

IMPACT OF SCIENCE ON POLLUTION: A CASE STUDY OF HUMAN EXCRETA AS AGENTS OF DISEASE TRANSMISSION

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Introduction

Reports of disasters resulting from pollution by radio-active and toxio chemical wastes make headline news, while consciousness of the dangers of industrial pollution and the need to take pre-emptive measures increases. The frightening consequences of environmental pollution by these agents, particularly their impact on human health and survival have tended to overshadow the more insidious effects of a third group of pollutants. I refer of course to human body wastes as agents of pollution whose impact on health is almost as damaging, if not as dramatic. These body wastes or excreta (specifically faeces and urine) play a significant role in the transmission of the class of diseases which occupy a preeminent position in the health status of the peoples of tropical Africa; and what is even more crucial, they result from the contact and interaction man makes with his natural environment in the business of daily living.

It is to this group of agents of environmental pollution, their role in disease transmission and what it will take to prevent or bring them under control, that I wish to focus attention today. The relationship between 'science' and 'pollution' is a multifaceted one; not only does science help to identify or diagnose the problems caused by pollution, it also devolves on science to seek the modalities for ameliorating their impact. It is my intention in this paper to explore the ramifications of this complex relationship using pollution with human excreta as a model for three reasons:

- (i) much more is known by the reading public about the toxic and radio-active aspects of pollution — thanks to the information media;
- (ii) modesty demands that when addressing an enlightened audience, I dabble only with subjects with which I can claim some measure of familiarity; and
- (iii) time constraints.

The Environment in the Slums and Rural Areas.

To be able to follow and appreciate the scenario which I intend to develop in the next thirty minutes or so, it will help to try, if you can, to forget the rarefied environmental conditions in which most of you live and work, some even in air-conditioned comfort; the sanitized environment copiously provided with reliable, clean and potable water supply, and good sanitation; conditions under which contact with the natural state is hard to establish. Rather I would urge you

to cast your mind back, if you can, to the environmental conditions prevailing in your rural origins (if you have not been a city-slicker all your life). If you have been, and therefore can lay no claim to any rural antecedents, then let your fertile imagination go to work. This is Cowper's graphic description of rural Nigeria as regards disease transmission:

"A child born in a Nigerian village is almost bombarded by parasites from soon after birth throughout his life. The water used for drinking and domestic purposes is a source of schistosomiasis and guineaworm; the food he eats, both vegetable and meat, is a source of tapeworm, roundworm and lung fluke where freshwater crabs are consumed; the soil on which he walks barefoot infects him with hookworm; and the profusion of biting insects infects him with onchocerciasis, filariasis and malaria. Non-biting insects, dogs, cats, goats and poultry in the houses and yards assist the mechanical spread of intestinal parasites, and the use of human night soil as manure increases the risk."¹⁴

And most authorities agree that the rural areas are where over 75% of the Nigerian population live. These rural folk may be free, for the time being, from the problems of industrial pollution. But they have to contend with the ravages of diseases which result from pollution of their environment with human excreta. If a simple expression is sought to define the environmental quality of rural Nigeria, it is 'poor sanitation', characterized in this case, not only by the lack of excreta disposal facilities but by the widescale propensity for indiscriminate defaecation and urination. One never fails to be struck, if not overwhelmed, by the pervasive odour of stale faeces and urine emanating from the general surroundings in most rural communities in Nigeria.

Alternatively, if rural life is too far removed from your personal experience, just think of the environmental conditions which prevail in the slums and shantytowns in Lagos and other big cities in which over 50% of your urban-dwelling cousins maintain some semblance of existence. The hallmark of these communities is squalor of incredible dimensions, the result of a combination of factors among which according to Okpala are:

- (i) poor level of sanitation manifested in the lack of, or grossly inadequate facilities for excreta and refuse disposal;
- (ii) lack of safe, clean, potable water supply;
- (iii) poor personal hygiene; and
- (iv) poor housing, low economic status, and ever-rising house rents, all resulting in overcrowding.⁸

All these factors acting in concert are known to moderate the epidemiology of these diseases tremendously, resulting in greater prevalence rates among the slum-dwellers than in the rural areas from which they migrated in the first place.

