

T I T L E

A Study of Two Peri-urban communities living in Kayole, Nairobi,
Comparing their prevailing household environmental conditions and the
nutrition status of their pre-school-aged children.

by

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A Thesis submitted in part-fulfilment for the degree
of Master of Public Health

University of Nairobi

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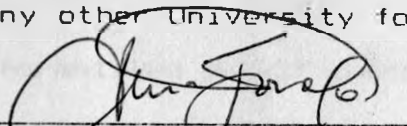
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DECLARATION


I JAMES MWANGI NJOROGE hereby declare that this is my original work and it has not been submitted to any other University for a degree.

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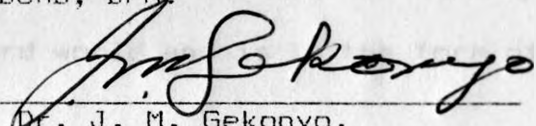

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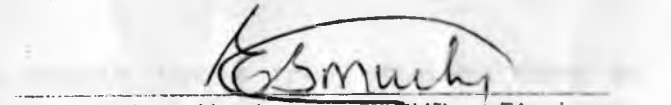

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ABSTRACT

The idea of this study was formulated out of concern for the plight of slum dwellers who seem to be minimally catered for by most providers of services in the City of Nairobi. Upon further liberating search on the subject it was discovered that this is a wide spread situation in the Third World countries and is actually a growing problem. This is because the most rapid growth of cities in history is taking place today, it is taking place in the third world and is in the form of slums rather than organized city growth.

There is a global movement being sponsored by the Habitat organization of the United Nations to convert attitudes of policy-makers from abolishing slums to upgrading them. This makes sense from the point of view of the Primary Health Care approach adopted by the World Health Organization.

In order to contribute to this debate facts from studies done on local slums are needed. An important question is how the poor environmental conditions of slum habitats influences health status, if at all. This study aimed at investigating some aspects of this question for Kayole slum in Peri-Urban Nairobi. This study was designed and formulated after the fashion of the C.B.S. studies of cross-sectional. It was carried out in June and July, 1990 by the Principal Investigator and three assistance. By pairing up two teams were formed, each team was assisted by a local opinion leader (social worker, group secretary, school teacher or well known clothes vendor) who acted as guides.

252 households were sampled from the slum area of Kayole by selecting those with a pre-school aged child (6 months to 60 months old) which was the major criterion. After asking demographic and household information from the household head or the incharge, the child was weighed (accurate 0.1 kg.) on a spring balance scale, using a pair of pant to hang the child by. The height was taken by marking off the beight on a suitable door jamb *** or on a coffee table. The height was then read off to the nearest 0.5 cm. 13 households were covered by each team per day on average, in ten days the sample size was achieved.

The procedure was carried out in the adjacent site and service scheme of Kayole where 255 households were sampled. This procedure was over in ten days also.

The minimum sample size for each group was $n = 240$, which was achieved. The prevalence rate was taken as $p = 35\%$, the finding of the CBS & Maina Studies. During that time, water was sampled once and sent for analysis. In August stool was collected from some of the children of the neighbourhood and assessed for stool ova and cysts.

The data was first of all treated in order to determine each child's standard deviation score from the reference median in order to give his/her nutrition status in terms of weight for age, height for age and weight for height. The latter was dropped from the analysis.

Wasting was taken as any S.D. score falling below median minus 1 S.D.

Stunting was taken as any S.D. score falling below median minus 1 S.D. According to this classification, the percentage of wasted children in the study group was twice as high as in the control group, 15.4% as opposed to 8.4%. This was less than expected in both cases. The ideal normal population would be expected to have 16.5% wasted.

The percentage of stunted children in the study group was 40% compared to 23.2% for the control group. The normal population would be expected to have 16.5%.

Thus stunting was in the expected range as compared to previous studies in Kenya, by the Central Bureau of Statistics and others.

No explanation for this "over-weight" of the peri-urban children was found. Nevertheless the independent variables in the study were cross-tabulated with these two nutritional indices, W/A and H/A.

The Environmental Variables

- (a) Those having significant correlation in the Study group and confirmed in the Control Group.
- (i) Solid Waste Disposal vs. stunting only, $p = 0.027$,
Chi Squared = 17.3. (8)
 - (ii) per capita water consumption vs. wasting positively
Chi squared = 13.8 ; $p = 0.0078$. (4)
- (b) Those having significant correlation in Study Group but not confirmed by Control Group.
- (i) Wall class vs. wasting (negatively) Chi squared = 27.7
 $p = 0.0011$.

(c) Those having significant correlation only after combining data from both groups.

(i) Type of fuel used vs wasting Chi squared = 32.6 p = 0.0053 (15).

(ii) Excreta disposal mode for under 2 years old vs. wasting. Chi squared = 40.4, p = 0.0001.

(iii) Handwashing after defecation vs wasting, p = 0.0001, Chi squared = 32.96. (9)

(iv) Drinking water quality vs. stunting - p = 0.0043, Chi squared = 28.7, Rain water = 20%, piped = 30.7% borehole = 47%, surface = 30%.

(v) Indoor air class vs. wasting Chi. squared = 13, p = 0.042.

(d) Those environmental variable correlating significantly with control group household excreta disposal vs. stunting (positively)

Chi. squared = 14.9, p = 0.021

(e) Those having no correlation

(i) Drainage facility

(ii) Crowding Index)

(iii) Roof standards) p = > 0.05

(iv) Floor standards)

(f) Non. Environmental variables having significant correlation with control group.

- (i) Maternal Education vs. wasting $p = 0.028$ Chi. Squared = 17.2 (18)
- (ii) Sex of child male > female (wasting Chi. squared = 6.76, $p = 0.034$, stunting) $p = 0.037$, Chi squared = 6.57 (2).
- (iii) Duration of stay vs. wasting $p = 0.024$. Chi. squared = 95.3 (70)

(g) Non Environmental variables having significant correlation with study group.

None except U.R.T.I. which had a p value of 0.057 when correlated with wasting. It was concluded that in a slum area like Kayole the single most important contributor to malnutrition most strongly indicated by this study was poor solid waste disposal methods.

For the non slum area in Kayole the most important contribution was also solid waste disposal followed by households excreta disposal method. In the case of the slum area it indicates that room for civic contribution by means of solid waste disposal facility to nutritional well-being exists.

In the case of the non-slum area it indicates that where this is marginally provided, other contributors to poor nutritional status like household excreta disposal mode may not be solved merely by provision of sewage facility. Health education so that proper excreta control is achieved is needed. The same applies to provision of water standpipes and the proper use of the water—health education is needed to achieve nutritional improvement as well.

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INTRODUCTION.

The problem is that the present course as a nation or member of Third World Countries is not leading us towards increased productivity and prosperity.

In spite of adopting the Western technologies the nation is not developing as would be hoped. Instead, there is falling per capita income year by year and a run away population growth rate.

