The Fecal Contamination of Janakpurdham's Water Supply on the Occasion of the Ram Navmi Festival

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Abstract:

This paper examines the extent to which Vaishnavite pilgrims contaminate with fecal matter the bathing and drinking water of Janakpurdham on the occasion of the Ram Navmi festival. The results — using *E. coli* as an indicator bacteria — show that the pilgrims do constitute an extra - ordinary source of contamination of the pond water used for bathing, but not of the tubewell water used for drinking and rinsing purposes. If limited resources could be made available to government agencies or to the Town Council for the benefit of public health at the time of festivals, the results of this survey suggest that such resources might be more usefully directed toward safeguarding the pond water than the tubewell water. In conclusion one health policy measure is proposed, based upon the relation between public space and public health in Hindu Society.

It is widely recognized in Nepal that key for any general improvement in public health lies in preventing illness and that in the field of preventive medicine the proper management of water resources is of central importance. The relation between illness and water is a complex one, varying according to such factors as local settlement patterns, water use practices, climate, geography and of course, the availability of water itself. Given then regional variations in these factors, it is no surprise that each region in the kingdom might claim to be a 'special' place. The special characteristics of Janakpurdham, where a public hygiene and sanitation survey is presently being conducted, are on the one hand a ground water supply of sufficient abundance and purity to be the envy of

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many other places in Nepal and on the other hand the presence of vast body of surface water which constitutes a major public health hazard. Within the town limits there are scores of ponds, water-filled excavation/sites and stagnant drainage ditches whose waters play host to numerous bacterial and viral pathogens, excreted helminths and parasitic vectors. The ponds contribute to the incidence of diarrheal disease as well as skin, eye and ear infections (especially among children who play in the ponds during the hot season). Moreover, the ponds, excavated sites and drainage ditches are breeding places for the mosquito vectors of eosinophilia, for which the Dhanusa District has the highest incidence in the kingdom.

The ponds and ditches of Janakpurdham present a major problem for the Janakpur Town Council and the Water and Sewage Corporation, the two public bodies entrusted to provide for and to manage the water supply and the sanitation network. Yet there is one respect in which the problems faced by these two responsible bodies are unlike those of anywhere else in the kingdom, with the possible exception of Pasupatinath. Throughout the calendrical year many hundreds of thousands of Vaishnavite pilgrims travel to Janakpurdham in order to pay their respects to Ram and Sita. Although these pilgrims may arrive at any time of year, the largest numbers (local estimates vary from 200,000 to 400,000 people) are attracted by the festivals of Vivaha Pancami (the marriage of Ram and Sita in late November or early December) and Ram Navmi (the birthday of Ram in late March or early April.) During these few days the town's water and sanitation resources are stretched beyond the limit. Many tens of thousands of devotees camp in the pilgrims' hostels, temples, orchards and the few remaining open spaces in town. At first light they push their way toward the ponds where they perform their ablutions and bathe and then surging in one unbroken mass, they proceed along a well-defined route to the temples of Janak, Ram, Janaki and Laksman. After completing their devotions, many pilgrims congregate near or in the Janki temple where they collect drinking water from the public taps and hand-pumps and then they make a space for themselves in the crowd where they eat their breakfast. By the evening or the following most of the pilgrims have returned to their villages, and the town appears almost deserted by contrast. Yet the festival cannot be forgotten by the local people. Throughout the town -- in vacant lots, by the roadside and on the banks of sacred ponds -- thousands of piles and puddles of human excrement remain as testimony of the recent festival. The stench fills the air such that local women, leaving their homes for the bazaar, must hold handkerchiefs to their faces; and even the rickshaw-walas, riding past the Janaki temple, cycle one-handed, keeping the other hand pressed to their nose. The purpose of this paper is to report on the extent to which the town's bathing and drinking water is subject to fecal contamination by Hindu pilgrims on the occasion of the Ram Navmi festival and to assess the implications of the contamination for public health policy in Janakpurdham.

