne diseases. The problems are compounded by the fact that households in these two villages also suffer from water shortage during the dry season. The frequency of cleaning of the source is also quite low, which does not make much of a difference because of the open-air nature of the source, i.e., stream. Dewlieh does not suffer from these problems because it depends on common tap, an improved source but the frequency of cleaning of the source is very low, which increases the possibility of the contamination of the source from where the tap water is derived from. Dewlieh, however, is problematic because of other reasons.

Lack of electricity, location (outside the house), no separate water tank and place for washing hand is a common problem for the households in all the villages. But Dewlieh does very badly in terms of cleaning the toilet, not every day like households of other villages. Water shortage for the toilet is a specific problem mentioned. The same problem was mentioned by households in Laitumiong who also reported of their toilets not being functional. Sanitation is greatly compromised in such a situation and makes the households in these two villages susceptible to water-borne diseases.

Then when it comes to drainage and waste disposal, Dewlieh, Laitsohpiah and Laitumiong are problem villages. Dewlieh and Laitumiong did not have any proper drainage system which is a big sanitation problem. Many households in Laitumiong do not have soak pit as well. Laitsohpiah suffers from drainage being of an open type and the possibility of diseases spreading from the drains. This problem, however, is universal except for Laitthemlangisah whose drains are closed and the cleaning of drains is a communal activity. This appears to give the village an edge over other villages as households from this village expressed satisfaction with the quality of the drains. Other villages, the quality of the drains is ranked from average to poor. Laitthemlangisah could be a role for other villages in terms of sanitation, especially drainage.

And finally as for hygiene villages scored well except for households in Ladmawphlang and Nongtraw. In these two villages, household members do not wash their hands after playing with a pet. In general, hygiene practises are quite good in the study area.

Water borne disease

Consumption of unsafe water, inadequately protected water sources, inappropriate waste disposal and unhygienic conditions around homes has significant implication for spreading infectious diseases such as cholera, dysentery, hepatitis and especially diarrhoea (**Shibulal, 2013**). New research on malnutrition, which leads to childhood stunting, suggested that an underlying cause of it may be an abundance of human waste polluting soil and water, rather than a scarcity of food (**WHO, 2012**). Although a few studies identify genetics as the reason for the short stature of Indian children (**Panagariya, 2013**), most researchers contradict this by claiming childhood stunting is correlated with disease environment and open defecation (**Dwivedi et al., 2019**). Addressing malnutrition among adolescent girls, especially among early adolescents could be a window of opportunity for 'catch-up' growth. This subject is also important for breaking the inter-generational cycle of undernutrition. Undernutrition is directly caused by inadequate dietary intake and/or disease and indirectly related to many factors, including poor water, sanitation and hygiene (**WHO, UNICEF, USAID, 2015; Dangour et al., 2013**). Thus, reducing the burden of malnutrition among adolescents requires a shift from interventions focusing solely on children and infants to those that reach young girls to improve their nutrition as well as the living environment (**Danaei et al., 2016**).

Table 10 Hygiene practises in the household

Hygiene	Response	Villages						
		Dewlieh	Ladmawphlang	Laitsohpliah	Laitthemlangсах	Laitumiong	Mawmihthied	Nongtraw
How often the family members especially children wash their hands before meal?	Always	96.7%	96.7%	100.0%	100.0%	100.0%	100.0%	100.0%
	Sometimes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Never	3.3%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
How often do family members wash their hands after using the toilet?	Always	96.7%	83.3%	93.5%	100.0%	100.0%	100.0%	100.0%
	Sometimes	3.3%	13.3%	3.2%	0.0%	0.0%	0.0%	0.0%
	Never	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%
How often fo family members wash their hands after contact with a pet?	Always	96.7%	13.3%	100.0%	100.0%	100.0%	86.7%	6.7%
	Sometimes	0%	26.7%	0%	0%	0%	13.3%	93.3%
	Never	0%	23.3%	0%	0%	0%	0%	0%
Do family members use soap to wash their hands?	Always	96.7%	86.7%	100.0%	100.0%	100.0%	96.7%	93.3%
	Sometimes	3.3%	6.7%	0%	0%	0%	0%	6.7%
	Never	0%	6.7%	0%	0%	0%	0%	0%
Frequency of cutting nails by family members?	Always	100.0%	96.7%	100.0%	100.0%	91.7%	100.0%	100.0%
	Sometimes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Never	0.0%	3.3%	0.0%	0.0%	8.3%	0.0%	0.0%

