Perceptions of water, sanitation and health: a case study from the Mekong Delta, Vietnam

ABSTRACT
In the Mekong Delta in the south of Vietnam about 5.7 million people lack access to safe drinking water and 10 million people in rural areas live without adequate sanitation. Between May and August, 2007 a survey was carried out in An Bin, a peri-urban ward in the Mekong Delta, to gain insight into water, sanitation and health as well as to health-related hygiene behaviour. The study employed a combination of quantitative (standardized questionnaire) and qualitative (focus group discussions, semi-structured interviews) methods. The most important features in the choice of drinking water sources are matters of hygiene and the taste of the water. The majority (74%) of the 120 households surveyed indicated their ownership of a sanitation facility, but the fish pond toilet (64%) which is predominantly utilized is considered to be unimproved sanitation. The local peri-urban population link water and hygiene to health, but sanitation instead to environmental pollution. This and other outcomes lead to the assumption that people have a basic knowledge of proper hygiene behaviour. However, hygiene measures such as hand washing are put into practice in an untimely manner, most likely due to a misconception of risks and/or a lack of background knowledge of cause–effect relationships as well as ingrained habits.

Key words | health, hygiene, perception, sanitation, vietnam, water

INTRODUCTION
Vietnam has undergone a significant transformation process since 1986. Today, it is an emerging market and has high economic growth rates. The annual GDP growth averaged 6.8% between 1994 and 2005 (UNDP 2006). However, infrastructure development in terms of safe water supply and sanitation lags behind, particularly in rural areas where currently 73% of the 84 million Vietnamese earn their living, mainly in agriculture, aquaculture and fisheries (GSO 2006).

Vietnam’s rapid economic development over the last two decades and high demographic pressure has led to serious environmental consequences. Pollution, overexploitation and other forms of environmental degradation have stressed the country’s natural resources dramatically (O’Rourke 2004). This is also the case for the country’s water resources, which seem to be inexhaustible in terms of quantity, but water quality is constantly declining due to the
extensive discharge of untreated agricultural, industrial and domestic waste water into open waters. According to UNEP (2007), the poor water quality has a significant impact on human health, with 6 million cases of waterborne diseases such as typhoid, dysentery and dengue fever in the last four years.

The Mekong Delta is one of the most densely populated regions in Vietnam with 429 inhabitants/km² (17.5 million) (GSO 2006). Typhoid fever is endemic (Kelly-Hope et al. 2008) and as a result water-related health issues are pressing. The delta consists of nine main river branches and a dense network of canals, serving irrigation, drainage and transport purposes. In this region, water has always been at the centre of daily life and is still the basis for most people’s livelihoods. Traditionally, people in this area settle along rivers and canals, creating a so-called river-water civilization (Van minh Song Nuoc) (Le Anh et al. 2007).

Aside from agriculture, aquaculture is an important income source. Fish is produced for both local and international markets (catfish).

Surface and groundwater pollution has become a major environmental problem in the delta. Wastewater treatment systems for the industrial zones in the delta are in rather poor condition or even absent. Currently there is no domestic sewage treatment plant in the delta at all. Thus, all wastewater enters the river and canal network untreated, leading to chemically and microbiologically contaminated water. This is the most probable cause of the high number of typhoid fever and shigellosis cases in the region (Lin et al. 2000; Kelly-Hope et al. 2007). Furthermore, the link between sanitation, water sources and periodic flooding exacerbates the epidemic potential and spread of hepatitis E (Hau et al. 1999). A common way of disposing of human excreta is the so-called fish pond toilet or direct defecation into rivers and canals. Fish pond toilets are simple constructions hanging above ponds where human excreta are directly disposed into ponds, leading to the growth of plankton and other microorganisms which serve as fish food. Only minimal additional feeding of the fish is then required.

The objective of the study is to gain insight into local practices regarding water and sanitation, such as water use, treatment, storage and consumption as well as sanitation-related health behaviour, as a basis for practical recommendations for action.

