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Chapter 23

A Study of the Interpersonal Spread of Human Faeces in Rural Teknaf of Bangladesh

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ABSTRACT

Transfer of human faeces among people was observed by following the normal regular movement of hands of the mother, particularly after defaecation or after cleaning of the bottom of a child. Only those aspects of hand movement were observed which were likely to play an important role in transmitting faeces among human beings. The movement of the hands of 21 mothers with children aged under five years was observed. These mothers were from 21 different households in several villages located within the Teknaf thana. The main objective of this study was to gather first-hand information in order to develop health messages for community members to promote use of water following the cleaning of bottoms after defaecation.

The study explored the possibility of contamination of food and water from human faeces through the use of naked hands in cleaning faeces after defaecation.

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INTRODUCTION

Human faeces act as the principal source of enteric pathogens. The purpose of this study was to identify the various ways of spreading enteric pathogens through human faeces within the household and the community in rural Teknaf. Identification of these methods may provide useful clues for development of a strategy for health education, in order to reduce transmission of diarrhoeal diseases. Cleaning the anal region after defaecation, with water, sticks, leaves, grass, etc., is common practice in Asia. The unwashed or inadequately washed hand may act as the main vehicle for spreading diarrhoea-causing organisms.

Isely (1) (n.d.:1) observed that when the environment is contaminated by the stools of infants and small children, multiple sources serve as the vehicle of contamination. All the main pathogens causing diarrhoea are transmitted from anus to mouth (2). There are many opportunities for such transmission in a poor and crowded community. To identify the mechanism of transfer of human faeces, it was decided to observe the hands of the mother after defaecation or after cleaning the anal region of a child.

The study villages are situated in Teknaf *thānā*, a coastal area situated in the southern tip of Bangladesh. The people in this area use water from ditch or tubewell for all purposes. Most of the study households had no fixed latrines. The study population is Muslim and the major occupation is agriculture and fishing. Most of them had no formal education.

Shigellosis is known to be associated with poor hygiene. A single intervention, like washing of hands with soap and water, sharply reduces the rate of incidence of this disease (3). This study showed that secondary infection rate of shigella was 10% in the study group and 32.4% in the control group. This study clearly demonstrated the importance of hand washing in reducing the rate of *Shigella* infection. Ash could be used when soap is not available (4).

In the Teknaf study area people carry a pot of water when going for defaecation (5). This water is used for washing the anal region with the left hand after defaecation. Frequently, the amount of water carried is not sufficient for proper cleaning. Due to scarcity of water stored at home, most often hands are not properly washed before eating or handling food. Because of *pardā*, women rush through defaecation, particularly during the day-time. So there is little scope for proper washing of hands afterwards. As women are the carriers of water, their restricted movements during the day, due to *pardā*, result in limiting the quantity of water stocked at home.

METHODS

The data for this study were collected through participant observation method. Two female field workers were assigned to collect information on movement of hands after defaecation, particularly in relation to washing of clothing, utensils and food items before cooking of food, handling of water and interpersonal contacts. Transfer of human faeces among people was observed by following the normal regular movement of hands of the mothers of children under five years of age, after defaecation or after cleaning of the anal region of a child. Length of each of these observation was more than 12 hours, beginning before sunrise. The prospective mothers were asked permission by the female field workers to be allowed to stay within their respective houses to observe the activities centering around their children for a day. Only willing mothers were the subjects of observation. Mothers from 21 different households belonging to several villages located within the Teknaf *thāna* volunteered. However, 4 mothers refused. The two female field workers were instructed to record all activities of the mothers, with special emphasis on behaviour after defaecation by themselves or by their children.

FINDINGS

The findings of this study were that contamination is transmitted through fingers mainly in the following ways:

1. Handling of utensils: through handling cups and other utensils before serving.
2. Serving of food: especially by direct touch. Most of the time only the right hand is used; but in some cases, e.g. making or handling rice cakes or pickles, both hands are used.
3. Serving of fruits: while peeling or serving fruits, such as mango, pineapple, papaya, jackfruit, etc.
4. Feeding infants and children and sharing infant's food: by holding the breast before breastfeeding, feeding the baby with fingers, sharing of food from the same plate by the mother or other adults and children, eating child's left-over food.
5. Carrying and storing water: while drawing water from a well both hands are used, thereby transferring contamination from the hands to water via rope. When water is transferred from the well or from tubewell to the pitcher, the fingers of both hands frequently touch the collected water. When the collected water is poured into other containers, the fingers of both hands also come in touch with the water.