The poverty stricken population is increasingly housed in slum type of housing in urban areas growing at an unprecedented rate. The majority are under employed.

Yet for the developed world their giant cities are their hall mark. The Urban to rural ratio is 8:2., or even 9:1. In Third World Countries it is 2:8. The Government has accepted to limit the growth of cities as per the advice of Western experts at independence, in order to achieve our Western style development.

But three decades later the situation is worse off than before. Instead of arresting rural-urban migration what has been achieved is massive slum growth. The people have overcome against government policy, insisting on living in the cities, though they be able to afford only slum housing there.

The areas remain slum-like because the governing bodies cannot sanction their existence. What is good for the people is not good for society. There is a dichotomy between the people's desire (to live in

the city) and the governments policy (to promote rural development). yet the government in democratic state exists to enable the achievement of the people's desires.

The key to this paradox is the mistake that was made in associating rural-urban migration with failure to develop the country. This was foisted on the newly independent countries and is to blame for this twin crises. Namely, explosive population growth crisis and foreign debt (economic failure) crisis being witnessed in many third world countries.

City growth must be allowed to occur not as fast as the government wishes but as fast as the population demands. In this way the government, local or central, should truly be servant to the people, facilitating supply of proper roadworks, titles to land, water, electricity, telephone, police services, etc, to the homes of citizens where-ever they come up in the country. One result will be the freeing of native energies towards productive pursuits in all economic spheres for the well housed population, instead of confining their mental pursuits to the level of seeking shelter or improved shelter time after time.

Until the political will towards this is raised the care of the beleaguered citizens of such slums should be striven for by public health specialists. In order to assist the process of political will, documentation of the effects of slum-dwelling should be attempted especially from the view point of health effects on the family and the child, the future decision maker. This study tries to make a contribution towards that end, of trying to delineate some of the adverse effects of unplanned urbanization on the health of the citizens of the nation.

HYPOTHESISSTATEMENT OF PROBLEM

The null Hypothesis is therefore:-

"Household environmental conditions do not influence the nutritional status of pre-school children".

The Alternative Hypothesis:

"Household environmental conditions do influence N.S. of pre-school children".

Method of Verification

(1) Method of verification for the water used in households.

Analysis of Water for:-

(i) Heavy metals

(ii) Coliform Bacteria

(iii) B.O.D. (Biological Oxygen demand)

Bore hole water to be sampled once

"Pond", and, tap water - sampled once each in the course of the study.

Analysis was done in Ministry of Water Laboratories in Industrial Area.

(1) Stool sampling for evidence of hookworm and ascaris from the pre-school children.

STATEMENT OF PROBLEM

The high population growth rate of less developed countries (L.D.C.'s) of which Kenya is one, is unprecedented in history. This high growth rate corresponds to the transitional phase of demographic change from agrarian type of equilibrium (high birth rate (b.r.) high death rate (d.r.) towards the modern of technically developed type of equilibrium (low b.r.. low d.r.).

At the corresponding phase of their development D.C.'s never attained such a high population growth rate as LDC's (1) but their increasing population was accommodated largely by the growth of their cities. However migration also helped to absorb some of the excess population. This was from 17th Century to end of 19th Century. Though improved public amenities contributed to the fall in death rates a major factor was also the increased wealth that was brought about by the increased freedom of movement of workers engendered by the building of town based industries. These industries became possible with the invention of railway systems and steam engines running on coal. In short the Industrial Revolution. (2) Though at first slum conditions developed as rural immigrants poured into the towns, overcrowding residential areas in the locality of the factories and other work places, eventually the political movements brough about improved housing through the passing of by - laws to maintain Public Health and through government sponsored (public) housing schemes. (2)

From the first of the known human civilization till now it is apparent that men come to realise their talents best when they conglomerate into cities (22).

The advantages of living in a city are that economies of scale are possible so that by specializing and competing one may get such expertise that is richly rewarded by working in a large but concentrated market in the city.

So much did men appreciate the ability of city life to magnify the value of time spent doing a specialized activity that not even the very high mortality rate of medieval city dwellers in Europe could stop the rural-urban drift.

It is even said that some cities only used to maintain their population by rural to urban immigration. The mortality rate of city dwellers was so high and their life spans so short. (2)

Today the cities of the developed countries are huge and the ratio of rural: urban population is around 2:8: the reverse of that in the L.D.C's where the ratio is 8:2 or more. There seems to be direct relationship between development and concentrations of population into cities or urban areas. (2)

In the L.D.C's this relationship is at best ignored and at the worst fought against by government sometimes at the behest of foreign consultants from the D.C's themselves.

Thus we have the idea of stopping rural-urban migration so as to promote development in Kenya as a government policy since the Todaro-Harris report recommendation was adopted in 1970's. The slogan used is "Back to the Land". This policy brings about many other implicit policies and consequences which are justified on those grounds.

For example bulldozing of slums and relocating some dwellers to other areas; penalizing the setting up of industries in urban areas through tax incentives and exemptions for those setting up in rural areas; promoting the partitioning or fragmentation of farmlands into tiny individual holdings from co-operative holdings or other large-scale agricultural units, etc. The irony is that all these activities are supported by governments in order to promote development, and hopefully development that emulates that of the Western countries. It is ironical because in U.S.A., U.K., Germany etc, we have the land being consolidated into larger holdings with increasing development thus enhancing mechanization and economies of scale; in Israel, land is farmed by co-operatives; the cities there are assisted to grow properly with large housing estates and proper roads for all users and publicly supported mass transit systems wherever necessary.

In third world countries, from S.E. Asia to Latin America and Africa we have the governments hindering the efforts of the indigenous people to house themselves properly through the reluctance to plan for or facilitate increased city growth, increased water and sewage supply and other infra-structure.

Due to the high population growth rate and low economic development rate the inevitable drift to the cities has grown to an unprecedented torrent because the land cannot support the extra population as was the case in the developed countries.

The slums now threaten to become the norm of the cities in L.D.C.'s in the near future (Dwyer 1975)(4), unless action is taken to enable the rural poor who migrate into cities to build more permanent houses and

implement better infrastructure and amenities, and secure more productive occupations(22). As it is, the majority of the Third World population will soon be living in slum conditions whether in urban areas or in rural areas(14). The medical profession should attempt to document the existence of suffering and disease in this important community whose cure lies not in curative medicine or even preventive medicine but in the re-orientation of the whole of public policy to face the fact that unless healthful city growth is sponsored by the government and legislation(22)(23) as well as education appropriately modified, then health for All by Year - 2000 will continue to elude us (just as development will) in the third world (22).

3. LITERATURE REVIEW

In Kenya it has been estimated that the rate of population growth is such that by the year 2000 the districts with spare population capacity (Coast Province and Rift Valley Province in 1975) will no longer be exploitable by Agriculture (Mbithi 1975)(39), (Ministry of Lands and Settlement - 1975).(38). Though now the policy of the government is to encourage rural development to reduce rural urban migration some people with land in rural areas still have been making their way into urban areas and settling into slum regions. At the same time illegal squatting on rural land belonging to others is occurring (Mbithi 1975).(39) The reasons given for these movements are inability to support oneself and family on own traditional land (Mbithi 1975)(39). Where the government has tried to evict illegal settlers or squatters by force the efforts have often failed due to the intransigence of the squatters. (Mbithi 1975)(39).