Methods

Within the circumambulation road of Janakpurdham there are twenty-one ponds

connected with the Vaisnavite cult, three of which -- Dhanusa Sar, Argaja Sar and Ratna Sagar -- were selected for study. Dhanusa Sar and Argaja Sar are situated on the eastern side of town; the former is adjacent to the Ram temple and to the town's largest pilgrims' hostel; the latter to the Janaki temple. Both ponds have an extensive brick and cement embankment, facilitating the bathing of thousands of pilgrims at a time. These two ponds, together with Ganga Sagar, attract the great majority of bathers on both ordinary days as well as major festivals. Ratna Sagar is situated in a rural setting on the western side of town. The monasteries which line its banks attract at the time of Ram Navmi several hundred ascetic and lay pilgrims who, in the course of their stay, bathe in the nearby pond. The fact that Ratna Sagar is a relatively well-maintained but under-utilized pond makes it an interesting point of contrast with the other two ponds in the study.

The extent of fecal contamination of these three ponds was measured by the presence of *Escherichia coli*, as an indicator bacteria. Let it suffice for the present to sound two cautionary notes. First, *E. coli* are natural inhabitants of the intestinal tract of all warm-blooded animals; thus a bacteriological analysis of the bathing or drinking water does not indicate the extent to which the contamination is of animal or human origin. Observations of the use of these three particular ponds would suggest, though, that the contamination is of human origin. Unlike other Janakpurdham ponds, water buffalo and swine do not ordinarily bathe in their waters nor do they graze or forage on their banks. Secondly, *E. coli* are sensitive to temperature, sunlight and to other microbial life. In tropical surface waters they are subject to a rapid falling-off. Certain pathogenic bacteria and helminth eggs do not, however, experience such a rapid mortality; hence pathogenic agents may still be present in the water, even though the *E. coli* indicators have diminished considerably.

The three ponds were tested six times over a period of eight days: one and three days before Ram Navmi and on each of the four days following the festival. Because of their sensitivity to temperature and sunlight, the water samples were collected from all three ponds at the same time of day, between 10.30 and 11 am. In such an investigation much depends on the isolation technique used. Since the purpose of the present study was to measure the extent to which pilgrims pollute the ponds and to assess the health implications of this for other bathers, samples were taken from just below the water's surface at places where pilgrims bathe. In other words, samples were collected of water in which subsequent pilgrims were likely to immerse themselves or with which they might rinse their mouths in the ritual of *achman*. Having selected a site at each pond, samples on subsequent days were taken from the same place and at the same time of day. It must be said that even in normal circumstances, the ponds of Janakpurdham are rather contaminated. Hence one ml. samples, diluted with sterile distilled water, were subjected to analysis. Samples larger than that would have been uncountable with the equipment used.

As for the drinking water, public tubewells have been sunk by the Town Council and temples at places where pilgrims bathe and camp. Also on the occasion of festivals the Water and Sewage Corporation makes available to pilgrims water from the municipal supply at temporary standpipes. From all these possible water sources the tubewell within the Janki temple was selected for study because worship at the temple marks the culmination of the pilgrim's devotions. The handpump within the temple compound is used by thousands of pilgrims, either for washing their feet before entering the temple or for drinking purposes after worship. Since the purpose of the survey was to test the extent to which pilgrims contaminate the drinking water and to assess the health implications of this contamination, the mouth of the tubewell was not cleaned prior to the collection of the sample, nor was the handle pumped for more times (two or three) than a pilgrim would be likely to do prior filling his waterpot. In other words, the water tested was the water which pilgrims actually drink, rather than the water they might be in a position to drink, were the well to be clean. Samples were collected at 10.30 am every morning over a period of eight days, starting three days before Ram Navmi and ending four days afterward. Additionally on the morning of Ram Navmi samples were collected hourly and, for comparative purposes, a similar survey was conducted two months later during an ordinary day not taken up with religious celebrations. In all cases five ml. samples were collected; these were not diluted with sterile, distilled water.