The Parasitic Diseases:

The diseases which are associated with environmental pollution with human excreta are collectively known as communicable or endemic diseases which Burnett appropriately defines as "all those infectious diseases present in a community in which the social circumstances do not offer any effective barrier to their spread".⁵ In other words the four attributes which best describe the socio-economic profile of the Less Developed Countries (LDCs) apply, namely; poverty, ignorance, malnutrition and squalor. Of these, the parasitic diseases stand out as diseases of great public health and socio-economic significance in tropical Africa. Without going into too much detail, they are well established as the cause of great morbidity and mortality, accounting for unnecessary and avoidable pain, suffering and death; their debilitating and incapacitating effects result in significant reduction in the productive capacity of the people thereby exerting serious adverse impact on the national economy. They have also been incriminated in the stunting of the physical and mental development of children, resulting in poor performance in school with the attendant loss of great intellectual potential to the society.^{11, 17} The dangers of pollution with human excreta are truly great and real indeed!

Three examples will be used to highlight the major issues relevant to this topic. They are:

- (i) schistosomiasis,
- (ii) guineaworm, and
- (iii) intestinal parasitic infections, featuring particularly ascariasis and hookworm disease.

Science has established the link between the spread of endemic diseases and poor sanitation and poor water supply arising from pollution with human excreta; hence, one of the pillars of primary health care as advocated by WHO, which is the provision of safe, clean water supply with complementary basic sanitation is based on sound scientific principles.¹⁵

Soil and Water Pollution with Human Excreta.

It must now be quite apparent that we are dealing with important diseases which are acquired through man's daily contact and interaction with his natural environment. Thus for example man's intimate interaction with the soil through farming or playing makes it a good medium for the transmission of diseases like ascariasis which favour the faecal-oral route, or hookworm whose infective stages develop in the soil and infect man by penetrating through the skin of the feet. All this can only happen when the soil is contaminated with infected human faeces. Indiscriminate defaecation and urination and the use of untreated human faeces as fertilizers in the rural areas, and the use of pail latrines for excreta disposal in the slums all have the same effect. They all serve as a focus for the infective agents of these diseases which are now broadcast through the action of rain, insects, wind etc. so that the entire land environment in the community becomes contaminated or seeded with these infective agents. In such an environment, infection can occur in one of the following ways:^{11, 17}

(i) Ingestion of eggs of parasites through eating with or licking dirty or unwashed fingers and eating unwashed raw leafy vegetables and fresh fruits e.g. ascariasis. Foods, like bread, cakes, meat pies, groundnuts, peeled oranges etc, packaged with polythene and other forms of wrappings are relatively safe, provided care is taken to avoid contamination while removing the cover.

(ii) Penetration of larvae through the skin of feet, buttocks etc. e.g. hookworm. There are dangers indeed in going about barefoot in endemic areas, but because of the limitations imposed by poverty, footwear is less commonly used by the poorer segment of the community. As I said elsewhere (Ukoli, 1990), certain traditional dances make a virtue of barefoot participation, while some religious groups, both traditional and modern, make it mandatory for worshippers to go about barefooted, and in certain societies, the barefooted appearance before a traditional ruler is considered the height of reverence. Needless to say, nothing in the epidemiology of hookworm suggests that festival arenas, places of worship and traditional palace grounds are so sacred that they are free of hookworm larvae.¹⁴

Water, like soil, is another part of the natural environment with which man must needs interact. Man comes into contact with water for a number of reasons, including, occupational, recreational accidental and domestic reasons. Unfortunately, water is the source of a wide variety of infectious diseases like guinea-worm, schistosomiasis, cholera, typhoid fever etc. which are therefore water-borne diseases by definition. If they don't get you when you drink water, they get you by penetrating your skin when you make contact with it, or through inoculation by insect vectors that breed in it.