In the urban areas, especially, the lack of legal status of the

dwelling has rendered the communities there to be neglected in the supply of water, sewage, power, paved roads, storm drains and other infra-structure by the relevant governmental bodies. As a consequence water and transport have to be paid for at exorbitant prices by the slum dwellers and often higher rents paid for the rude shelter than that paid by other city tenants.(23)(27).

The shelters are made crudely because they are made of cheapest materials and only as temporary buildings because of the ever present threat of eviction and demolition; to reduce the possible loss to the owner in case of this(23).

Thus even the provision for clinics and health centres by the government and other bodies is naturally discouraged in these areas though they may have the biggest needs. Such health care is mostly sought in centres serving surrounding legal estates. (Lahti Workshop Report 1987)(6). An example is Kibera where 200,000 people had 2 dispensaries only in 1987. The occupations undertaken by many of the dwellers in slums are marginal and often illegal or immoral. Brewing of alcohol, prostitution are amongst the worst though the majority attempt to gain employment, others undertake one-man enterprises like carpentry, tailoring, vehicle repair, kiosks or hawking food in the city streets to make a living. These are the people who are vulnerable to harassment any time from the law officers for usually they have no licenses for these activities.

The initially held belief in most third world countries from the time of independence was that the local people would take too long to come up with entrepreneurs to run the national businesses and take up

new challenges.

It was assumed therefore that in order for rapid development to take place the government had to play a very big role in the production side of the economy.

Parastatals were launched but these in most cases have failed to drive the economies as was planned (Economist Survey 1989).

In the meantime such impediments both legal and bureaucratic were put in the way of private entrepreneurs that the whole idea of a private sector was almost done away with. Thus in some countries it is said that "the private sector works at night when the government is asleep". (Economist 1989)(33).

During this decade of debt-crisis in the third world and privatization in the first world some governments have come to see that private enterprise is not a bad thing.

Indeed some countries that were undeveloped at the time of independence movement in 1960 have now become developed e.g. S. Korea, Taiwan, Singapore.

These countries put faith in their own populations to come up with competent world class entrepreneurs to exploit their own situations appropriately in order to gain from world trade and prosper(35).

Kenya is at present having a housing demand worth 2.2 billion shillings per year, that is not being met (Horizons 1989)(36). It was suggested that by encouraging the homeless and slum dwellers to use

appropriate technology and local materials they cannot only learn to house themselves affordably but also start a very viable industry.

To harness the energy of the under-employed in the urban areas the government will need to realise that it must take a strong stand and acquire land that is suitable for housing town dwellers and provide it at affordable rates to the unhoused.

At the same time the government will also need to review the housing (building) code to accommodate the type of houses that the poor can afford to build though possibly making provision or requiring that they be improved over time till they meet the appropriate health and aesthetic standards (3)(23). S.S. Yahya attributed the relatively low number of slums in Mombasa in 1970 to the acceptance of the "Swahili type House" by the colonial authorities (S.S. Yahya Thesis 1970) (4).

One organization that is already trying out this approach is Shelter Afrique. The project is based in Mathare and involves women who have grouped themselves into registered units. The aim is to improve their individual homes through learning the skills of brick and tile making first. Then using these skills to rehabilitate their dwellings over time.

Small loans for each woman are given out by sponsors for this, guaranteed by the respective groups (5).

Eventually the women groups are expected to continue using their newly acquired building skills and business acumen to run the businesses as an occupation as they go on providing materials and houses for the

other dwellers in the region (37).

The C.S.D. project (Child Survival and Development Project) has also focussed attention not only on a rural region (Baringo) but also on Kibera, a slum village in Nairobi (Lahti workshop 1987). The project is being implemented as part of a UNICEF sponsored strategy for promoting maternal infant and child survival in Africa.

A major factor considered necessary for the success of this strategy has been to attempt to link the university with the communities so as to enable the former to study practical problems of the community with a view to solving them.

This is because in many third world countries including Kenya, though society has invested heavily, "to train manpower and skills" in universities "the involvement of the universities in solving various problems of the communities has been weak due to limited supporting resources and lack of co-ordination" (LAHTI Workshop 1987) (6). The duration of this project is 1988 till 1994 June (6).

Though the project proposal for C.S.D. in Kenya has given the disease profile for (the rural) Baringo District, that for the urban slum area (Kibera has not been given. Another pointer to how little is known or how little importance is given to health status of slums regions is that C.S.D. project proposal does not give a figure for Infant Mortality Rate for Kibera while giving the National Figure and that for Baringo District (6). The baseline survey will presumably take care of this.

One of the objectives of the C.S.D. project is to do Community Health Status baseline survey as part of the health component (6).

In view of the poor public health facility network in Kibera (2 dispensaries for 200,000 people) (6), it should not be surprising if the disease profile is not known for Kibera. In comparison Baringo District with 259,000 people has 3 hospitals, 10 health centres, 38 dispensaries and 1 clinic. Ironically the lack of adequate water and sanitation can be expected to put the urban Kibera community at special risk in view of the crowded environment.

This is because the problem of deprivation in Peri urban areas has not been well recognized or incorporated into the planning of government and non-government agencies as well as that of rural areas.

One community Survey that has been done in Nairobi Slum Communities on the nutritional status of pregnant and lactating mothers has attempted to correlate nutritional status of slum mothers with birth weight of their infants (A.M. Pertet 1981 Thesis).(7)

A study done in an Indian City in 1982 (Agarwal D.K. et al 1982) (38).on morbidity in the under five children showed that morbidity is significantly more in the slum than in two other regions of the same city.

In Poona, India,Bapat M and Crook M (1984)(39), in a study called the Hutments Settlements study found that housing standards were related to the malnutrition rate in children.

The Wadi Riman Study (Bishrat & Twefika 1985)(40), in an Amman Squatter Settlement found that low income status was positively correlated to the Malnutrition rate and also to child mortality rate (CMR).

One interesting report by Meera Bapat entitled "A Sanitary environment is crucial to Good Health"(41), specifically stated that "the Environment (in the slums of Pune) has a much greater impact than maternal education, level, breast feeding or family income".

When children who were both malnourished and suffering from illness were assessed, the co-efficient of correlation was 65%. This compared to 5% co-efficient of correlation in case of malnutrition versus environment. "This demonstrates beyond a shadow of doubt that the environment is the PRIMARY culprit lurking behind the high infant mortality rates (IMR)". The study stated that the variations in environmental quality and IMR were closely related and observable on very small scales viz.: districts, streets or even households.

The Study concluded that the basic need was for political will to invest in and create a healthy home environment.