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6. Disposal of the faeces of children: the soiled pieces of clothes or mats are cleaned in water with both hands, Infant and children's faeces are frequently disposed with either an oyster shell, or broken tin plate or leaves with both hands. Following the removal of faeces of a child from the courtyard, the spot is cleaned with the help of a broom, which is subsequently used again to clean the floor of the dwelling house without washing it. After the removal of child's faeces from the floor of the dwelling house, the mother frequently uses her foot to clean the spot, pouring water until the faeces is no longer visible. Subsequently at the prayer time, while undergoing ablution (*azu*), she touches the same foot to wash three times by using her hands.

7. Preparation of food: especially while making 'mashed preparations' (*bhartā*) out of cooked brinjal, boiled potatoes and dry fish; tasting the curry or other food preparations by putting a bit of it on the palm of the left hand.

8. Preparation of betel leaf with betel-nut: betel leaf and betel-nut are touched by fingers of both hands before chewing.

9. Personal habits of washing herself and the child: cleaning of teeth by using the index finger of the right hand and taking of powder for cleaning from the palm of the left hand, washing of hands and face of child by using both hands. The water pot used to hold water for cleaning of anus after defaecation is also used for ablution (*azu*) and routine washing of hands and face for self and others.

In addition, it was also observed that the riverside, which was full of faeces, was repeatedly being washed by the high tide, and during such process of washing the children were found to play in the waves of the rolling water.

However, certain routine activities were found that might be helpful in reducing or stopping the transfer of human faeces among people. These included washing of clothing, taking of bath using soap, cleaning of utensils by using ash and straw, washing of hands by using earth after defaecation.

DISCUSSION

Presence of faeces on the outer part of the body or in items of food or drink is universally viewed as impure (*nāpāk*) in Teknaf. After defaecation, the cleaning of the anal region is done exclusively by using the bare left hand. Left hand is therefore consciously avoided in many activities during a person's daily life. The specific avoidances include salutation or greetings, shaking of hands, handing over or receiving any objects including food items. In spite of prevalence of such consciousness for avoiding the use of left hand, which is used for cleaning faeces, some activities are being done in the observed households which are responsible for transfer

of faeces unintentionally. Incompletely washed faeces-soiled hands used in preparing or serving various eatables, washing hands and face of others and self, and drawing of water from wells facilitate the transfer of faeces.

It was found that frequently people were conscious about the presence of faeces so long as it was visible and, accordingly, when soiled clothes were washed after the removal of the faeces, both the hands were used to clean them to acceptable levels. In the past, many of the investigators who studied the sanitation problems did not examine the role of inadequate handwashing after defaecation in transferring the faeces (6). However, Isely (n.d.:1), quoting the Academy for Educational Development, (7) observed that micro-organisms are transmitted via contaminated fingers of the child or his mother,

- to household objects;
- to food itself;
- to water transported or stored;
- to the hands of other children, and
- ultimately to the mouths of other susceptible individuals.

To maximize the expected benefits of the separation of faeces from the environment by installing sanitary latrines, attention must be given to introduce adequate hand washing after defaecation, so that soiled fingers do not serve as a medium of transferring faeces. The fundamental issue is to understand how people may be motivated to change the age-old custom and wash hands adequately after defaecation. The ways of such motivation can only be developed after proper understanding of the existing ways of transmission of faeces from person-to-environment, from environment-to-person and from person-to-person. This study has given rise to the following research topics regarding the transmission of enteric diseases which deserve further investigation: (a) the role of fingers; (b) the role of kitchen utensils; (c) the role of interpersonal contact of children.

ACKNOWLEDGEMENT

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Discussions

Dr. Keusch

I would congratulate Dr. K.M.A. Aziz and Dr. M.U. Khan for the two papers they presented this morning. These are extremely important studies, especially from the point of view of intervention. We can learn many things about these diseases, but these particular kind of studies have not been done in the past; the data is very exciting.

Dr. Kostrezewski

We listened today to two categories of intervention studies. Targeted were attempts to control shigellosis. One, the group of papers on immunity, especially on vaccination, presents data on quite highly sophisticated work, which, in certain ways, results from about 70-80 years of studies on vaccines. This is the first time we can prove that a vaccine, if properly prepared and properly applied, may be effective. However, there are many problems involved. One important problem is the changing pattern of shigellosis. However, having the possibility of speeding up the work and updating our information on the aetiological pattern and particularly on an effective surveillance system to learn where each type of dysentery is prevalent, will be helpful.