MATERIALS AND METHODS

Study area

The survey was carried out in An Binh, a peri-urban ward located on the outskirts of Can Tho City, which is the largest city in the Mekong Delta with 1.1 million inhabitants. An Binh belongs to the inner-city district of Ninh Kieu and is administratively governed as an urban unit. It covers an area of 11.5 km², of which half (6.5 km²) is under agricultural use. By 2006, the ward of An Binh had a population of 19,537 (1,638 inhabitants/km²) which is relatively low compared to the average of Ninh Kieu district (7,256 inhabitants/km²) (Statistical Office of Ninh Kieu district 2007).

An Binh is representative of other communities in the Mekong Delta, experiencing the same water-based natural environment. Most of the households involved in the study were directly located along the banks of the Rau Ram canal, a tributary canal of the Can Tho River. The study area can be classified as peri-urban, since the majority of the households earn a relatively high share of their livelihood in urban economic sectors, e.g. construction work, trade and transport. Among the households interviewed, occupational diversity was high, ranging from farmers to drivers to private entrepreneurs and university staff. However, even households with no engagement in agriculture had at least a small fruit orchard and often their own fish pond.

Standardised questionnaire

Taking into account that in Vietnamese society women traditionally take care of domestic hygiene, food hygiene, water treatment and other hygiene and health-related matters, women were the preferred interviewees for the standardized questionnaires as well as for the semi-structured interviews.

The households selected are situated within the service area of a small waterworks abstracting groundwater with a capacity of 6 m³ per day. The water treatment comprises rapid sand filtration and activated charcoal. One hundred and twenty households were enrolled in the study, of which 64 are connected to the waterworks. For the quantitative data collection, a standardized questionnaire...
was developed, modified to the local dialect and pre-tested in 12 households. Based on 78 both open-ended and closed-ended questions, data on the following topics was collected: household metadata, socio-economic situation, access to water and sanitation, water management practices, perception, awareness, attitudes and hygiene behaviour regarding water and health. The interviews were performed by four local trained medical students and one physician. The survey was carried out between 23 June 2007 and 23 July 2007 and the data were analysed using standard software packages (Excel®, SPSS®).

Semi-structured interviews and participatory methods

Since human perception and behaviour are directly related to water use and drinking water hygiene, the survey was complemented by a qualitative study of water perception and health risks. The qualitative data collection included 3 focus group discussions (men, women and children) and 12 semi-structured interviews.

The focus group discussions were carried out using methods such as Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) employing Venn diagrams, seasonal calendars, and problem exercises. Each focus group discussion lasted about three hours. The semi-structured interviews were conducted in 12 households randomly selected from those enrolled in the study. The interview guide for the semi-structured interviews took into account the preliminary results of the survey in order to deepen discussions on the perception of water, sanitation and health, particularly the perceived links between these topics. In addition, the cultural and religious background relating to the above mentioned topics was of interest.

RESULTS

The results of the semi-structured interviews clearly indicated the absence of spirituality concerning water. Water seems to have a very practical meaning in people’s lives. Day to day spirituality has no real effect on the perception and utilization of different water sources.

Even though only 38% saw themselves as religious, all households practiced ancestral worship and offered gifts to the ghosts and gods hosted in their house shrines, both of which clearly relate to religious backgrounds. The reasons behind performing such rituals were frequently given as being “for good luck”, “success in business” or similar phrases. A cultural or traditional attitude towards water could not be detected. However, in southern Vietnam there are some Buddhist religious rituals related to water, though household water usage and hygiene behaviour do not seem to be touched by these cultural events, since they are confined exclusively to religious locations such as special pagodas.

This study showed that in the Mekong Delta various water sources are utilized for drinking water purposes. A large proportion of the surveyed households indicated the utilization of two or more water sources to cover drinking water needs during the rainy (55%) and dry seasons (42%). In answer to the question “What kind of water do you value the highest for drinking purposes?” bought purified water (38%) was rated as the most popular drinking water source followed by rainwater (34%) and groundwater from the water supply station (18%). The reasons for these preferences were indicated as being hygiene concerns (87%), the socio-economic situation (2%), spiritual reasons (1%) and others (10%).