4.OBJECTIVES OF HOUSING STUDY

(a) Long Term Aims

- (1) Change attitude of people that Third World Countries will get developed without city development.
Historical evidence: geographical evidence.
- (2) Bring about awareness in general public as well as policy makers that the majority of third world population must of necessity continue to congregate into towns and therefore:
"The health status of pre-school children in an urban slum depends on the household environmental conditions.
- (3) Facilitate the realization that health problems of slum dwellers will become more and more common and of increasing public interest since slums population is growing faster than either true urban or rural population.
- (4) Facilitate exploration of the idea that if slums are well managed so that city growth is supported by institutionally implemented infrastructure then cities in the third world can become engines of development both human and economic on a nationally self sustainable basis.

BACKGROUND SITUATION AND INFORMATION

Interest in the health problems of poverty - prone groups in Kenya has existed since before independence (8) but was enhanced further primarily as a response to worries due to new policy changes as adopted by the government (under sessional Paper NO. 1 of 1986)(9). These changes include the concept of cost-sharing which, though not new (Situational Analysis Conference report 1989)(9), is to become adopted

by the government more explicitly and more widely. The measures are known as S.A.P.'s (Structural Adjustment Programmes) and have been recommended by the IMF (International Monetary Fund) to the government continuously since 1975 partly as a condition for continued financial support to the Kenya Economy (p. 59) (10).

The underlying reason for the need of this support is the continued poor performance of the Kenyan Economy since 1973 following the oil crisis.

Other measures investigated by the IMF & World Bank through the Kenya Government include the piecemeal devaluation of the "floating" Kenya shillings, reduction of state sector expenditure, additional taxation on mass consumption goods, (p. 60, (10)) removal of price controls, planning removal of food subsidies, improvement of public Sector efficiency etc.

These comprise the so-called " S.A.P. "; Structural Adjustment Programmes.

As a consequence of the implementation of these measures, which are considered necessary, fear has risen that the vulnerable segments of the population (composed of mainly of women & children) might be pushed into a worse state and their health status deteriorate further unless counter measures are instituted to protect them specifically. In order to address this issue, UNICEF (United Nation Children Fund) sponsored a seminar in Nairobi in November, 1988 to discuss how the various sectors of the economy would likely be affected by the intended measures and also how this would affect the vulnerable groups in the population. (UNICEF, Kenya Economic Association, 1989) . (9)

A review of various studies that have been done previously was used to provide information at the workshop. Where not enough information was available areas suitable for research were identified. Where enough information was available the report has come out with clear recommendations(9).

The vulnerable groups in the Kenyan Population were identified as follows (Dev. Plan 1979 - 83) (11).

- (1) Urban poor
- (2) Rural landless
- (3) Small holder farmers
- (4) Pastoral groups
- (5) Handicapped.

The UNICEF identified itself with the welfare of these vulnerable segments because the child was always the one to suffer the brunt of poverty and the condition of women would almost inevitably be reflected in the children of the UNICEF identified groups :

- (1) Women headed households
- (2) Women and Children of poor rural/urban households below poverty line.

UNICEF is also instrumental in the currently on-going CSD or Child Survival and Development for third world countries (see above) (6).

The conference report shows that the issue of effects of S.A.P.s on health of vulnerable segments was approached very holistically and taking account of the historic context. The report can be distilled into the answer that unless these poorer segments of the population are

pecially catered for in policy decisions then their health specifically and quality of life in general can be expected to deteriorate faster than at present as a result of the adoption of S.A.P.s

CURRENT STATUS, TRENDS AND FUTURE PROSPECTS - AN OVERVIEW OF SOCIO-ECONOMIC FACTORS

Firstly the report points out that since 1979, the rate of increase in government spending on basic services that includes health and education has been falling in spite of the high population growth rate. One explanation is that the government has continued to increase its recurrent expenditure through increasing personnel enrolment and their emoluments, and this has occurred at the expense of materials to provide services with (vehicles, stationary, building maintenance, etc).

The poor in the population, who depend more on government for health services, subsidized fees for aided schools, grants to install and maintain water projects, and other basic services have thus seen a deterioration of their living standards and spending capacity.

In many cases cost-sharing had existed even in health sector as people bought note paper and drugs and bottles in order to receive the "free" services. (10) Thus this reduction in Government spending on basic services has obliged the poor to pay more even when these services were free or subsidized.

Secondly the Government has increasingly relied on indirect taxes for more of its revenue than direct taxes viz.: Sales tax, V.A.T., Cess, etc. Since these indirect taxes are regressive it means that the

poor pay as much as the rich; no allowance is given for their lower income earning.

Third is the fact that the poor are earning a progressively smaller proportion of the country's income as time goes by, further aggravating their situation.

The poor are getting poorer and the rich richer. (10)

A fourth factor is inflation. This reduces everybody's spending capacity pulling more people below the poverty line. Before 1973 inflation was a manageable 3 - 4% per annum but since 1976 has increased to over 10% per annum. (10)

Other important aspects of livelihood that have strong bearing on the health situation of the vulnerable groups are:-

- (5) - Official Government policy as stated in 5 year development Plan.
- (6) - Food availability and affordability.
- (7) - Cooking fuel supply and cost.
- (8) - School fees and requirements and effect on budget as well as effect on dropout rate.
- (9) - Water supply.
- (10) - Transport cost in public means.

- (11) - Housing availability, affordability.
- (12) - Unemployment and underemployment and the informal sector.
- (13) - Health services availability, accessibility and affordability.

(5) OFFICIAL GOVERNMENT POLICY ON THE ECONOMY

As stated in the Five-year Development Plans, only the 1979 - 84 Five-year plan specifically considered how to cater for the vulnerable and poor members of the population nutritionally. However, immediately after the plan was launched the country's economy went into severe recession with accompanying serious inflation. The rate of unemployment increased.

The drought of 1984 made matters worse for pastoralists, smallholders, rural landless poor and urban poor who actually starved and only a government sponsored massive famine relief programme prevented deaths from starvation. (10)

Thus the policy aims of the 1979 - 1984 Five-year Development Plan to increase rural and urban employment and purchasing power by increased domestic investment failed to improve the nutritional status of the vulnerable groups.

No other Development Plan has tried to cater for the welfare of the poor in a similar manner. The vulnerable group have been treated as part and parcel of the general population as far as policy making is concerned. (9)

It should be noted that during the drought period (1983/84) implementation of Structural Adjustment Programmes (S.A.P.'s) was intensified, with devaluation of the shilling, reduction of government spending to reduce deficits and inflation and adoption of conservative monetary-policies.

The IMF and World Bank insisted on fiscal measures to restore balance of payments equilibriums in order to provide balance of payments support.