Table 11 Status of villages in term of WASH

Indicators	Village						
	Dewlieh	Ladmawphlang	Laitsohpliah	Laitthemlangсах	Laitumiong	Mawmihtied	Nongtraw
Source of water	No problem	No problem	Problem	No problem	Problem	No problem	No problem
Access	No problem	No problem	No problem	Problem	No problem	No problem	No problem
Water shortage	No problem	No problem	Problem	Problem	Problem	No problem	No problem
Water treatment	No problem	No problem	No problem	No problem	No problem	No problem	No problem
Frequency of cleaning of source	Problem	No problem	Problem	Problem	Problem	No problem	Problem
Toilet	Availability	No problem	No problem	No problem	No problem	No problem	No problem
	Functional	No problem	No problem	No problem	No problem	Problem	No problem
	Water availability	Problem	No problem	Problem	No problem	Problem	No problem
	Cleaning	Problem	No problem	No problem	No problem	No problem	No problem
	Electricity	Problem	Problem	Problem	Problem	Problem	Problem
	Location of toilet (outside)	Problem	Problem	Problem	Problem	Problem	Problem
	Separate water tank	Problem	Problem	Problem	Problem	Problem	Problem
Waste	Washing hand	Problem	Problem	Problem	Problem	Problem	Problem
	Segregation	No problem	Problem	No problem	No problem	No problem	No problem
Drainage	Collection frequency	No problem	No problem	No problem	No problem	No problem	No problem
	Availability	Problem	No problem	No problem	No problem	Problem	Problem
	Cover	Problem	Problem	Problem	No problem	Problem	Problem
	Soak pit	No problem	Problem	No problem	Problem	Problem	Problem
Quality of drain	Problem	Problem	Problem	No problem	Problem	Problem	Problem
Community cleaning	No problem	Problem	Problem	Problem	Problem	No problem	Problem

Table 12 Intra village comparison of incidence of water borne diseases

% Within name of the village										
Year of observation			Incidences							Total
			Amoebic dysentery	Ascariasis	Bacillary dysentery	Gastro enteritis	No incidence	Scabies	Skin sepsis	
2019	Name of the village	Dewlieh	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		Ladmawphlang	0.1%	0.0%	0.1%	0.1%	99.4%	0.2%	0.1%	100.0%
		Laitthemlangсах	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		Laitumiong	0.7%	0.3%	0.0%	0.0%	97.6%	1.0%	0.3%	100.0%
		Laitsohpliah	0.9%	0.0%	0.1%	0.0%	98.9%	0.1%	0.0%	100.0%
		Mawmihthied	0.1%	0.0%	0.0%	0.0%	99.8%	0.1%	0.0%	100.0%
		Nongtraw	0.6%	0.3%	0.0%	0.1%	98.5%	0.6%	0.0%	100.0%
	Total		0.4%	0.1%	0.0%	0.0%	99.1%	0.3%	0.1%	100.0%
2020	Name of the village	Dewlieh	0.0%	0.0%	0.0%	0.0%	97.9%	0.0%	2.1%	100.0%
		Ladmawphlang	0.1%	0.1%	0.0%	0.2%	99.1%	0.0%	0.5%	100.0%
		Laitthemlangсах	0.0%	0.1%	0.1%	0.0%	99.8%	0.0%	0.0%	100.0%
		Laitumiong	1.6%	0.0%	0.2%	0.0%	96.2%	1.4%	0.7%	100.0%
		Laitsohpliah	1.0%	0.0%	0.1%	0.1%	98.6%	0.2%	0.0%	100.0%
		Mawmihthied	0.2%	0.0%	0.0%	0.0%	99.7%	0.1%	0.0%	100.0%
		Nongtraw	1.7%	0.7%	0.0%	0.1%	96.1%	1.3%	0.1%	100.0%
	Total		0.7%	0.2%	0.1%	0.1%	98.4%	0.4%	0.2%	100.0%