When considering the actual use of different water sources, it becomes clear that during the rainy season rainwater is the most important drinking water source (67%), while during the dry season the use of alternative drinking water sources increases (Figure 1). Due to its distinctive features of sweetness and coolness, rainwater is considered to have the best taste. Many respondents stated that the longer one stores rainwater the better the taste, but had no explanation for this. In contrast, it was frequently stated that groundwater from the waterworks has an unpleasant taste, characterized as unnatural or chemical. A measure to prevent contamination in rainwater harvesting is the collection of run-off water from roofs not directly after the onset of rain, but after the dirt from roofs has been washed off. Of the households practising rainwater harvesting, 28% collect the roof run-off immediately, 14% after 5 minutes and 55% start the collection 5 to 15 minutes after it starts raining.

In total, 98% of the households store water in their homes. Water is mostly stored inside the house in clay jugs
with a volume of 150 litres (42%), plastic barrels, tanks and flasks (51%). Taking care of the treatment and storage of both water for drinking purposes and household needs is a predominantly female issue, which is carried out mostly by the wives of the household heads (44%), female household heads (26%) or daughters-in-law (9%). Even in the majority of the households which have access to piped water and receive drinking water directly from the water work, water is stored (always 69%, sometimes 7%). Water shortages due to intermittent supply (64%) and the need for sedimentation (17%) were the main reasons for the storage of drinking water from the groundwater waterworks. Another reason observed for collecting and storing water in vessels is to outsmart the water meter, because it does not measure dripping water (due to the low pressure).

People assess the quality of drinking water according to visible contamination (43%), turbidity (18%), odour (18%) and other factors (20%). The majority of the interviewees rated the quality of their drinking water source as good (70%), but many of them still treat their drinking water in the home. Most of the households which practice household drinking water treatment apply it on a regular basis depending on the water source, with 65 to 89% always applying it. Water from all drinking water sources is boiled before consumption, on a more or less regular basis (Table 1). For the treatment of rain water, a cloth filter is often used (67%). Aluminium sulphate is used to flocculate suspended particles mainly in surface water and water from drilled wells. A small proportion of the households use ceramic filter devices (binh loc), which combine both purification and the storage of water for drinking purposes.

Seventy four percent of the surveyed households indicated ownership of a sanitary facility, which for 41% is exclusively utilised by the family members. The sanitary facility predominantly used is the fish pond toilet (64%). Other common sanitary facilities are pit latrines (17%) and flush toilets (13%). Interestingly, 6% of the households own a fish pond toilet as well as an improved sanitary facility. Even though fish pond toilets are prohibited in some provinces of Vietnam and represent an unimproved sanitation type, the majority of the respondents (77%) are satisfied with the current sanitary situation according to their answers to the standardised questionnaire. During the semi-structured interviews this turned out to be inconsistent with the respondents’ view that they could also imagine having a “modern” toilet. “To use the fish pond toilet is also clean but […] a toilet inside the house is more convenient in the evening”.

Hand washing is regarded as essential by 90% of the respondents and practiced by 40% before preparing food, 43% before eating and 51% after defecation. The direct question on washing hands after defecation was answered in the affirmative by 97%. The median average hand

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**Table 1** | Treatment methods applied to drinking water from different sources (multiple answers)

<table>
<thead>
<tr>
<th>Water source</th>
<th>n</th>
<th>Aluminium sulphate HH†(%)</th>
<th>Cloth filter HH†(%)</th>
<th>Ceramic filter HH†(%)</th>
<th>Boiling HH†(%)</th>
<th>Others HH†(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater</td>
<td>79</td>
<td>67</td>
<td>8</td>
<td>46</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Water supply station</td>
<td>29</td>
<td>3</td>
<td>14</td>
<td>83</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Drilled well</td>
<td>13</td>
<td>15</td>
<td>0</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>River/channel</td>
<td>20</td>
<td>0</td>
<td>10</td>
<td>80</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Bought purified water</td>
<td>70</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

†Number of households.