The result was a worsening of the situation of the vulnerable and poor, price hikes due to devaluation eroded the purchasing power all including the landless, the unemployed and the unemployable; increased the unemployment rate; reduced the quantity and quality of government services including health and education, etc. (9,10)

(6) FOOD AVAILABILITY AND AFFORDABILITY

In a study done in 1979 (The Urban Food Purchasing Survey (UFPS), the expenditure for a household of a minimum wage earner on "least cost diet" to meet the FAO/WHO daily dietary requirements was estimated. Projected to 1984 the figure was 1,060/= per month. But the minimum wage was 480/= per month. This obviously led to lower intake than necessary for the poor with consequent semi-starvation(10)

(7) COOKING FUEL AVAILABILITY AND COST

A Beijer Institute Energy Study (1980/81) revealed that the poor spend 30% of their income on the cooking fuel used by the poor (fire wood and charcoal). The richer group earning 1890/= per month or more spent only 10% of their income on cooking fuel used by them (mostly gas).

As a response, adaptation by the poor was found to lead to the adoption of quick cooking diets; thus, instead of maize and beans, to ugali with tea; or instead of ugali, porridge; instead of porridge, tea.

(10)

Thus due to the reduced purchase power of the poor, healthful diets have to be given up increasingly, due to the adverse economic performance in the country; the non-vulnerable were affected to a much smaller extent. (10)

(8) SCHOOL FEES AND FUNDS AND EFFECTS ON COST OF LIVING FOR FAMILIES AND EFFECT ON DROP-OUT RATE.

It was found by several researchers into the status of the school enrollment by district in the country that Nairobi and Mombasa fared very much worse than other districts (MOE Statistics 1987). (13) Thus Nairobi had a primary school enrollment rate of 63% and Mombasa 64% putting them 8th and 9th last in the country.

The National average was 94% enrollment. Given the greater awareness of the importance of education by urban parents, it was speculated that the urban poor and slum dwellers were not able to send their children to Primary School.

The payments required include Building fund, furniture fund, uniform, text books, PIA funds and transport costs.

Apart from these the Primary Schools increasingly required the child to have successfully completed nursing school which was not free either. (10)

In the matter of Pre-Primary School enrollment, Nairobi is again last of the 8 provinces with only 5% enrollment of the eligible pre-school age group (Ministry of Education (MOE) Statistics, 1987, WAITHAKA 1987) (15). Adjustment for possible error of assuming that the proportion of 3 - 6 years old is 22% of the population was made after consulting R.A. Henin's (undated population projections).(10)

These gave a pre-school aged population proportion of 15% for Nairobi compared of 22% for other Provinces. Thus enrollment ratio rose to 7%; however, Nairobi still ranked last in the 8 Provinces.

A conclusion was reached in the workshop that either the enrollment in pre-primary schools in Nairobi was suspect (under-reported) or else the dimension of the extent of urban poverty in Nairobi had been underestimated (10).

It should be noted that nursery and pre-primary school had been left to the private sector by the government which had almost no stated policy at this level of education and spent only about Kenya pounds 200,000 in 1985 for recurrent expenditure.

Whereas Nairobi suffered from inadequate pre-primary and primary school enrollment a greater proportion of Nairobi children gained entrance to Secondary school than in other Provinces.

(9) WATER SUPPLY

This is an important factor that affects health. In spite of the IDWSSD (International Drinking Water Supply and Sanitation Decade) which ended in 1990, the proportion of the population with access to adequate water supply was only 28% in Kenya, in 1989. In Rural areas, only 21% and in urban areas only 61%. Kenya was placed 6th in Africa when percentage of population who had access to adequate water was considered, behind such countries as Egypt (75%) Ghana (50%), Tanzania (50%) Zambia (47%), Somalia (46%), Nigeria 33%. One country worse off than Kenya was Uganda (28%) (9)

In spite of Kenya being a major exporter of water pumps to the region Kenya lagged behind (9).

Also in spite of this unenviable position the expenditure of the government to develop water supplies actually fell in 1982/83 i.e from 44 million Kenya pounds in 1981/82 to 2.6 million Kenya pounds in 1982/83 (10) (W/S. 1988).

Though the proportional expenditure was highly biased towards some Provinces and towards certain districts in these Provinces. It was apparent that seven of the ten districts with the largest budgets for water development were in arid or semi-arid areas. (10)

Thus the priority in allocation of funds went to areas with low density population.

The persistence of this trend would mean that the percentage of the population with adequate water supply in Kenya would be unlikely to improve in the near future.

It should be noted that only 35% of the country had proximity to surface water. Therefore boreholes should be considered the means most likely to allow supply of water for all by the year 2000 and it was suggested that the government could reduce cost of boreholes by reducing tax on the imported equipment.(10)

The Benefits of improved water supply are that the time spent by women and children fetching water from distant sources is saved and put to more productive use as stated in a recent publication on water-related diseases

(10) HOUSING AVAILABILITY AND AFFORDABILITY.

Economists have argued that the group at the core of housing problem is the urban poor.

Of Nairobi's population in 1985, 30% lived in slums and squatter settlements (10).

From before independence the government had adopted the view that the people should live in decent housing (8) but left it up to the private sector to provide.

The National Housing Corporation which catered mostly for the urban poor only built 2,500 houses annually of which 1500 were in Nairobi. The private sector concentrated on building middle class houses but rarely low cost houses. The hope was that the poor would move into houses vacated by the richer people was only realized in some instances (e.g. Eastleigh and Pangani). Usually "segmentation" resulted so that houses remained vacant for years in Golden Gate Estate while the poor crowded into other houses elsewhere. However, the buildings of only 1500 per year houses in Nairobi by the private sector could hardly be expected to cater for the high demand. (10)

It could be concluded that market had failed to provide the housing required.

It had been suggested that in recognition of this fact, Government should intervene (Kevin Lancaster 1971, Musgrave 1989). Of course this meant that subsidization of housing for the poor would result but this was defended as equitable in light of the fact that the rich often benefited from similar subsidy (H. Harms 1972, H. Stretton 1974:(21). Their argument was underpinned by the assertion that apart from the private benefit, by the poor, there would also be a benefit by the general public ("mixed public good").(10)

That the government was coming round to this view could be seen from the change in stated policy:

In 1966, Sessional paper NO. 5 stated that "If towns are not to develop into slums.... slum clearance must continue to form a major part

of the nation's housing policy." In the 1984 - 1988 Development Plan however was the following: "..... An estimated 30% of our population live in (slums). To upgrade these dwellings will involve beneficiaries to improve their housing structures and environment through self help. Assistance will be offered through materials, loan, technical advises, provision of water points and toilet blocks". (10)

"It was the World Bank, in fact that pushed to have the government change its policy so that by 1980 the Kenya Government had stopped demolition of slums."(10)

KENYAN HOUSING POLICYHISTORICAL BACKGROUND

In the Colonial era it was widely held that African industrial labour was considerably less efficient than that of the Asian or the European (20).

This was asserted in a 1957 edition of "African Survey" (20). Among the factors to be blamed for this was thought to be the migrant labour system practiced by the African labourer who maintained his family in the Reserve while working in the town and occupying a single room.