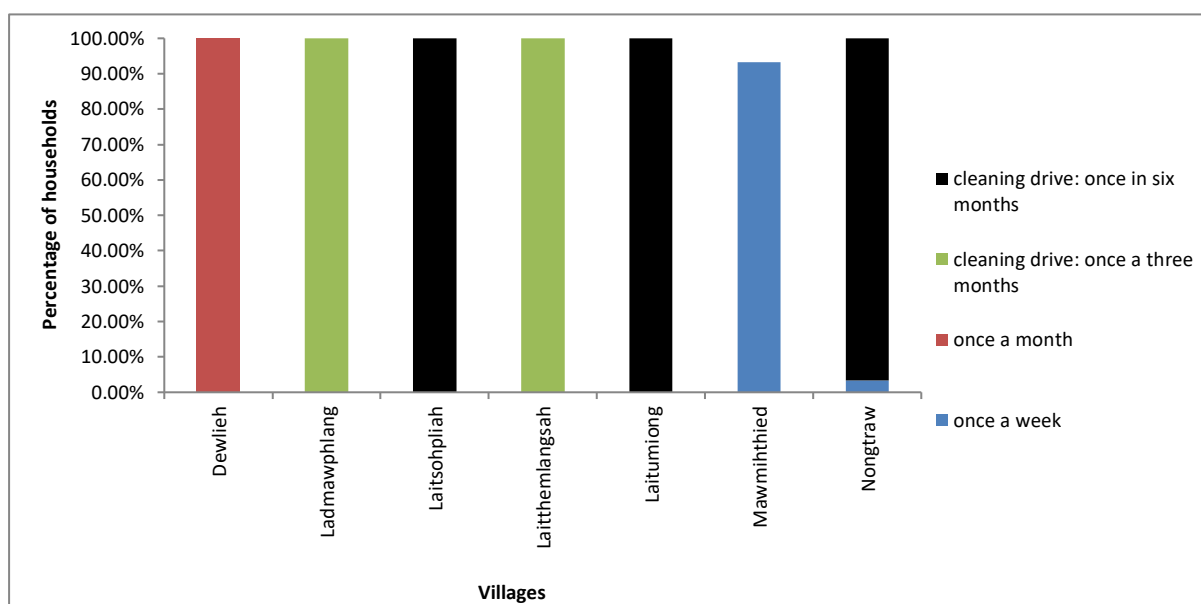


Figure 7 Frequency of community cleaning drive

Understanding this, NESFAS had given awareness training on WASH to the villages. To assess whether that awareness and training given to the community have made an impact, six water-borne diseases were chosen. An assessment was done on the incidence of water-borne diseases among NESFAS and non-NESFAS villages and the selected villages across two years, 2019 and 2020. The diseases chosen are common water-borne diseases known to be quite prevalent in the Sohra region.

1. Amoebic dysentery is caused by a parasitic infection of the colon with the amoeba *Entamoeba histolytica*. It is most common in tropical areas with untreated water. It spreads through drinking or eating uncooked food, such as fruit, that may have been washed in contaminated local water. Symptoms include mild and include cramping and diarrhoea. Bloody stools, fever and, rarely, a liver abscess may occur in severe cases (Jeremy et al., 2018).
2. Bacillary dysentery is an intestinal infection caused by a group of *Shigella* bacteria which can be found in the human gut. It is transmitted directly by physical contact with the faecal material of a patient or carrier (including during sexual contact), or indirectly through consumption of contaminated food and water. Infection may occur after consuming a small number of bacteria. Therefore, the disease is highly contagious and many outbreaks are related to childcare settings and schools. Infection by *Shigella* may be asymptomatic or only cause mild illness. For patients who develop bacillary dysentery, they commonly present with acute onset of fever,

diarrhoea with abdominal cramps and nausea or vomiting. The stool may contain blood and mucus. Complications include toxic dilatation of the large intestine and acute kidney disease (**Centre for Health Protection, 2019**).