Both the bathing and the drinking water were analysed using the "Paqualab" designed by the Department of Microbiology, University of Surrey, England (see *Rising Nepal* 10th October 1984). At present three prototypes of this portable water laboratory are being tested by the World Health Organization; a fourth is in service in Janakpurdham in a public hygiene and sanitation survey supported by the University of London and the Overseas Development Administration, U. K. The laboratory operates on the principle that, unlike other coliforms, the *E. coli* retain the ability to ferment lactose at 44°C. After filtration the filter membrane is placed upon a lauryl sulphate medium and incubated at 44°C for fourteen hours. At the end of this period the *E. coli* appear as yellow colonies on the filter membrane. The colonies are counted and the total is corrected for a 100 ml. sample.

Results

The fecal coliform counts for the three ponds, corrected for 100 ml. of water, are reported below (Fig. 1). Although the counts varied considerably between Ratna Sagar and the other two ponds, all ponds showed significant increases in contamination on the day following the festival: Dhanusa Sar increased by 77%, Argaja Sar by 415% and Ratna Sagar by a rate of 225%. Given the crowded conditions, it was impossible to count the number of bathers at each of these three ponds on Ram Navmi, but there can be no doubt that the most popular pond was Dhanusa Sar followed by Argaja Sar. Thus the ranking of the ponds by their utilization correlates well with the ranking of ponds by

their percentage increase in contamination. The falling-off rates of the three ponds, however, were more similar, suggesting thereby the common lethal effect of temperature, sunlight and other forms of microbial life. The rates were 78% for Dhanusa Sar, 73% for Argaja Sar and 57% for Ratna Sagar. Two quirks in these rates require explanation. At Ratna Sagar the *E. coli* remained roughly constant for two days and did not drop off until the third day. This might be explained by the immense trees which line its banks, casting shade over the water's edge from where the samples were taken. This coil shade would have been less lethal than sunlight to the *E. coli*. As for Argaja Sar, there is the astonishing increase in *E. coli* registered on the fourth day which can only be explained by the misguided efforts of some sweepers who cleaned the nearby road of excrement by brushing it into the pond.

In Fig. 2 below is the *E. coli* count for the Janaki temple handpump at 10.30 am. on the three days before Ram Navmi and the four days afterward. From Fig. 3 it can be seen that the diurnal contamination on Ram Navmi peaked at 8.30 am and on an ordinary day of worship two months later at 7.30 am; the slightly earlier time in the second sample was presumably due to the fact that the increasing heat and earlier sunrise encouraged local people to put an earlier start to their day. There would appear to be some connection between the use of the pump and its contamination, although this does not emerge fully from the data. Fig. 4 charts the pilgrim flow into the Janaki temple. Devotees were counted on the hour for a period of ten minutes just prior to the collection of the sample. The entry of devotees into the temple peaked at the very same time that the diurnal contamination peaked (8.30 am on Ram Navmi and 7.30 am on the ordinary day). This correlation between use and contamination persisted throughout the day, even though it is poorly indicated in the figures. In the case of Ram Navmi the demand for water was so great that eventually the well went nearly dry. At 12.30 pm the pilgrims had to struggle amongst themselves to collect water and even my research assistant lost a shirt sleeve in collecting the final sample. On the ordinary day very few devotees entered the temple at 12.30, but the handpump was frequently used by the resident ascetics and visiting devotees who had entered the temple earlier and who, having finished their midday meal, were now washing their hands and mouths at the pump. In sum, on both Ram Navmi and the ordinary day the use of the handpump at midday is not indicated by the figures showing temple entries. Thus the upswing in contamination at 12.30 pm on the ordinary day still correlates with the use of the pump. The picture for Ram Navmi is less clear, for the effect, if any, of the well being reduced to a trickle cannot be estimated from the data.

Discussion

The arrival of pilgrims in Janakpurdham presents a dual problem of public health authorities. On the one hand, adequate drinking, bathing and sanitation facilities ought to be provided for the convenience and well-being of the pilgrims. On the other hand, the health and well-being of townspeople ought to be safeguarded from the potential ill

effects of the periodic but massive fecal contamination of the town by pilgrims. At present both aspects of the problem are dealt with by the authorities. The Water and Sewage Corporation sets up approximately forty temporary standpipes drawn on the municipal water supply; and the sweepers employed by the Town Council dispose of the excrement left by pilgrims as promptly as possible. These measures are appropriate, but insufficient to cope with the enormity of the problem.