I still think that vaccination offers us some hope at the present time. However, I am afraid that the information we are receiving about the possibility that high doses of infectious agents may be able to overcome

acquired immunity may mean that a vaccine may be less successful in some situations. Particularly disturbing in this regard was the last presentation of Dr. K.M.A. Aziz, about some anthropological patterns, because these may be evidence of very high contamination levels. For this reason, I think the second group of studies is of extreme importance. As a matter of fact, I am speaking about enteric diseases as a whole. They are the diseases transmitted by dirty hands. So, by washing hands the difficulty is overcome. I would say that Bangladesh presents a very good situation for this sort of study, because this a country where there is plenty of water.

At the same time, however, I think we must ask ourselves what will happen if we look at all these anthropological problems in North Africa communities where water is not easily available, and people use a small jar of water for washing for the whole day. This is becoming an important issue, and I think this is the sort of study that should be done in the future. We also should think of doing the type of anthropological studies that may answer some questions about the primitive every day movements of people--movements which contribute to the spread of diarrhoeal diseases, and cause endemic situations and epidemics. I think we should encourage more interest in this direction.

Dr. Sutton

Mothers may play a more significant role in the transmission of *Shigella* than one might have anticipated. Who used soap in the hand washing study? Was it only the mothers, or was it everyone?

Dr. Khan

It was the mothers who are responsible for washing the bottoms of the children. Moreover, most of the children are fed by the mother. She also washes the hands of those young children who can feed themselves. Thus, she is the crucial person for using soap and water.

Dr. Keusch

The study shows the importance of the mother as the intermediary in transmitting *Shigella*.

Dr. Khan

We have seen that when the mother is infected, the secondary infection rate is much higher than when the father is infected. It is not only the mother but also the older female child (above the age of 15) who performs the duties of the mother. If a child is able to eat by himself, the instruction was to wash his hands before eating.

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However, the question is, "If a child was of the age group where the mother washes his hands, the mother's hand washing should have terminated transmission." If the index case was a child over that age group, then it is quite possible that the child was the transmitter, and hand washing by the mother was irrelevant. Thereby, the age of the index case may be interesting.

Dr. Levine

I have a question for Dr. Aziz or Dr. Mujibur Rahaman. It is about the seasonality of shigellosis in Teknaf, which peaks in June-July, if I remember. Is June-July the wet season? If that be the case, then we have seen from studies in Central America that both the availability and quantities of water are important; and that even impure water can decrease the incidence of shigellosis. The peak of shigellosis in Teknaf, where presumably water was abundant, would suggest that other mechanisms operated, mechanisms which enhanced disease transmission. Would you comment on what is going on?

Dr. Aziz

June and July is the wet season. Even though there is a lot of water we found a peak in disease incidences at that time. Another study in the same area, where we closely monitored the actual amount of water used by individuals, has shown the same thing: that shigellosis is a water-washed disease. People who used more than a certain amount of water had very low incidence rates, and those who used less water had high incidence. In the same areas where there is a lot of water available, still the incidence of shigellosis is high. It does not necessarily follow because more water is available, people will use extra water for personal hygiene and consumption.

We also have found that the *E.coli* (coliform) recovered from tubewell water was high when the water table rose. In other words, there is a possibility that at that time the organisms spread all over, resulting in transmission by water. There are other modes of transmission as well -- by touch or contact. But I do not know what role immunity plays in it. So, the issue is very complex. It may depend on how much water a person is using and what the quality of the water is.

Dr. Levine

What about the breeding of flies, the fly density in the wet season versus in the dry season?

Dr. Aziz

In the wet season the fly density is higher.

Dr. Kostrezewski

Another factor may have contributed to this. It is the availability of less sunlight, which is a very powerful disinfectant. There is less sunlight in the wet season.

Dr. Aziz

I would consider that as a very big factor because, for a number of days, average hours of sunshine is much less during the rainy season, as opposed to the dry season. On the other hand there may be enough sunshine, because the days are longer at this time compared to the dry season.

Dr. Glass

We have data which represent three sets of seasonalities for dysentery, one each for Teknaf, Matlab and Dhaka. The incidence of shigellosis in all these three places is low in the cold, dry season. In Teknaf, the incidences are higher in July/August. In Dhaka, they go up before the monsoon. In Matlab they are highest in July and August. Incidences in all these places are low in February. So you have distinct seasonality. Matlab is a low-lying riverine area, while Teknaf is mostly hilly.

