THE HIGH COST OF BEING POOR: WATER

TO:

Dr. Irwin Hornstein
Science Research Officer
Office of Nutrition
Agency for International Development
Washington, D.C. 20523

FROM:

Instituto de Investigacion Nutricional
Apartado 55
Miraflores, Peru

and

Dr. George G. Graham
Principal Investigator
615 North Wolfe Street
Baltimore, Maryland 21205

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ABSTRACT

Longitudinal anthropometric and socio-economic assessment was made of 127 families of children admitted with malnutrition in 1961-1971. In 1972, those recruited in 1961-66 had higher incomes and were more likely to have running water and electricity than those recruited later, who were more likely to be using candles or kerosene and to buy water in cylinders, at a unit cost 16.7 times higher. Mean mid-parental heights were equal, but the children from families with water and electricity services were taller for their age.

Expenditures for illumination were similar, whether using electricity or burning candles or kerosene, but expenditures for water were much higher, for a much smaller volume, in families without running water. When expenditure was expressed as percentage of income or as the amount of working time to pay for water, the differences were even greater: 2.6 - 2.7% vs. 0.4 - 0.7% and 423 - 445 vs. 71 - 129 minutes/month.

During more than twelve years we have been following surviving children who were admitted under our care to the British American Hospital in Lima with the diagnosis of severe malnutrition between January 4, 1961 and December 31, 1971. During the last six years we have included their entire immediate families in the study. It now covers 167 families, but this report deals with only 127 of them. With the exception of 8 families into which 8 of our ex-patients were adopted, they belong to a very low urban socio-economic level, coming from the peripheral slums or "barriadas" of Greater Lima.

This report deals with the cost of a single basic commodity, water, seldom considered of major significance in the budget of most families. The importance of an abundant supply of pure water to the maintenance of a decent standard of living and hygiene is not questioned (1). We have analyzed the type of water service, the amount consumed, and its cost in absolute terms, in relation to total family income, and to the amount of time worked to pay for it. To the extent possible, we have compared its cost to that of another basic necessity, artificial illumination. We have also related the data on water consumption and cost in 1972 to the growth performance of the families, based on the heights of their members in the same year. In populations where undernutrition is the rule, rather than the exception, we consider this to be the single most convenient expression of nutritional state and general health over long periods of time (2).

MATERIALS AND METHODS

These families have one common denominator: at least one child who in early life was malnourished enough to be admitted to the hospital. Of the 167 families, 91 correspond to admissions during the years 1961 through 1966. Twenty-two of the 91 are not included: one is living in the United States, 14 do not pay for water, and 7 receive it from their employer. Eighteen of the 76 families corresponding to admissions during the years 1967 through 1971 are excluded: 11 do not yet pay for water, 6 receive it from their employer, and one adoptive family enjoys a standard of living very much higher than that of the remaining families. We have included 69 from the first group and 58 from the second, a total of 127 families.

They entered the study when the index case of malnutrition was discharged from the hospital: anthropometric, clinical, and socio-economic data were obtained at this time, six months later, six months after that, and yearly thereafter. At least one visit was made to the home. On the date of each periodic evaluation the entire family was transported to our unit.

1. Anthropometry. This included height, weight and head circumference. Height of children was converted to a height age, that to which it corresponded on the 50th percentile of a commonly used U.S. Standard (3). The height quotient used in this report was the height age as a percentage of chronologic age, each to the nearest month. It allowed us to compare

or to average children of different ages and sex, and to compare the same child at different ages.

2. Clinical examination. Children being seen for the first time, particularly young infants, were examined thoroughly. If a child was sick, all the necessary diagnostic services were provided free, as were most medications and all immunizations.

3. Socio-economic status. On the first visit a detailed social history was obtained, and on each subsequent visit it was brought up to date. For each member of the family it included place of origin, length of residence in Lima, marital state, formal education, state of health, personal hygiene, occupation, total income, disposable income (for the home), and expenses. Among the latter we specified amounts for rent, water, lighting, fuel, street lighting and garbage collection, transportation, clothing and food. For the home itself we included location, ownership, conditions of occupation, type, construction materials, composition, services, sleeping facilities, population density, furniture, condition and state of hygiene.