Given the limited resources at the disposal of the Town Council and the Water and Sewage Corporation what else might be done in order to bring under some measure of control the periodic contamination of the town? The results of this study suggest where such limited resources might be usefully directed. It will be recalled that on Ram Navmi approximately 91,000 pilgrims entered Janki temple between 5.30 am and 12.30 pm; and that on an ordinary day only 2,000 pilgrims entered. Yet the absolute amount of fecal contamination as well as the diurnal variation in contamination were roughly the same for both days (see Fig. 3). In other words, 91,000 people did not contaminate the tubewell any more than did 2,000. Thus the handpump did not, in the short term at least, accumulate pollution. The ponds, however, did accumulate pollution for several days until the sun and microbial life killed the *E. coli* in such numbers that the contamination of the ponds was restored to its normal level. In sum, the quality of the drinking water at the time of a major festival was no more a problem than it ordinarily is; and if resources are insufficient to deal with this problem on ordinary days, there is no reason to allocate resources to deal with this problem on festival days. The pilgrims, by virtue of their numbers, seem only to have caused exceptional deterioration of the bathing water. This suggests that in the context of limited resources available for public health expenditure at the time of festivals, such resources might be more usefully directed toward safeguarding the quality of the bathing water.

A number of ideal solutions to the problem of bathing water present themselves, such as the provision of additional public latrines, the landscaping of the ponds in such a way that they can only be used for bathing, and the construction of additional pilgrims' hostels. Yet these solutions require major capital expenditure and the local people, acting through their elected Town Council, have not yet succeeded in organizing themselves for such action. In the short term one might propose instead a temporary strategy based on the simple notion that people do not defecate where they live. The distinction between actions carried out inside the home and those actions which take place outside the home is fundamental to Hindu social organization. Polluting actions, such as defecation, take place outside the home in the vegetable garden, in a paddy field, by the railway tracks or on a river bank. Moreover, from the point of view of townsmen pilgrims are 'outside people' who being outside their homes are likely to defecate anywhere in Janakpurdham where unused space and the cover of shrubbery, alleyways, or darkness gives them opportunity. The Town Council, police and voluntary agencies who provide public services at the time of major festivals might discourage pilgrims from defecating on the banks of sacred ponds

or on the roadside and around the temples adjacent to the ponds by having these places cleaned before the festival and by encouraging the pilgrims to camp at such places for the duration of the festival. The pilgrims will police their own campsite and, as a matter of course, prevent other pilgrims from defecating nearby. Similarly those who run the more than five hundred temporary market stalls, selling snacks, toys, religious pamphlets and household goods to pilgrims, might be instructed to set up business along the roadside and the banks of ponds where pilgrims at present are inclined to defecate. Defecation almost invariably takes place in slightly hidden, unused space, and it is by making some use of hitherto unused space that the Town Council can encourage pilgrims to perform their ablutions away from the ponds.

Such a strategy will not, of course, be completely successful. Infants are thought to have no 'knowledge' and hence they will still innocently defecate wherever their inclination leads them; and village women, somewhat fearful of their security in a large town, will not go to unfamiliar, distant places to perform their ablutions. But until such time as ideal solutions to the sanitation problem become feasible this temporary and costless measure might diminish to some extent the massive fecal contamination of the Sacred Ponds at the time of religious festivals.

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Fig. 1 Fecal contamination of Janakpurdhām ponds during the week of Ram Navmī.

Fig. 2 Fecal contamination of Jñānī temple handpump during the week of Rām Navmī.

Fig. 3 Diurnal contamination of Jānkī temple handpump on Rām Navmī and on an ordinary day of worship.

Fig. 4 Number of devotees entering Jānkī temple on Rām Navmī and on an ordinary day of worship.