The original tendency was to enact laws that kept Europeans strictly apart from the African & Asian communities so as to protect the Europeans from epidemics. By insisting on building standards Africans were effectively prevented from building permanent structures in urban areas. This was largely under the jurisdiction of the Public Health Department. It was also made sure that public land in urban areas was only leased out to those considered able to finance very high standard housing.

The Africans who did not have such capital resources did not therefore qualify for the grants of land on which to build their own permanent houses. This was in spite of the governments acceptance of the principle that encouraging Africans to become urbanized would be good not only for industrial labour but also for pre-empting political unrest in the African population.

By 1940's the Government policy was that African urbanization be encouraged in line with recommendation of a report on urbanization in South Africa and Rhodesia which were toured in 1949 by the Deputy Labour Commissioner and the Commissioner of Local Government, on behalf of the Kenya government. Instead, however the Commissioner for Lands insisted on making more grants of land to employers and to encourage "african lodging Housing" rather than making grants of Urban plots to individual Africans(20).

The Carpenter report (1950) was accepted as the basis and principle of Kenya's Housing Policy in 1953 by the Legislative council and the Government. It provided for the reservation of land by the Lands Department in every urban area for African Housing; leasehold was to be given, minimal land rent to be charged where necessary. Buildings were to be allowed in temporary materials "provided a concrete plinth be mandatory and conversion to permanent material be done at end of 10 years". In case of public estates the occupiers were to pay economic rents.

In 1954 the carpenter committee recommended that the neighbourhood unit be adopted for African urban development just as was the case already for European urban areas. By 1955 the elements of a national urban housing policy were set and these were to persist to the present day. (Post Independence).

The East African Royal Commission of 1953 published it's Report in 1955 and made recommendations that coincided very well with those already adopted or implied by the Government policy in line with enhancing development of East Africa by encouraging rapid urbanization and modernization of the African populations.

SLUMS HOUSING BACKGROUND SITUATION AND INFORMATION

The existence in Nairobi of slums and shanty neighbourhood is a direct result of the urban housing shortage that characterises the less developed countries. The concern of the pre-independence governments that the housing requirements of the African urban labourers was often not met and led to the adoption of the recommendations of several study commissions. However these good intentions were never well implemented (8).

The Primary constraints were in the conditions upheld by the Public Health Department as to the requirement for building standards in towns. Stringent standards effectively prevented low wage earning Africans from being able to afford the capital to build in urban areas.

This resulted in the government having to sponsor housing estates (e.g. Ziwani Estate) and encouraged the employers to build houses for their workers.

As both Government and Private sectors claimed not to have enough resources for building these worker's quarters, the workers resorted to building sleeping-rooms or building temporary shelters at the periphery of urban areas. One exception to this trend was Mombasa, where an already established African Swahili/Arab land owning class precluded the widespread application of these preferred buildings standards. Thus "shanty type" housing and forms of land tenure were tolerated. "Majengo

This housing was and still is characterized by "elastic" building standards so that the house is built according to the means of the owner and then continually modified and improved as he earns his income (and indeed increases it) over time.

To this factor has been attributed the smaller scale of the squatter problem in Mombasa (4).

A second major constraint to the adequate provision of African housing by the colonial government was the reluctance of the Lands Department to issue title deeds to Africans.

This was on the basis that they did not have enough capital to build according to the standards in the building code. This was in spite of specific government adoption of the Carpenter Report's recommendations that land for African housing be set aside in all towns and urban centres in the country for putting up urban shelters. Actually the (previously segregated) by-laws to govern the housing in urban areas were unified by acceptance of this report. (8)

Nevertheless the two contradictory trends - one towards facilitating urban growth, the other to prevent it, have persisted, up to the present day. (8)

No major change on housing policy in Kenya had been made to change it significantly from that in 1955 to date even though independence occurred in between.

However, the building code was re-issued in 1965 by the then Minister of Housing though still with the same standards as before. The "defacto" situation on investments in new buildings however, was altered around the independence period.

The outlay in capital formation or building of new buildings (and housing) reduced markedly from just before independence till up to the 1970's. (20)

The expenditure by the Government on housing remained very little and was through the National Housing Corporation (NHC). Approximately 2% of the national budget was spent on housing manually. Singapore in contrast spent 20% of its budget annually on housing projects.

It is significant that the Royal Commission on Development in East Africa of 1955 chose to dwell on provision of housing as a major factor in the rate of development that the region would be able to achieve given its low endowment of natural resources. In most less developed countries however the link between proper housing development and economic development had not been emphasized as much. Thus in Kenya the policy up until 1984 - 1988 development Plan was that to prevent towns turning into slums, "slum clearance must continue to form a major part of the Nations' housing policy". (1966 Sessional Paper NO. 5). The 1984 - 85 plan, on the contrary, then advocated that upgrading of slum dwellings should hence forth be facilitated by "the provision of toilet blocksslum demolition is no longer a Government policy".

This change in Government policy should have augured well for both national development as well as for the health of urban dwellers. The root cause of the problem of people building slum and shanty grade dwellings was attributed to the unrealistically high building standards insisted upon in the urban areas of many third world concerns.

In many cases the standards were inherited from colonial governments who imported them (unchanged) from the colonizing countries.

Where the option was between living in a substandard house or in the open (because one cannot afford to rent or build a house that fulfills the requirements) people choose the former course of action. A suggestion that "non-static" building standards be adopted has thus been made. (23).

Non-static building code means that the house may be built up to a stage where it is habitable without being finished.

When the occupier raises enough capital to continue improving his house then he converts the roof from temporary to more permanent material, or the pour flush latrine to water closet type, or connects the septic tank to the sewage system. And so forth.

Thus the code could be evaluated in light of the practical constraints of low income, lack of customized building materials and lack of amenities like piped water and sewer lines in the face of insufficient housing for a rapidly growing population. At the same time the building code could be reviewed frequently in order to keep its

edicts balanced between the practical limitations and the ideals recommended. (23) (44)

The inability of either private developers or the government to put up sufficient housing for the lowest income earning urban dwellers had had several consequences. These includes overcrowding of families into small apartments, mushrooming and occupation of mud and wattle renting units, undesirable plots along river beds, on rocky ground and disused quarries amongst others. The few good low income housing estates in Nairobi that had actually addressed the problem were funded by International N.G.O.'s; examples being Dandora and Umoja estates.

The success of these estates had been "marred" by the fact that some of those people allocated the houses had either rented them out in part, in whole, or sold it altogether thus seemingly defeating the whole aim of the subsidy given to him as being a shelterless person.

But it has been pointed that it may be a good thing for a very poor person to convert the house subsidy (in this manner) since his real problem is insufficient income, which has prevented him from fulfilling his basic needs, housing amongst them.

The development plan of 1984 - 88 (p.164) suggested the modification of the present building code for housing standards.

In order to make it more realistic and performance oriented especially in the area of low cost housing J.S, Yahya and Associates (1981) did a study on the housing by-laws and came up with meaningful minimum standards. (20)

Recently published authorities on the situation of shelter availability in L.D.C.'s have supported this current view of government and architects such as Yahya in Kenya.