In a previous report we related the later growth of the index case of malnutrition in many of these same families to various socio-economic indices (2). In the present one we are looking at the cost of a single basic item, water. Not all the families enjoy the same type of service for water or for

lighting. Some have the advantages of private metered water and sewerage services; others, though having these same services available, share them with other families living in the same unit or "callejón", where water is provided by a single common spigot or "caño común", with a single meter. The cost is prorated. In the newer peripheral slums there is still another type of central water service, but without sewerage facilities. Families with this type of service have been excluded from this study, as the water from a strategically located common spigot is not metered and they do not yet pay for it. Still another number of families do not have water or sewerage services, and have to acquire water from tank trucks and store it in cylinders or barrels (Figure 1): they are included in our analysis.

Those families with private water or a common spigot had electric light; those with no water service used candles or kerosene lamps for lighting.

The 127 families are divided into two groups, I and II, on the basis of the recruitment dates, 1961-1966 and 1967-1971, and by the three types of water service: private water and sewerage, common spigot, and cylinders.

RESULTS

Thirty-seven families, 30 from group I and only 7 from group II, enjoyed private water and sewerage services.

Twenty-two families, 16 from group I and 6 from group II, used a common spigot.

Sixty-eight families, 23 from group I and 45 from group II, had no water service and had to buy it in cylinders. These results are summarized in Table 1.

Table 2 summarizes the total monthly family income in Soles (one U.S. dollar = 43.38 Soles at official rate), the amount of water purchased (derived from amount paid), the actual amounts paid for water and lighting, the percentage of monthly incomes represented by each expense, and the minutes of work that the expense represented each month. The families are divided by type of water service and by group (I or II).

Those families with private water services had a significantly higher income than those who used a common spigot or bought water in cylinders. The income of these last two sets of families was not different, whether they belonged in group I or group II. In all three sets, the income of group I families (recruited in 1961-1966) was higher than that of group II (1967-1971). This is not surprising as parental age and length of residence in Lima were greater for the group I families.

The families with private services consumed roughly twice as much water as those with a common spigot and, because they

paid the same rate, spent twice as much. Those with no water service spent two to six times as much money for one third to one seventh as much water as the others; they also spent as much on candles or kerosene as was spent for electricity by the others.

When the expenses for water or lighting are expressed as a percentage of income or as minutes worked to pay for them, the greater expense to those not having services is further exaggerated. In Figure 2 the consumption of water and the minutes of working time to pay for water and lighting for the three types of water service are shown. Groups I and II have been combined.

The above estimates are based on an average cost of 1.50 Soles per cubic meter (m^3) of water from the public system and of 25 Soles/m^3 when it is bought in cylinders. The actual charge is 5 Soles for a cylinder holding 0.20 m^3.

The charge for one kilowatt hour of electricity is 0.80 Sol. An ordinary candle burns 4 hours and costs one Sol, or 0.25 Sol/hour. One liter of kerosene costs 0.60 Sol and burns 4 hours, or 0.15 Sol/hour.

Table 3 illustrates the hypothetical very high cost of an average tub bath (0.25 m^3 of water) for those families without services, either in money or, more dramatically, in number of minutes of working time to pay for it. The mean hourly wage for the families having private services was the equivalent of U.S. $0.62, while for those without such services it was U.S. $0.36.

The mean height quotients of the ex-patients and their siblings in the families with no services were significantly lower ($P<0.05$) than those of the other two sets of families combined (Table 4). Because of the preponderance of group II families in this set, the mean ages of parents and of ex-patients were significantly less. Mid-parental heights were not different.