3. Gastroenteritis happens when bacteria causes an infection in your gut. This causes inflammation in your stomach and intestines. You may also experience symptoms like vomiting, severe abdominal cramps, and diarrhoea. While viruses cause many gastrointestinal infections, bacterial infections are also common. Some people call this infection “food poisoning.” Gastroenteritis can result from poor hygiene. Infection can also occur after close contact with animals or consuming food or water contaminated with bacteria (or the toxic substances bacteria produce). Gastroenteritis symptoms vary depending on the bacteria causing your infection. The symptoms may include, loss of appetite, nausea and vomiting, diarrhoea, abdominal pains and cramps, blood in your stools, fever (**Healthline, 2016**).
4. Ascariasis is caused by *Ascaris lumbricoides* (sometimes called just *Ascaris* or ascariasis). *Ascaris*, hookworm, and whipworm are parasitic worms known as soil-transmitted helminths (STH). *Ascaris* parasites live in the intestine and *Ascaris* eggs are passed in the faeces of infected people. If an infected person defecates outside (for example, near bushes, in a garden, or a field), or if the faeces of an infected person are used as fertilizer, eggs are deposited on soil. The eggs can then mature into a form of the parasite that is infective. *Ascariasis* is caused by ingesting eggs. This can happen when hands or fingers that have contaminated dirt on them are put in the mouth, or by consuming vegetables or fruits that have not been carefully cooked, washed, or peeled. People infected with *Ascaris* often show no symptoms. If symptoms do occur they can be light and include abdominal discomfort. Heavy infections can cause intestinal blockage and impair growth in children. Other symptoms such as cough are due to migration of the worms through the body (**Centre for Diseases control and prevention, 2020**).
5. Scabies is a skin infestation caused by a mite known as the *Sarcoptes scabiei*. Untreated, these microscopic mites can live on your skin for months. They reproduce on the surface of your skin and then burrow into it and lay eggs. This causes an itchy, red rash to form on the skin. After the initial exposure to scabies, it can take up to six weeks for symptoms to appear. The symptoms usually develop more quickly in

people who've had scabies before. The hallmark symptoms of scabies include a rash and intense itching that gets worse at night. Continuous scratching of the infected area can create sores that become infected (**Healthline, 2019**). Inadequate water to wash infected clothes and performing hygiene is an important cause of scabies.

6. Sepsis is mostly caused by a bacterial infection which is the most common cause. Sepsis can also be caused by fungal, parasitic, or viral infections. The source of the infection can be any several places throughout the body. Bacteria can enter the skin through wounds or skin inflammation or through the openings made with intravenous (IV) catheters (tubes inserted into the body to give or drain fluids). Conditions such as cellulitis (inflammation of the skin's connective tissue) can also cause sepsis. Because of the many sites on the body from which sepsis can originate, there are several symptoms. The most prominent are: Fast heart rate, Fever or hypothermia (very low body temperature), Shaking or chills, Warm or clammy/sweaty skin, confusion or disorientation, Hyperventilation (rapid breathing) or shortness of breath (**Cleveland Clinic, 2019**). Poor hygiene and inadequate water are a factor in contracting the diseases.

Table 13 Incidence of water borne diseases

Diseases	2019		2020	
	Number	%	Number	%
Amoebic dysentery	31	2.58	63	5.25
Ascariasis	8	0.67	14	1.17
Bacillary dysentery	3	0.25	4	0.33
Gastro enteritis	2	1.67	5	0.42
Scabies	25	2.08	40	3.33
Skin sepsis	4	0.33	13	1.08

In 2019 amoebic dysentery and scabies was the most common diseases affecting households in five of the seven villages, viz., Ladmawphlang, Laitumiong, Laitsohpiah, Mawmihthied and Nongtraw. The number of villages infected by amoebic dysentery remained the same in 2020 but households in Ladmawphlang did not report any incidence of scabies. So it can be said there has been an improvement in terms of health outcomes. However, this is not the complete picture. The number of villages affected by skin sepsis and gastroenteritis remained the same, two, but ascariasis and bacillary increased from two to three villages from 2020. In 2019, ascariasis was reported by households from Laitumiong and Nongtraw, which included in 2020 included Ladmawphlang and Laitthemlangah. The number of cases in Nongtraw

increased from 0.3% to 0.7%. Ladmawphlang and Laitsohplich were the villages who recorded cases of bacillary dysentery in 2019. The following year Laitthemlangah was added to the list. The picture, therefore, is quite mixed and no perceptible trend can be gauged apart from the individual diseases some which have gone down while some which have increased.