(23) (44)

The concept of elastic standards for residential buildings in urban areas has been recommended which entails the overhaul of foreign made and often obsolete building codes borrowed from now developed countries. The development of local materials to replace expensive, often imported, building materials through research and freeing of architectural norms was expected to reduce the cost of building houses.

DEVELOPMENT OF HOUSING & NATIONAL DEVELOPMENT IN THE INTERNATIONAL SCENARIO

The health of any community has always been thought to depend on its interaction with the environment. The ease of availability of basic needs like water, food, building materials and work and the affordability of protection from natural and man-made hazards often dictated the siting of settlements.

The perceived advantages of living in close proximity include the possibility of increased efficiency by specializing in a skill and exchanging one's products for those from other "specialists". Simultaneously the capability of given limited resources in an area to support a higher population can be enhanced by the resultant raised productivity. This explains why throughout history civilizations have always risen through the making of cities. Development has invariably been synonymous with increased urbanization.

It follows that even in East Africa the phenomenon of rapidly growing urbanization is not only necessary (for survival of the rapidly growing population) but also essential if national development is to take place. The main constraint then becomes that of urban planning. This should keep pace if not ahead of the explosion of city growth. Urban slums represent city or town growth without proper planning.

The paternalism with which already developed nations urge third world governments to impose policies aimed at keeping their populations rural and tilling the land is misplaced. Japan, during the aftermath of the second world war was similarly given the same advice to remain rural and concentrate on handicrafts (22). The Japanese ignored this advice to become a developed country with-in 15 to 20 years.

Singapore which in 1960 had a third world economy, spent approximately 20% of its budget on urban housing initially compared to 3% of the budget by Kenya (10).

Today Singapore is a developed country (one of the four "tigers" or N.I.C.'s i.e. "newly industrialized countries" that have developed in the latter half of the twentieth century). Other "tigers" are Taiwan, South Korea ,and Hong Kong.

The fact is that "a major portion of our population that still lives in rural areas in under-productive and under employed and longing to get out to an urban environment: migration to towns is a normal social process" (2, 22)

Development of agricultural productivity beyond the peasant farming stage is only possible with increasingly technological inputs which can be supplied only by urban areas large enough to provide these skills and also be agreeable places in which to live; (22) many people prefer low income jobs in a city to rural life. (22) We can therefore expect the tremendous urban growth to continue and even increase, in view of the high birth rate and current relatively low urbanization rate in East Africa compared to the rest of the world.

One of the main obstacles to a rational and more practical approach to the problem of a slum in Kenya as well as other third world countries is the Public Health department edicts as laid down in Housing by-laws.(23)(48). These often legislate against the use of locally available materials. The increased cost of buildings which results prevents the majority of would be house owners from building their own houses. (22) (23) (43) (48).

Since the by-laws mostly apply to urban centres these immigrants become an easily exploitable group who accept to rent dwellings made of temporary materials and with little or no provision for maintenance of hygienic standards because they need the work in the town.

It would therefore be interesting to document the correlation between the defects of housing conditions in which the poor urban groups well and their health status. This would either confirm the need for these housing standards or else show whether changes can be contemplated from a health point of view to support the economic basis of re-assessing the current by laws of urban housing. If so a way for

reducing the building costs incurred in urban areas would be opened, and justified on health basis as well.

This is important because many "temporary" houses in slums are made of mud and thatch and yet generations of citizens have had to be brought up in such conditions.

STUDY JUSTIFICATION

The issue of shelter is closely related to health. Approximately fifty percent of a persons life is spent within a shelter of one form or another, for children and women this shelter is often the home. It is likely therefore that much morbidity and mortality can be traced back to the condition obtaining in the habitat or home environment.

In L.D.C's such as Kenya much of the morbidity is known to be due to infectious diseases interacting with malnutrition and thus affecting infants and pre-school children the most. Furthermore it is not the whole spectrum of population that is affected but rather the poorer classes rather than the richer.

A past Ministry of Health survey in Kenya found that women and children (childbearing and under five year age groups respectively) account for more than seventy percent of the morbidity and mortality in the population. These are individuals who per force spend much of their time in the home environment. The curative services as a response to this monumental discovery have rightly put emphasis on the maternal and child health component.

In this age of Primary Health Care it is appropriate to think of how to prevent morbidity and promote health in this same population by addressing any causes that may be defined in the home. This is better than waiting to cure the ills after they have already developed and led to suffering and loss of productivity to both the home and the economy.

In the case of immunizable disease the effort is already being made and successfully so in Kenya. But the efforts against Diarrhoea, intestinal worms, acute respiratory illness, malnutrition, malaria and skin diseases, etc are yet to be made as successful.

These are ailments whose control or eradication in the community lies further outside the scope of health workers in the traditional (curative approach) set-up.

Water supply, sewage and rubbish disposal, income-earning capacity and housing standards all involve non-medical sectors that are so crucial to health and non health of the inhabitants. This may be even more true of the urban dwellers than the rural dwellers.

In spite of all the determined efforts and stated policies it has become obvious that the majority of our population will be moving to urban areas in the near future (by the year 2000 more than 40% will be urban dwellers in Kenya) This is an unprecedented rate of urbanization and involves all Third World countries.

If these city dwellers come to live in slum conditions then the health problem they will create will be great and will fall in the lot the Public Health Sector to solve. Health professionals need to begin to appreciate and document the various factors, illnesses, and conditions that come with living in overcrowded unplanned cities now so that in the near future they will be able to advise and act appropriately to facilitate decision makers and civic bodies to ameliorate if not anticipate and plan for the flood of problems that will arise.

East Africa today has the distinction of being one of the least urbanized regions in the world. This is due to the relatively sparse population and history of rural (or scattered) settlement of the land before the advent of colonialists. (1900 A.D). However the highest population growth rate has been recorded in this region with Kenya having one of 3.8% p.a. today.

Though the rate of rural-urban migration is high, it means that flexibility for planning where to promote urban development still exists for governments to direct the process of urbanization rationally and more advantageously. It would therefore be timely to point out now the ills of 'defacto' unplanned growth of urban centres that has resulted due to lack of firm government vision and/or urban planning and implementation, before the historical chance is lost.

As the government is interested in development of the economy and health of the people (which is intentioned with the former) the health sector can profitably research the linkage between housing and health.

STUDY RATIONALE

The precariousness of health in the pre-school children of a community is usually greater than for school age children and adults in the same community. Thus any adverse environment (healthwise) more clearly manifests itself through lowered growth rate, raised morbidity, and mortality, of the pre-school children than morbidity and mortality of the older age groups.

In a slum or poor environment this may be even more pronounced because the younger children spend more of their waking hours in the vicinity of the house than their elders who may go out to school or work in a different area.

At the same time the pre-school children have not yet developed resistance to the various noxious challenge.