DISCUSSION

The segregation of these poor families by type of water service enjoyed, and by the dates of recruitment into our study, indicates that upward mobility with time is indeed possible. The presence of a severely malnourished infant or small child in the family is generally an indicator of social decompensation, dating a very low point in the fortunes of each family. For group I families this low point was in 1961-1966 and by 1972, when mid-parental age was significantly higher, they enjoyed better incomes than group II families and 66.7% of them had electricity and running water (private or from a common spigot). By the same date, the group II families, whose "low point" was more recent (1967-1971), had lower mid-parental ages, lower incomes, and only 22.3% enjoyed the same amenities. Some of the families in group I still had lower incomes and did not have running water or electricity by 1972, despite their longer stay in the capital city.

The lower mean height quotient of the ex-patients in those families without these basic services was suggestive of

a poorer environment for "catch-up" growth. Part of the difference might be due to the shorter length of time elapsed since discharge, although most of the "catch-up" in height quotients which we observe, occurs in the first two or three years after discharge (4).

Although those families living in the most primitive homes spent roughly the same amount of money for lighting as those who had good services, this represented almost 2% of their income instead of 0.9-1.4%, and they were using candles or kerosene instead of electricity. The obvious conclusion is that if the services were extended, they would be able to pay the going rate for a much safer and efficient form of illumination, assuming that it could be provided at the same cost. For a variety of reasons, this might not be true.

The water situation is a much more dramatic one: the poorest families are spending 2.6-2.7% of their income for water while families supplied through common water spigots or private services spent 0.4-0.7%. The actual amounts spent are 2 to 6 times greater than those spent by the families that are economically most advantaged, and more important, for this amount they are getting as little as one seventh the volume of water, the unit cost being 16.7 times greater. Here it is quite obvious that these families could and would bear the cost of at least a rudimentary system of piped pure water. When one looks at the potential cost of one tub bath, one

realizes the enormous difficulty faced by these people in keeping themselves, their children, and their clothing "presentable", and cannot help but admire the mothers who do just that.

On the basis of these data it would seem that the extension of the public water system to these slums, with all the implications for a better quality of life, is not only desirable but economically reasonable.

REFERENCES

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Figure 1

Pictorial view of the "water supply" for a sector of one of the peripheral slums of Lima. Most of the homes visible have already evolved from the original straw mat construction. The very dry desert soil is evident.

Figure 2

Monthly consumption of water and its cost in terms of minutes worked to pay for it, relative to that for illumination, by types of water service.