Table 14 Incidence of water borne diseases among NESFAS and non-NESFAS villages

Name of villages/Type	Incidence of waterborne and water washed disease w.e.f January 2020	Mean
Nongthymmai I	32	
Nongthymmai II	21	
Laitthemlangah	2	
Laitkynsew	24	
Diengkynthong	12	
Mawkalang	5	
Synrangsohnoh	2	
Tiewlieh	19	
Tyniar	6	
Kyrdemkhla	11	
Lumkyntung	29	
Rangtmah	1	
Umdiengpoh	14	
Lumkynto	2	
Laitumiong	0	
Lurbah	37	
Mawmyrsiang	37	
Mawkdok	24	
Steplakrai	3	
Mawroh	14	
Shilliang Wah	44	
Mawbeh	46	
Laitsohma	1	
Dympep	16	
Ladmawphlang	12	
Dewlieh	7	
Laitsohplich	7	
Nongtraw	5	
Mawkma	46	
Mawmihthied	54	
NESFAS villages		16.62
Non NESFAS villages		19.39

Among the villages, Ladmawphlang was the village most affected by water-borne diseases with households from the village reporting incidences of amoebic dysentery, bacillary dysentery, gastroenteritis and scabies. It was followed by Laitumiong and Nongtraw, the

incidence of four water-borne diseases. The number of diseases reduced for Ladmawphlang in 2020 but the combination changed. The households now report incidences of amoebic dysentery, ascariasis, gastroenteritis and skin sepsis. Laitumiong was now joined by Laitsohpiah with four diseases. The highest incidence of diseases is reported from Nongtraw whose number of diseases has gone up to five from four. In 2020 it reported incidences of amoebic dysentery, ascariasis, gastroenteritis, scabies and skin sepsis. It appears that there has been a reduction of infection from the maximum but this is offset by the increase from the minimum, i.e., maximum incidences have gone down but minimum incidences have gone up. It is very difficult to state with absolute certainty as to whether there has been an improvement in terms of WASH. General trends are no clear but individually, the incidence of amoebic dysentery, ascariasis and scabies has gone up while bacillary dysentery and gastroenteritis has gone up.

When it comes to comparison with non-NESFAS villages, there seems to have been some benefit of the intervention. The mean number of water-borne diseases was 16 for NESFAS villages and 19 for non-NESFAS villages. This however again hides inter-village differences among NESFAS villages as well with Mawkma and Mawmihthied having very high incidences, more than 45 in the entire Sohra region for which data was available. So while the WASH interventions by NESFAS seem to have improved the status of the villages under it as compared to those not under NESFAS, overall a lot still needs to be done.

CONCLUSION

WASH is a very important intervention in terms of bringing about improved health outcomes in terms of prevention from a water-borne disease which has a debilitating effect on the community, especially the children. The assessment revealed that the impact of the intervention may be seen in terms of comparison with non-NESFAS villages. There is a slight difference in terms of water-borne disease incidence with NESFAS villages have a lower count. Inter village difference within NESFAS villages, however, must be considered. Primary data collected from the individual households were not able to provide any clear trends of improvement in health outcomes after the WASH awareness program. Individual villages show improvement as well as a decline. The good thing is that the interventions have brought a realisation among the community members about the importance of WASH and this behavioural change will surely show change soon. What the study also revealed are certain gaps in the types of sources community members depend on especially Laitsohpliah and Laitumiong and the lack of sanitation infrastructure. More stress can be put on these aspects for future interventions. There need to more follow up with the interventions to see that the health outcomes can be realised.

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