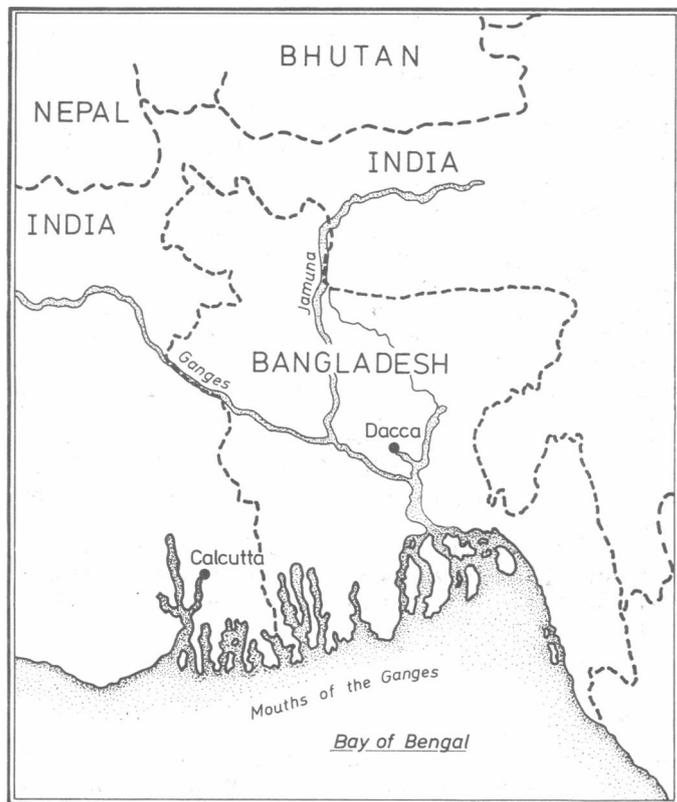


My Student Elective

Death and epidemiology in Bangladesh

FARUK MAJID

On 12 July 1982 I arrived at the International Centre for Diarrhoeal Diseases Research, Bangladesh, to spend my elective attached to one of the research teams investigating the epidemiology of gastroenteritis. After a short interview establishing that I had some knowledge of microbial genetics I was told that I could conduct a project investigating plasmids in *Campylobacter*. But first I had to "learn about the centre and diarrhoea in Bangladesh."



Everyone but staff and the most recent visitors know the centre as the Cholera Research Hospital, although it received its present grand title in 1967 when the research programme was expanded. The centre, with the original building, extensions, laundry, canteen, transport office, library, and publication

Liverpool L6

F MAJID, BSc, medical student

Correspondence to: 57 Sheil Road, Tuebrook, Liverpool L6.

department, now occupies a large area. It includes a 126 bed hospital with an observation ward, two inpatient wards, and a study ward catering for infants. The beds were locally made, wooden trellis like structures covered with tough green polyethylene. An extension tube fitted around a hole cut in the centre of the polyethylene led diarrhoea into a collecting bucket—simple but efficient. Fluid loss estimation, stool collection, and cleaning were made easy and quick.

Exhausted children in outpatients

Rueful mothers with infants and children presented in the humid heat at the back of the hospital under cover of tin and jute awnings. The queue was always long since treatment at the centre was free. Many had walked miles. For a moment I marvelled at the well behaved queue, then I realised—silence reflected the mothers' concern and the enormous respect the doctors commanded. The babies were simply too exhausted to cry out.

The message began to sink in that diarrhoea in young children was one of the major causes of death in the world. In many countries, especially developing ones like Bangladesh, it accounts for more deaths than any other disease. Past World Health Organisation surveys showed that 40% of children suffered diarrhoeal attacks per month.¹ One or two were likely to occur in each child each year during the first three years of life. Up to a quarter of these episodes were fatal. In Africa, Asia, and Latin America between five and 18 million children die each year because of this disease. The immediate feeling was disheartening.

The severely ill patients gained access to the green polyethylene beds. For a month at a time, each morning, the visiting or resident consultant would call a ward round. (The study ward had its own staff, and patients were continually monitored as several research projects continued.) Progress was discussed and treatment regimens for new patients were established. Those with viral diarrhoeas were often selected for the study ward. Most of the children in the other wards turned out to have bacterial causes, including infections with *Salmonella*, *Shigella*, *Vibrio*, *Escherichia*, and *Campylobacter* species. Infections with *amoeba*, *Giardia*, and *Trichomonas* were also very common as one drug company promoting metronidazole had recognised, to judge by their custom built Bangladesh posters.