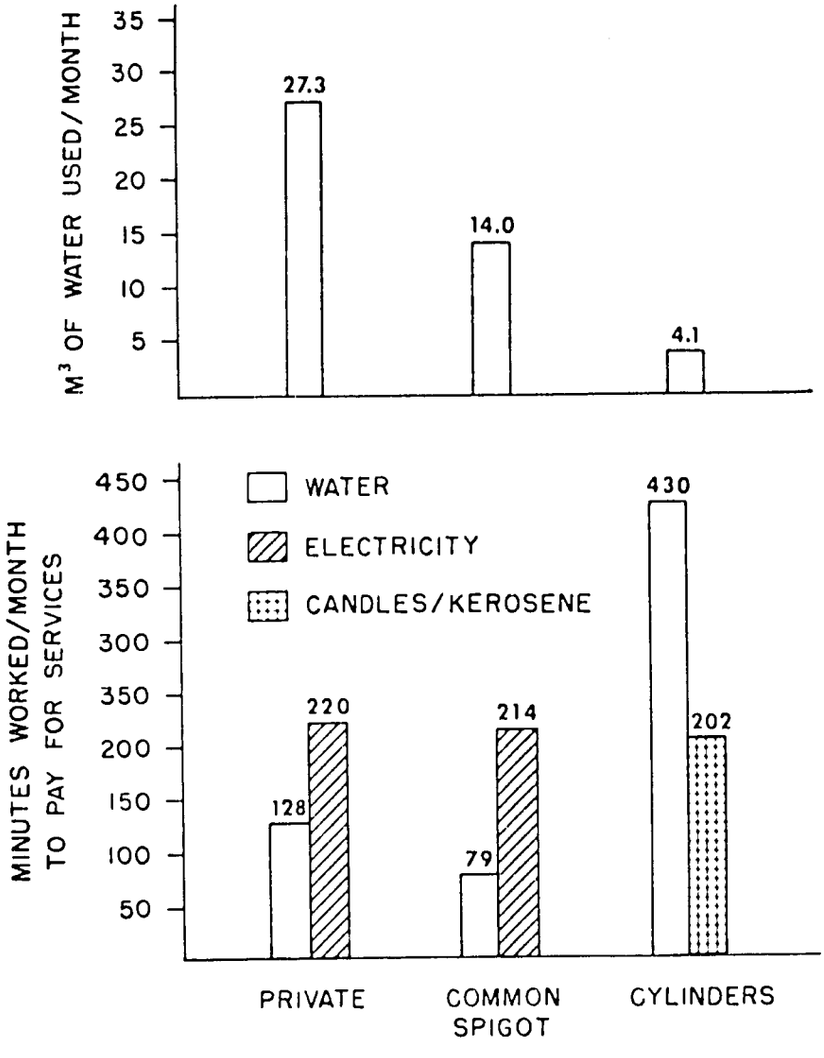

Table 1

Distribution of families according to year of admission into program and the type of water service in 1972.

Group	Year of Admission	TYPE OF WATER SERVICE a-Private	b-Common spigot	c-Cylinders	Total
I	1961-66	30 (43.5%)	16 (23.2%)	23 (33.3%)	69 (100%)
II	1967-71	7 (12.0%)	6 (10.3%)	45 (77.6%)	58 (100%)
		37 (29.1%)	22 (17.3%)	68 (53.6%)	127 (100%)

Table 2

Monthly averages (±SD) for income, water consumption, and amounts paid for water and lighting in Soles, as a percentage of income, and in minutes of work, during the year 1972, by 127 families divided by type of services.

Type of Service	Group	Income in Soles	Water in m^3	Amount paid for water or lighting		
				in Soles	% of income	minutes of work
a. Private water and sewerage	I*	6505±5240	28.6	43±21	0.7%	129
	II	6034±2947	21.4	32±13	0.5%	125
Electricity	I	-	-	84±56	1.3%	224
	II	-	-	55±19	0.9%	206
b. Common water spigot	I	4609±3780	12.7	19±13	0.4%	71
	II	3695± 352	16.1	24±14	0.7%	100
Electricity	I	-	-	60±38	1.3%	216
	II	-	-	53±22	1.4%	207
c. Water in cylinders	I	4283±2386	4.5	113±63	2.6%	445
	II	3571±1952	3.9	98±53	2.7%	423
Candles or kerosene	I	-	-	74±32	1.7%	285
	II	-	-	64±24	1.8%	308

* Group I corresponds to 1961-66 admissions, Group II to 1967-71.

Table 3

Hypothetical mean cost of water for one tub bath in 1972 for 127 families according to the type of water service.

Type of Water Service	Income in Soles per		Cost of water in Soles/m^3	Cost of water for tub bath ($0.25m^3$)	
	Month	Minute		Soles	Minutes of Work
a. Private	6416	0.45	1.50	0.38	0.8
b. Common Spigot	4360	0.30	1.50	0.38	1.3
c. Cylinder	3812	0.26	25.00	6.25	24.0

Table 4

Mean mid-parental height and age, mean height quotient of siblings in 1972, and mean height quotient and age of ex-patients in 1972 for the three types of water service.

	TYPE OF WATER SERVICE		
	Private	Common Spigot	Cylinders
Number of patients (n)	32	20	74
Mean mid-parental height (cm) ± S.D.	153.3± 4.6	154.1± 5.1	154.5± 4.5
Mean mid-parental age (yrs.) ± S.D.	42.5± 7.4	41.9± 8.8	35.4± 6.4
Mean height quotient of sibs ± S.D.	78.1± 7.6	76.1± 8.7	73.2± 8.9
Mean height quotient of patients ± S.D.	71.8±10.6	72.5±11.9	68.6±11.9
Mean age of ex-patients (mo.) ± S.D.	107.3±34.8	101.8±30.4	68.0±34.2