HH households.
wash frequency is 6 times per day with a range from 2 to 20. To an open question, out of those households with children under the age of 5, only 9% indicated that they wash their hands before feeding babies and 18% after handling infant excreta. As hands are most often washed when they are visibly dirty, using soap or another type of detergent is very common. “If hands are dirty, I wash them with soap, if they are clean I wash them with water only (...) with channel water only”.

Results from the standardised questionnaire show that water is frequently linked to disease (Table 2). River water is assessed as the most hazardous water source in terms of causing disease (81%). During the focus group discussions it became evident that respondents are concerned about water pollution from sewage, solid waste disposal and fish pond toilets. Furthermore, diarrhoea is perceived differently according to gender, but is seen as a disturbing fact of daily life (62%). Most respondents (97%) rated diarrhoea in children as a dangerous or very dangerous disease which can lead to death (75%). About half of the respondents are not aware of the importance of hand washing as a preventive measure for diarrhoeal diseases.

One aim of the adult PRA workshops was to collect and rank the best practices of domestic hygiene behaviour. Issues on food hygiene appeared to be most important in the eyes of the participants and hand washing was ranked second. On one hand, river water is perceived as polluted, but on the other hand as nice tasting, but time-consuming to treat. Despite these contradictions, it is the favourite water source for the preparation of tea. The obvious difference between the male and female group was that the male group mentioned chemicals and animal husbandry as major hygiene problems, whereas the female group paid more attention to personal hygiene and issues related to domestic hygiene, e.g. laundry. Fish pond toilets were not seen as a problem for domestic and personal hygiene in five out of the six groups. On the contrary, when talking about environmental and hygiene problems in the ward, fish pond toilets were mentioned as one of the main problems causing water contamination.

**DISCUSSION**

**Local perception and management of water**

The outcome of the 12 semi-structured interviews refutes our assumption that links between water utilization and spirituality exist, since the respondents negated all questions on issues such as spirituality and supernaturalism regarding the different water sources that are usually utilized for domestic use and drinking purposes. This is even though we know from the literature and conversations with colleagues that there is belief in a water god. However, this god is responsible only for the safety of waterways. According to this finding, there is no need to take into account spiritual matters in the development of safe and sustainable household water management strategies.

As the water pollution in An Binh constantly increases, the demand for connections to a waterworks is beyond the capacity of the local water supplier (TUOI TRE 2008). People even pay high prices to be illegally connected via their neighbours (TUOI TRE 2007). From households already connected who were interviewed it became clear that due to its taste water from the waterworks is mostly used for cooking, cleaning raw food, personal hygiene, washing dishes, and cleaning the house, but that bought purified water and rainwater are the main water sources for drinking purposes. According to the results from both the standardized questionnaire and the semi-structured interviews, this choice is influenced mainly by hygiene considerations and taste preferences. Therefore, household water management strategies should not be based on a single water source. According to our results, each household

<table>
<thead>
<tr>
<th>Disease</th>
<th>Water as cause of disease: respondents' assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>76</td>
</tr>
<tr>
<td>Cold</td>
<td>48</td>
</tr>
<tr>
<td>Worm infection</td>
<td>32</td>
</tr>
<tr>
<td>Dengue</td>
<td>30</td>
</tr>
<tr>
<td>Malaria</td>
<td>25</td>
</tr>
<tr>
<td>Headache</td>
<td>13</td>
</tr>
<tr>
<td>Fatigue</td>
<td>10</td>
</tr>
<tr>
<td>Meningitis</td>
<td>4</td>
</tr>
</tbody>
</table>

n = 120.
should have access to at least two water sources: 1. a safe and pleasant tasting one for drinking and 2. a fairly safe one for household purposes. According to the quality of the water sources and the (taste) preferences of the population, the promotion of safe rain water harvesting and storage practices for drinking and food preparation as described in the literature (Lye 2002; enHealth 2004; Sobsey 2004; UNEP 2008) are essential.