Nurses took instructions, working incessantly despite the gathering midday sun, which turned yesterday's monsoon puddles into dust again. They walked with splendid dignity in their white cotton saris bordered with green. But that was neither here nor there for 2 year old Mahlib. Malnourished and with severe pulmonary tuberculosis and severe shigella diarrhoea he sat dejected with his helpless mother by his side. Mahlib died, but as time wore on it was the successes that I remembered. I was to learn about oral rehydration and how this hospital was saving most of its patients.

Out of the centre and on to the noisy highway. It was 5 pm. The late afternoon sun was the colour of autumn leaves and much kinder. Colourful, rusty buses sped along the wide Dacca to Mirpur highway carrying far more people than was good for them. Three wheeled, blue, vinyl topped baby taxis carried customers from the residential suburb inhabited by the rich and foreigners. Other people used rickshaws. I saw a driver, resting, chewing "pan" (heart shaped leaves filled with



One of the workers from the centre measuring a baby's height and weight and collecting stool samples in Nandipara village.

crushed nutmeg, lime, and a black, powdered extract with stimulant properties), thick haired, and with a face scarred by smallpox. The pavement was narrow and dusty on one side, and there was bare ground on the other. Fruit sellers sat huddled in front of baskets of pineapples, guavas, and custard-apples, pedestrians weaving between them towards the bus stop. I did the same.

Research into campylobacter enteritis

The following day I was to start my project. Research at the centre included clinical and epidemiological studies on campylobacter enteritis (discovered by Skirrow in 1977).² This affected about 10% of patients in the hospital. My supervisor suggested that I should survey new and stock strains of *Campylobacter* for plasmids.

All hospital admissions were screened for *Campylobacter*. If bacteria were isolated stool samples were obtained from human contacts (relatives and friends) and from animal contacts (including goats, cats, dogs, and chickens) and were also screened for *Campylobacter*. Samples obtained using a rapid extraction procedure³ from all the isolates of *Campylobacter* were tested for plasmids. Separation was by gel electrophoresis.

I found that 10 to 20% of campylobacter isolates from patients carried plasmids of molecular weights between 3.5 and 25 Mdal, some more than one. No plasmids were isolated from human or animal contacts. The nature of the plasmids and the importance of these tentative findings obviously need further

work with a larger number of samples, but the work adds a small part to more extensive studies being carried out by the centre.

Epidemiological studies and stool sample collections necessitated travel into the suburbs and often further out of Dacca. Transport on unsurfaced roads in Bangladesh is difficult at the best of times and a good deal trickier after the monsoon rains. I soon gained immense admiration for the centre's van driver. Completely unruffled he weaved his way around the muddy hollows and gave not so much as a sigh as an oncoming grey Toyota flashed by skimming paint off the right wing. At times the pace became snail like, obstructed by a swarm of gaily coloured rickshaws which rattled with indecision in the crowded hum of voices. Turning right was a daredevil exercise: you had to face opposing traffic head on and pray that someone would be compelled to give way. The slim white cattle were lethargic but usually obedient, moving aside at the sound of a horn. If you were unlucky there would be a present for you on the bumper or bonnet. Amazing to think that in some parts of the world they actually worry about sparrows and pigeons.

Eventually he came to a complete standstill. Ahead there was an overloaded bamboo cart, precariously tilted and hopelessly embedded in mud a foot and a half deep. We walked the remaining mile to the noukas (long shallow black-painted boats). The centre's oarsman was waiting to ferry us to Nandipara. In the dry season you can walk to Nandipara, but now the rains had flooded the lowlands, isolating the villagers on to a few dry acres.

Children swam, fished, and bathed along our approach to the mooring area. A crowd of women and more children formed a greeting party as we balanced our way along a pair of bamboo stems on to dry land. They had been informed of the visit earlier and had collected stool samples from infants with diarrhoea. These were placed beside freeze packs, and then preselected families were visited. We monitored growth by measuring the babies' heights and weights (figure). For campylobacter studies, rectal swabs were taken and immediately plated on to blood agar and kept cool. All this was quite easy, but trying to obtain a rectal swab from an irate goat was a matter for the veteran members of the team.