Again, just like the soil, water is liable to pollution with human excreta; indeed there is a close relationship between water and sanitation — there can be no good sanitation without adequate water supply, while poor sanitation results in the pollution of water.¹⁰ So between them, poor sanitation and poor water supply account for the high prevalence and severity of communicable diseases in tropical Africa. It is therefore imperative in the interest of the good health and welfare of the people to initiate control action, and any such initiative must place a great premium on the development of the twin programmes of water supply and basic sanitation. Unfortunately these programmes are not aggressively prosecuted by the authorities in most countries in tropical Africa, with the drive and commitment which their crucial role in the community, particularly the rural areas and slums, seem to dictate.

Improvement of Sanitation

For example in Nigeria, the Environmental Sanitation Programme which is enforced every last Saturday of the month is not the answer to the prevention and control of communicable diseases, however strong the aesthetic appeal may be. What is relevant is the disposal of human excreta which is really the source of infection. Indeed, the WHO definition of *environmental sanitation* include:

"In addition to excreta and waste water disposal, other elements of the environment which might affect health, such as community water supply, housing, food, atmospheric conditions, occupational conditions and disease vectors".¹⁶

In my forthcoming book entitled, *Prevention and Control of Parasitic Diseases in Tropical Africa: The Main Issues* (Ukoli, 1990), I discussed this problem at some length and concluded as follows:

"In Nigeria, the thrust of the Environmental Sanitation Programme as presently operated, merely scratches the surface and whatever impact it may exert can only be cosmetic. On the one hand, the brunt of its implementation is borne by the individual and family who, though coerced into compliance, lack the capacity and resources to make the desired impact. On the other hand, the authorities who are better placed to provide the centralized and coordinated services required for tackling some of the problems posed by the other elements which constitute the essence of environmental sanitation, are hamstrung by serious financial constraints. Without addressing the main issues of excreta disposal and provision of safe, potable water supply, the E.S.P. as presently conceived can do little to bring down the prevalence rates of parasitic diseases in Nigeria".¹⁴

Improvement of the level of sanitation entails the installation and maintenance of an efficient excreta disposal system, even if it is of the most rudimentary kind, i.e. the simple pit latrine, or the V.I.P. latrine which is a slight modification of pit latrine to keep away the flies and eliminate the offensive odour. (V.I.P. stands for Ventilated Improved Pit latrines, *not* VIP). According to Cairncross, a V.I.P. latrine costs as much as US \$30 per capita to construct,³ so for Nigeria with a population of 100 million, it will cost US \$3 billion (i.e. ₦21 billion). Admittedly this is a tall order if Nigeria expects to achieve national sanitation coverage. But is there any indication that we are prepared to invest up to the 2 – 3% of our income on excreta disposal which Cairncross estimates is the minimum low-income communities are prepared to spend on such a programme?

Provision of Safe Water.

The second leg of the problem is the provision of safe potable water. But desirable as it may be, the implementation of this option poses technical and organizational problems of monumental proportions not to mention the astronomical cost, reckoned in billions of naira, all of which put the coverage of every nook and corner of Nigeria with adequate safe water supply (with complementary sanitation) beyond our resources and capabilities in the foreseeable future. Achieving only an overall national coverage of 38% (and as is only too well known, the supply is everywhere both inadequate and irregular), it has now

become clear that we are nowhere near the target of total national coverage prescribed for the *International Drinking Water and Sanitation Decade* (1981 – 1990). In the meantime, the Directorate of Food, Roads and Rural Infrastructure (DFRRI) set up by government to redress the situation is overtly sinking hundreds of million of naira into bore hole construction as a solution to the problem; in my view a most expensive approach and a mere palliative.^{1 3}