Despite the fact that the quality of the drinking water sources are rated as good, surprisingly, people frequently treat their drinking water. This shows that people do not infer that drinking water is safe even when they assess their drinking water source as good. As they are aware that the water is not safe, they apply treatment methods which they consider to be highly effective. Hence, the authors found several treatment practices in place which seem to be applied rather by chance. For the treatment of rain water, a cloth filter is often used (67%), but there is observational evidence that no attention is paid to proper application, e.g. the filter is sometimes used upside down. Aluminium sulphate is used to flocculate suspended particles in surface water and water from drilled wells. The dose of aluminium sulphate added is not based on an assessment such as a visual check for turbidity, but rather on a hit-or-miss principle. The local population believes that treating household drinking water in this way improves the water quality such that after treatment no health risk still exists. This is untrue except where the water is boiled.

Local perception of sanitation and hygiene

The people’s view of the predominant sanitary facility – the fish pond toilet – can be characterized as rather ambivalent. It seems to be the case that people like fish pond toilets because of reasons such as “using the fish pond toilet is much more comfortable”, “cooler”, “more convenient” and “people’s habits”. When talking about environmental and hygienic problems in the ward, fish pond toilets were mentioned as one of the main problems causing water contamination. Human contact with fish pond water occurs during fish harvesting and cyclic flooding episodes contribute to the contamination of ambient waters with human and animal excreta (Hau et al. 1999). A study by Lan et al. (2007) in northern Vietnam showed that wastewater-fed aquaculture ponds contained $\sim 10^6$ thermotolerant coliforms per 100 mL. Our own investigations in an earlier project phase, where one sample per month was checked in three fishponds, revealed average E. coli concentrations of between 1.58 and $2.92 \times 10^4$ per mL and the presence of Salmonella in 100 mL during the rainy season. Water from the fish ponds is released untreated to rivers or canals several times per year during the fish harvest. Thus, the discharge of untreated wastewater from the ubiquitous fish ponds and of domestic wastewater into ambient waters are important point sources for microbiological water pollution.

Several studies have shown water-borne disease transmission (Corwin et al. 1996; Hau et al. 1999) and chemical water pollution by pesticides (Minh et al. 2006; Minh et al. 2007) in the region. Surprisingly, polluted water is frequently utilized for personal hygiene such as showering or bathing either in the river (44%) or in a bathroom (86%) supplied with river water. It was not expected that people who have an idea of basic hygiene would bathe in this way. This leads to the assumption, that people do not perceive fish pond toilets as a sanitary problem and an inadequate sanitation facility but rather consider them only as a source of environmental contamination, responsible for the pollution of channels and rivers. Even households with a comparatively high socio-economic standard sometimes still use their fish pond toilets. In these cases the human excreta are still used as fish fodder, but the fish pond serves subsistence fish farming only. This aspect should be considered when promoting sanitation, because it might impede the exclusive use of improved sanitation solutions and thus still lead to faecal contamination of the environment.

Another aspect which was addressed in depth during the semi-structured interviews was the level of satisfaction with current sanitary facilities. Overall, as with the results from the standardized questionnaire, respondents stated that they were satisfied with their sanitary facilities, but in the course of the interview they were rather inconclusive or would even have preferred an improved sanitary facility. The statement “At the moment we do not have the money to build a modern toilet” reflects the fact that financial constraints also influence the sanitary situation. This observation is confirmed by 57% of the respondents who would be willing to invest in an improved sanitation facility,
if subsidised to a level of 50%. A direct statement on dissatisfaction with the already sensitive topic of sanitation might be not possible in the cultural context. Because the abolishment of fish pond toilets is a key measure to break the faecal–oral route of transmission, here further insight is needed. Hence, it is important to investigate locally what different groups request from sanitation and use this information to develop messages and promotional material to reflect the real needs experienced for improvement for the different groups (Jenkins & Sugden 2006). With respect to these difficulties, a very successful project has been carried out by the international NGO “International Development Enterprises” (IDE) in the provinces of Thanh Hoa and Quang Nam on Vietnam’s central coast. This market-based project on sanitation for the rural poor increased the access to sanitation by about 100% within only one year (Frias & Mukherjee 2005).