Back at the centre I remarked on how cooperative the people had been. Laughter. Apparently a good deal of medical bribery was necessary with headache pills, cough medicines, plasters, bandages, and cures for any other ailments arising. Otherwise interest in the centre's activities soon waned.

Stool sample collection must have been rather innocuous compared with the dreaded needle. In the tea room doctors lamented over the poor response to various government vaccination programmes. Vaccination teams would be sent out only to find that frightened villagers had collected their families and paddled out on their noukas to the middle of the rivers and lakes. They were prepared to wait all day if necessary until the needle men went away.

Village life

Without a measure of general improvement in the standard of life and availability of medical help, people were unwilling to subject their bodies to an unknown and apparently painful process. Pills to cure pre-existing disease were acceptable, but the benefits of prophylaxis were to be appreciated only after suitable education.

Village life is different. Villagers do not understand the foundations of modern medicine: good food, no crowding, and hygiene. Poverty does not help. Days are marked by the timeless calm of tradition. As early as sunrise things are on the move. Buffalo carts are loaded with cabbages, chillies, okra, pawpaws, cloves, tumeric and other spices, and vegetables made ready for the long journey to the wooden stalls in the open markets of town. This is the privilege of richer peasants, who have more land than most and are able to maintain themselves with a sufficiently varied diet. Meat, however, is almost out of the

question. Good lean beef sells at around the same price as in Britain but this is put sharply into perspective by the fact that 220 g of it costs the equivalent of at least one month's wages.

Along the miles of paddy fields in the red glow of the early morning sun farmers are already busy sifting the young rice shoots. Women are bent double, barefoot in the watery mud. Tediously, they separated tiny shoots and embedded them into their maturing positions. They work all day, and the sun burns dark the bare area between blouse and waist. Those too old for the fields are in the huts tending to infants and domestic fowl and preparing the meal. In most instances there is only one main meal a day: a large plate of boiled rice, some cooked or fried vegetables such as aubergine and okra or peas, lentil, and fish. The men like *pantabhat*—boiled rice left in water in clay pots for a day or so, after which it was considered a delicacy along with chillies and salt. This puzzled me until the alcoholic qualities of fermented rice were pointed out. Some children had the luxury of fresh milk, but this was not regular and often watered down "so that everyone gets some." There is, of course, no pasteurisation, and tuberculosis is widespread.

Fish, and water

Dietary protein is mainly fish from the massive mesh of water covering Bangladesh. There were stories that fish were no longer as large as they used to be. Some put all the blame on diversion by the Indians of much of the water of the Ganges to Calcutta to keep the port from silting up. But fishermen still sail early, gently coursing the rivers in large, elegant *noukas*. Some of the boats are elaborate, with sleeping and eating areas, and they serve as floating homes. Fine black nets sieve the swirling green and blue waters, then are hauled in and cast out again. The fresh, gleaming catch is in the markets by mid-morning. Customers argue with fishmongers over size and quality, eventually striking a bargain.

The water sustains life throughout rural Bangladesh, but it also provides ideal resting grounds for the larvae of malaria mosquitos. Faecal contamination of streams is unavoidable and helps the wide dissemination of disease. Cholera and typhoid are endemic. That thought in mind made it all the more awesome watching fishermen's children spend much of their day in aquatic games. In selected villages government and WHO workers have attempted to provide clean water by tapping underground tables with tube wells. Mortality and morbidity from cholera, typhoid, and other diseases in these villages have been considerably lowered, but the cash has not been raised to provide this service countrywide.

Sunset ends the working day—flame clouds in a blue violet sky against which distant farmers can be seen unyoking the oxen. Ready to drop, man and animal make their way home. After the meal village life rapidly comes to a close. Eyes shut in the sultry heat as exhausted men and women take to their beds—jute mats. Mosquitos begin to funnel in and fill the night with a gleeful, incessant hum.

The elderly and the more robust peasants sit by paraffin lanterns and oil lamps repairing torn clothes and discussing with sadness the death of a young village girl who developed a strange fever following a fish bone that had got caught and given her a sore throat. Others sit and look back to their childhood and bring alive the folklore. There is talk of terrible 100-toothed monsters who live in the tallest palms; of fairy queens, beautiful maidens, and rich princes; of scrawny witches who quietly pass in the dead of night snatching the breath from naughty boys and girls. The children listen avidly, shivering with awe and then are too frightened to sleep by themselves. They are hearing outside the footsteps of flesh eating demons. But even fear leaves untouched the child fed on watered down milk and crying with hunger.