Dr. Keusch

The epidemiological behaviour of an organism is a matter of how the organism adapts to the environment and the host. There are really two different eco-systems we should be thinking about: one is outside the human and the other is inside the human. This relates to the survival of the organism, its presence throughout the year, and what it does once it gets into the host. It is important not to forget about the organism's biological properties that allow it to adapt to environmental changes.

In various parts of the world, seasons can differ from before the rains to during the rains, to after the rains, and with this can differ the behaviour of the same basic disease - causing organisms. Important factors also affecting the behaviour of these organisms are peculiarities of particular societies.

I think we really must begin to understand the qualities of the organism that allow it to survive or not survive in a given environment, if we are to focus on transmission of the disease. For example, peculiarities of *Shigellas* are that they are adapted to humans. There will be no disease unless there exists a large population of primates to be infected. Nobody has presented any data on survival of the organism with a different serotype, in different species or the environment. The only comment I heard was Mike Levine's. But there was no data. Maybe it is true. I would like to see some data. This is obviously something very important. What is the organism and how does the organism survive outside the host? How is it

transmitted between the hosts? Once we understand that, we can focus on why one organism causes more severe disease or more frequent clinical disease or infection. I think we must deal with both the ecosystems.

Dr. Aziz

The well-known problem is, "If you have found *E. coli* three or four logs higher than *Shigella*, there is no medium that really can sort them out". We do not have any medium which selects strongly enough. Thus, it is very difficult or impossible to isolate *Shigella* from the environment. There have been only a few reports of such *Shigella* isolation.

Dr. Levine

There is some amount of data on isolation from the environment, particularly on cultivation of *Shigella sonnei* from bedpans and toilets. In this context is the broad discussion we had this morning, including the part about *sonnei* and its occurrence. Countries have a lot of data on duration and persistence of *sonnei* and the special interventions one must take to eradicate *sonnei* problems.

For example, washing of toilets causes an aerosol, and *sonnei* spread throughout the comode area by a flush mechanism. If one covers and prevents the aerosols, one significantly decreases contamination of the environment.

If one looks at patients with *dysenteriae* 1, *flexneri* and *sonnei*, one finds that you take routine media that are helpful, such as *Salmonella-Shigella* media from a bloody mucoid specimen that has 8 or 9 logs of the mechanism per gram, and try to grow *shiga bacillus*. You get negative results. That tells you that this is a fastidious organism. Even on culture media, it does not survive very well.

As far as I know, *Shigella flexneri* is the only bacterial enteropathogen for which there is clear-cut epidemiologic evidence that it is spread by flies. In many areas, without substantiation, we associate flies with being involved in the transmission of a number of organisms. For *Shigella*, however, there is substantiation, thanks to studies done in the U.S. in the mid-forties when that area was developing.

These studies involved massive disease prevention, using DDT in some areas but not in others. In the DDT areas, there was a decrease in infant mortality, a decrease in *Shigella* incidence. The following year, the researchers switched. They sprayed the control areas of the previous year, but not the previously treated areas. The study clearly established the fact that flies are responsible for the transmission of *Shigella flexneri*.

To some degree, whenever we talk about seasonality and *Shigella flexneri* in developing areas we would have to talk about flies. This confirms the interesting data presented by Dr. Khan, showing that 8 percent of the flies

caught in the Dhaka area grow *Shigella flexneri*. That is positively fascinating; and similar results have been found in at least one other study, done at the American University in Beirut. That study looked at a certain fly, a sub-species of *domestica* in Egypt, a fly that breeds in human faeces and feeds on human foods. In those areas, shigellosis is highly endemic.

Dr. Kostrezewski

I think this is a very good point and I agree with that. There is also enough data in the Russian literature on the importance of flies in spreading *Shigella*.

Dr. Hanna

I think; there is more than one mode of transmission. In different countries, in different seasons, there may be different ways of transmission. I would like to know what is the period of time between infection and illness -- because, as we know, very low infecting rates may have very long infecting results. Perhaps *Shigella* infections can transmit; and, if there is some break in immunity, it may make the illness appear. We had epidemics of *Shigella sonnei* in Warsaw in 1966. I counted the number of patients every day coming to the out-patient clinic. Men from whom I collected the data were all from swamps and there was coincidence with rain. From the Meteorological Institute I collected data about rain. There were many more patients on rainy days than on non-rainy days. Thus, I believe that if *Shigella* was not transmitted by water, then it was a question of false data.

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