**Linkages between local perceptions of water, sanitation, hygiene and health**

In comparison with western views, the perception of the links between water, sanitation, hygiene and health among the peri-urban population in the Mekong Delta is indistinct and partly relatively rudimentary. Water, and in particular surface water, is perceived as being highly polluted, but also the best tasting water source for the preparation of tea. Despite the fact that the majority of people rated their water source as good, household water treatment is very common. Looking to the household water treatment practices, it seems that they are at least partly arbitrarily applied. Water is clearly linked to health. For some diseases, the local assessment of cause–effect relationships between water and disease are concordant with medical evidence. In other cases these relationships seem not to be understood (Table 2). Similarly to results from Central Asia (Herbst et al. 2008), diarrhoea is perceived differently according to gender, but is generally seen as a disturbing fact of daily life.

Considering the perception between sanitation and health, the situation is somewhat clearer. There seems to be no link between fish pond toilets and health in people’s minds. The major concern about fish pond toilets is about environmental pollution and not about health. As human excreta are traditionally used as fish fodder in aquaculture a conflict might exist between economic and hygiene considerations. Obvious dissatisfaction with the current sanitary situation was not found, which challenges the identification of incentives for the spread of improved and sustainable sanitation options.

Recent studies and meta-analysis on hand washing revealed the outstanding importance of proper hand washing in the reduction of faecal-oral disease transmission paths (Cairncross 2003; Curtis & Cairncross 2003; Fewtrell et al. 2005). Hand washing should be practiced thoroughly by everyone, in particular, after defecation, after cleaning a child who has defecated, after disposing of a child’s stool, before preparing food, and before eating. The contradictory facts on hand washing behaviour of the present study pinpoint a gap between the basic knowledge on hygiene measures and actual practice. This leads to the assumption that people have a basic knowledge of proper hygiene behaviour, but that there is a missing link between the measure to be applied and its effect regarding disease prevention, which leads to hasty or inappropriate behaviour. This is emphasised by the observation that 46% of the respondents are not aware of the link between hand washing and diarrhoea, as well as by the results of the semi-structured interviews, where some respondents explained that they wash their hands only if they are visibly dirty, e.g. covered in oil, particles of food or soil.

Several observations lead to the assumption that people are “victims of their habits”. Many respondents were not able to give explanations regarding the background to their behaviour, but they keep on behaving in a certain way for reasons such as: “we have been doing things like this for generations”, “it’s our habit”, “it’s common in An Binh”, “we are used to it” or “everybody does it”. Habit was one of the explanations most employed for behaviour that seemed to be quite difficult to understand.

**CONCLUSIONS**

In a nutshell, one can say that basic knowledge of preventive hygiene measures exists among the population in peri-urban regions of the Mekong Delta. However, hygiene measures are put into practice in an untimely manner or are applied in an incorrect way, most probably
due to the misconception of risks and/or a lack of background knowledge of cause–effect relationships.

Experience has shown that providing people with information and giving them instructions or teaching them is not enough to bring about behavioural change. Behaviour is not only a matter of making a personal choice based on information, it also about a supportive environment including development, health service provision, community and society. Therefore, a behaviour change communication strategy tailored to local needs using a participatory multi-stakeholder approach has to be developed.

Key features for improving local water-related health are:

- The identification of incentives for the abolishment of fish pond toilets and subsequently abolishing them.
- The promotion of best practice for rain water harvesting and storage.
- The discouragement of the population from using chemically and microbiologically highly polluted river water for drinking, personal hygiene and household purposes.

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REFERENCES


TUOI TRE 2007 (26 February). *Nước sạch: bò tay!* (Clean water: hands are tied.), (Vietnamese newspaper).

TUOI TRE 2008 (19 March) *Thành Phố “khát” nước sạch!* (A city “thirsting” for clean water), (Vietnamese newspaper).