Towns are different. There are street lamps and people are about, shopping until closing time at 8.30 pm. The rich browse around the jewellery and sari stores. Foreigners flock around

the souvenir shops, collecting brass plates and vases and sniffing the polished elephants and tigers carved from sandalwood. Further out in the suburbs, just before the electricity cables run out, rickshaw drivers, mill workers, bricklayers, and other working men gather around small wooden stalls and tea houses passing the evening hours smoking locally made cigarettes. Vegetable samosas, *luchi* bread, onion *bhajis*, and hot kebabs roasted on spits over charcoal fires are on sale. Oil lamps mingle their thick yellow light with the low wattage of electric bulbs. Moths, beetles, and cicadas buzz round the lights, in the shrubs and trees, and all around.

Prayer times were strictly observed, and the call to evening worship is clearly heard all over *Dacca* from more than 700 mosques. After prayer there was still time to tell a friend that from next month you would be keeping your children at home because you could not pay their school fees. Despite hardship, people were all too ready to entertain you to tea, offering sweets and fruits they are rarely able to afford for themselves.

On the steps of the tea house I noticed a slim, middle aged peasant with closely cropped greying hair. He sat bleary eyed with his monstrously deformed right leg, quietly praying and rubbing the coins left in his cloth hat. It was late evening and for him time for breakfast. There were many beggars, often disabled by easily treatable conditions. Broken limbs healed at peculiar angles, and amputations and blindness after sepsis were common. One heard stories about gangsters profiting from such mutilations by sending out kidnapped and deliberately disabled children to beg or by selling their blood to criminal and bogus medical practitioners. People were generous in town: a dying man beside a footbridge lay wrapped in old blankets, hundreds of coins and some notes scattered by him.

There are several good hospitals and clinics around *Dacca*. Most of them are private. Successful clinics and surgeries are run by well qualified doctors looking after an affluent clientele. Most of the population, however, have to rely on government hospitals, which are much less expensive and provide care on a strictly limited budget. The huge cost of medicine poses formidable problems, even in administering very basic health care.

Recycling

Almost nothing is disposable. Needles, glass syringes, glass bottles containing saline for intravenous infusion are all autoclaved and recycled. I visited one of the smallest hospitals. A young man dying of septicaemia listened to the discussion during a ward round on hospital antibiotic stocks. There was no gentamicin on any ward. Even the pharmacy was empty, informed a nurse. On the command of the senior registrar an alarmed pharmacist was dragged to the scene and a mildly acrimonious exchange ensued.

"Why is the pharmacy empty, why have you not bought more supplies?"

"There's no money left."

"So why didn't you ask administration for more?"

"We did, but until the next budget meeting they won't help us."

"Those . . . so and so."

The gentamicin story is one of many examples. Another day one of the more sensitive registrars, angered by the blindness he discovered in a 14 month old girl with vitamin A malnutrition, again sent for the pharmacist. The rather timid man arrived and was immediately dispatched with a command to get hold of vitamin A no matter how. The registrar would pay—a generous offer considering his salary in comparison to the cost of drugs. Ward rounds were thus stressful at the best of times, but when the current failed (as often happened) and the overhead fans ground to a halt I wondered just how the staff kept their tempers cool.

The incidence of diarrhoea is more related to socioeconomic conditions and poverty than to geographical area or climate.

Naturally diarrhoea is widespread in areas of overcrowding and poor sanitation. In Bangladesh faecal contamination of water is common, and transmission of disease is facilitated by the enormous network of rivers and tributaries. Most of these lead to the Ganges, Jamuna, and Brahmaputra.

The severity of and death from diarrhoea increase when there is malnutrition.⁴ Marasmic children frequently presented at the centre and despite superhuman efforts at revival some died. In many cases other complaints and infections complicated the picture. The case of Mahlib is exemplary.

The replacement of elements lost in diarrhoea, though a simple concept, has only recently been widely accepted. Watten and Phillips's study of the 1958 Bangkok cholera epidemics led to a rational replacement regimen of faecal electrolyte losses, bringing cholera mortality rates down to less than 1%. Even in the late 1960s, however, people lay dying of cholera in villages surrounding the centre because there was no method of applying treatment to large numbers of people with limited access to hospitals.