In the first place, DFRRI estimates that over 90,000 communities are in need of water supply, and at a cost of anything up to ₦40,000 per hole (not counting the cost of pumps), the mind boggles to think of the cost and time it will take to complete the exercise. In the second place bore hole technology typifies the worst that transfer of technology represents, for it demands the expenditure of vast amounts of hard currency for the acquisition of the inputs for drilling, casings, water pumps, spare parts and ideally, water treatment, storage and distribution facilities, most of which have to be imported. Besides their record of performance in Nigeria is poor. For example it has been estimated that only 20 – 90% of the bore holes remain functional six months after commissioning (NICEP, 1989).⁶ Indeed a recent report revealed that of the 360 communities said to have been supplied with potable water by DFRRI in Anambra State, only 40% of them had functional water schemes for a variety of reasons including, faulty hand pumps, lack of servicing and the siting of the bore holes in “total disregard of geophysical formations and water levels”.² The minuses are legion, and emphasize once again the futility of transfer of technology as a means of solving problems of real relevance to the basic needs of our people.^{1 3}

The answer of course as I said in a paper I presented at a recent Workshop at NIPSS, is to seek through research, cheaper but just as effective alternatives that will be simple enough for the peasants to install, operate and maintain on a community selfhelp basis.^{1 3} In Nigeria however, research in this area is completely neglected; DFRRI does not see it as part of its mandate to encourage indigenous technologists by providing research support, neither is it listed among the ‘high priority areas’ deserving of support from the National Science and Technology Fund.¹

Conclusion

In conclusion, it can be seen that while research in the basic sciences (in this case parasitology, biology and ecology) has identified the role played by pollution with human excreta in disease transmission, it is work in the fields of mechanical engineering and technology for the design and construction of more efficient water pumps, and hydrology, hydrogeography, bore hole drilling technology and sanitary engineering which will produce the answer. It is right and proper that the provision of adequate supply of safe water and basic sanitation be given prominence in primary health care which the 1978 WHO Alma Ata Declaration recognizes as the key to the attainment of the target of “Health For All by the Year 2000,”¹⁵ because that is all it will take to wipe out over 75% of all the parasitic diseases in Nigeria. It is because the enormity of the problems and the magnitude of our economic predicament make the goals of this

option seemingly unattainable that it becomes necessary to explore other disease control measures like:

- (i) chemotherapy,
- (ii) immunization,
- (iii) vector control using pesticides, and
- (iv) health education,

all of which raise formidable problems of their own which are far from being solved, but which the theme of this Conference precludes us from discussing further.

Nigeria owes a great deal to the productive efforts of the rural dwellers; indeed the bulk of the food, export and industrial crops are fruits of their labour. And yet their health care and welfare suffer a measure of neglect which is incompatible with the level of productivity and the magnitude of the contribution to the national economy expected of them.^{1 2} It therefore makes sense, not only on humanitarian grounds but from the point of view of enlightened self-interest, for action to be initiated for the improvement of their welfare and quality of life. This is why the Better Life for Rural Dwellers Programme, together with all other steps taken by the Babangida Administration to foster rural development, is a welcome step in the right direction. In this respect, the Better Life Programme is consistent with the spirit of the Arusha Declaration of President Julius Nyerere of Tanzania made over two decades ago, whose aim is to transform rural areas into places where "people must be able to find their material well-being and their satisfaction".⁷

Since "without health there can be no socio-economic development",⁹ it also makes sense to give health care in the rural areas top priority in the quest to improve the lot of the people. Finally, since the dangers of environmental pollution with human excreta can be obviated through the provision of safe water and basic sanitation, a process which is guaranteed will wipe out most of the communicable diseases, one often wonders whether the interests of the beneficiaries will not be better served were the Better Life Programme to focus greater attention and intensify efforts in the execution of the twin sectors of water supply and latrine construction.

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