From the observation that sodium transport across a piece of rabbit ileum was enhanced by glucose,^{6,7} treatment of diarrhoea became very much simplified—orally administered fluid. This allows rehydration without expensive and difficult to obtain intravenous fluids and given early enough can replace any need for intravenous treatment.^{8,9}

In Bangladesh during the 1971 war oral glucose electrolyte solutions were made from table salt, baking soda, and glucose. Instructions for measures using ordinary teaspoons were printed, with pictures for the illiterate, and daily radio broadcasts gave the recipe for the fluid. Though no objective reports were available, numerous cases of cholera were said to have been successfully treated.

Unfortunately, in many parts of the world glucose is not widely available. Trials using sucrose show that although not quite as efficient as glucose at promoting electrolyte absorption

it does work. Studies at the centre⁸ show that rice powder serves as an excellent carbohydrate source for electrolyte absorption in diarrhoea applied on a large scale, and the use of starch may be the ultimate simplification for oral rehydration.

I was happy to leave the centre on that encouraging note. Cheap and simple but effective treatment of diarrhoea in the home now seems possible. The appalling paediatric mortality statistics of this disease in developing countries should decrease in the future.

I wish to thank Professor K McCarthy and Dr M B Skirrow for their help in organising the elective and the staff of the centre for guidance and for making my stay so enjoyable, especially project supervisors Dr S Q Akhtar and Mrs K Haider. I also thank Miss M Broly for typing this report.

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Do the skin's natural defences against fungus infection diminish with age, particularly during the menopause?

Certain fungal infections, notably superficial candidiasis, are commoner in elderly patients. Although this is related in some cases to specific factors such as denture wearing or iron deficiency,¹ in many patients such predisposing factors are absent. There is evidence that the background titre of antibodies to *Candida* does not decline with age,² although some older patients with chronic oral candidiasis have impaired T lymphocyte activity.³ Thus the increased susceptibility to superficial candidiasis with age seems to depend on a complex interaction between an immunological and other factors.—R J HAY, medical mycologist, London.

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There is an increased risk of hepatitis in departments of genitourinary medicine. What are the possible risks of the new hepatitis vaccine? In particular is it safe in the short term and are there any long term effects, such as chronic hepatitis or development of hepatoma?

The hepatitis B vaccine containing purified hepatitis B surface antigen (HBsAg) has been shown to be safe with no evidence of transmission of hepatitis B or non-A, non-B hepatitis. The only side effect of note in a placebo controlled trial has been a local reaction at the site of injection in about 15% of patients.¹ The possibility that other infectious agents, particularly viruses, are present in the vaccine is highly unlikely since the preparation of the vaccine effectively inactivates or removes representatives of all known groups of animal

and human viruses. For the same reason it is highly improbable that the vaccine leads to the development of chronic hepatitis or hepatoma, and indeed no such sequelae have been observed to date. Finally, there is no evidence that it plays a part in the development of the acquired immune deficiency syndrome (AIDS) that has been increasingly reported in homosexuals, who were the first clinical group in which the efficacy of the hepatitis B vaccine was tested.—ROGER WILLIAMS, consultant physician and director of liver unit, London.

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What might be the reason for a fit young man developing severe pain in his calves—which he describes as worse than cramp—after 20 minutes of sporting activity? What advice should he be given?

Exercise related pain or intermittent claudication in a young, apparently fit individual may be due to premature atherosclerosis, embolism, cystic disease, fibromuscular hyperplasia, lumbar spinal stenosis, or one of the entrapment syndromes. Given that systemic causes or aggravating factors such as hypercholesterolaemia, anaemia, polycythaemia, and heart disease have been ruled out and that the patient has no history of lumbar trauma or disc trouble a local mechanical cause should be looked for. For example, if the pedal pulses become diminished or absent with sustained active plantar flexion or with passive dorsiflexion at the ankle it suggests popliteal artery entrapment, in which there is an anatomical anomaly causing the artery to be compressed by the medial head of the gastrocnemius. It is also possible for the posterior muscles of the calf to be compressed during exercise in a manner corresponding to the better known anterior tibial compartment syndrome or "shin splints." Since local compression or mural disease of the popliteal artery may go on to complete occlusion a vascular assessment including arteriography is recommended.—C V RUCKLEY, consultant vascular surgeon, Edinburgh.