Most importantly from the perspective of this research proposal the insults which may have been endured by the whole community are likely to have left a mark or record in the stunting and wasting of younger children.

For those who live in slums or shanty neighbourhoods of the third world a great danger to their health is posed by the unsanitary and haphazard living conditions which promote chances of infection, trauma, accidents and stress.

If ever public health doctors are to play a role in the prevention of bad living conditions by appropriate advice to civic bodies a convincing attitude acquired from studies will be needed.

The fact is that slums and shanty towns are fast becoming the norm of third world cities. More importantly the rural-urban drift has become a torrent with unprecedented growth of cities predicted for the near future in the third world.(13)

It can therefore be argued that the majority of patients in many third world countries will soon be coming from slums and shanty neighbourhoods. Many important public health problems will be based in slum environments.

The ratio of doctors and medical personnel of population in third world is unlikely to improve very rapidly.

A preventive and promotive approach could therefore prove the most profitable or effective in containing the expected future morbidity.

It would therefore be timely to equip not only health professionals but especially social workers with tools to enable them to efficiently earmark households or communities that likely harbour health hazards or problems of public health importance.

Such a predictive list of criteria could possibly be based on the "apparent" house structure, quality and maintenance; water source used, facilities for excreta disposal, solid waste disposal, drainage, etc.

If such a non-medical assessment scale or "environmental scale" of the household situation could be linked to the nutritional health status of young children medically determined, then social workers, interested lay people, public health nurses, and even medical doctors could be trained to use it to make effective "diagnosis" of ailing communities or households for needing closer or more immediate attention or intervention.

Intervention could preferably start at the level of decision making in the civic body concerned by the medical expert of the body whether public health specialist or public health technician etc.

This study is therefore intended to collect information on some easily observable housing variables that determine a household's hygiene status (i.e. the degree of the inhabitants protection from infective factors hazardous to health). It is also intended to collect information on the health status of pre-school children in the households sampled. By cross tabulation (correlation) the household environmental indicators that may be designated as predictive of health status in the household or community will then be determined and those indicators that are apparently not so predictive will also be found out.

RESEARCH STUDY: AIM

To determine the relationship between household environmental conditions and community health status in a peri-urban slum.

SPECIFIC OBJECTIVES

1. To determine the nutritional status of pre-school children by height for age (H/A), weight for age (W/A) and weight for height (W/H) in households of a low income community.
2. To determine the environmental conditions of the households in a low income community.
3. To identify the environmental determinants of the nutritional status of the pre-school children.

METHODOLOGY/MATERIALS AND METHODSREFERENCE POPULATION

Peri-urban Nairobi city dwellers, in Kayole, Embakasi Division. Approximately 800 households headed by members of a self help womens group in Kayole slum village and their neighbours in that village. A comparable community living in the adjacent site and service scheme of Nairobi City Commission at Kayole in Nairobi.

TARGET POPULATION

Households in the reference population which have at least one child aged between six months and five years.

SAMPLE SIZE

Estimating 35% prevalence of stunting as found in C.B.S. study and Maina study, then

KEY

$$n \geq \frac{(Z_{\alpha} + Z_{\beta})^2 (p)(q)}{E^2}$$

Z_{α} = value for 95% confidence interval

Z_{β} = Value for 80% power of test

$Z_{\alpha} = 1.96$ $p = 0.35$ $P =$ Expected prevalence rate for stunting

$E = 10\% = 0.1$

stunting

$Z_{\beta} = 1.28$ $q = 0.65$ $Q = (1 - P)$

$E =$ Expected margin of error in

minimal sample size per group = n estimation of P.

$$n \geq \frac{(1.96 + 1.28)^2 (0.35)(0.65)}{(0.1)^2} = 240$$

$n \geq 240$ households (children) per group.

USE OF CONTROLS

The population in the Kayole site and service scheme served as the control group for the study.

The NCHS (national Council for Health Statistics) data were used as the reference data to determine the survey sample's nutritional status.

(46)

STUDY DESIGN

A cross sectional Analytic Study using close ended coded questionnaires filled in by experienced medical students and the Principal Investigator. The methods were,

- (i) interviewing head of household or the responsible person in charge at time of visit.
- (ii) measuring the children.
- (iii) observation of the household structure amenities and surroundings as appropriate.

SAMPLING METHOD(a) For Slum Community:

List of self-help women group members used to identify the households fulfilling sampling criteria via group officials (secretary or chairlady) of the group.

Once these were exhausted then neighbours to the member of household, identified in this way, were also interviewed where they fulfilled sampling criteria.

At the end Nursery school children of right age were identified and then followed back home in presence of school teachers in order to achieve the minimal sample size required. (n = 240). 251 were sampled in slum area.

(b) For non-slum community (Control Group)

One nursery school teacher was recruited to guide the Investigators starting one at one end of the Phase I site and service scheme estate going through towards the latter phases. One middle-aged lady who normally worked as a local vendor of second hand clothes was engaged through the teacher. Thus the team split into two groups working parallel to each other till the required sample was achieved (n = 240). 250 were sampled in non-slum area.

PLAN OF INVESTIGATION AND DATA COLLECTION

Three Assistants were employed to assist the Principal Investigator in data collection. In addition two local guides were engaged to facilitate the team each day. The collection was done after splitting into two teams each assisted by a local guide.

Each team carried a tape-measure, a weighing scale and questionnaires as well as packed lunch.

After meeting at an agreed place in the morning each team would set off with its guide. An agreed time for meeting at the of the morning stint set. At first only about 12 questionnaires were filled per day but after some days 25-30 became the norm. Thus from 18th July data collection began in Slum Area (Soweto) and by 11th July, it was over. On 18th July non-slum area (site and service scheme) was begun and data collection was over by early August 1990. In order to hot up the pace a target was set for 15 households per team per day and this was met.

On arriving at a likely household after preliminary greetings and sitting by team the interviewers were introduced by the guide. Thereafter, one interviewer proceeded and the other was taken to the next household by the guide.

Once oral information had been elicited on the presence of pre-school aged child(ren) then recording would be done. The observable household characteristics were recorded and then one pre-school child randomly chosen for assessment of nutritional status.

Height was measured against door jamb and weight by means of the scale and pants to dangle the child from a strong cross-bar support. Any computations were all done later during analysis of the data (see the questionnaire).

Only stool collection was left and done later (separately) for stool ova/cyst investigation.

One child's nutritional status was taken to represent one household's nutritional status.

re-testing Questionnaire

This was done on 10th April 1990 in the presence of one external supervisor. A few corrections were made on the basis of this pre-test for specific objective.

Discussion of Choice of Nutrition Status Indicators in Form of S.D. Scores in this Study

Suitability of using W/H, W/A and H/A.

In the Child Nutrition Surveys 1977,78,82 by the Central Bureau of Statistics NSI, NSII, NSIII respectively, the used to assess child nutrition were Weight for Height, Height for age and weight for age i.e. W/H, H/A, W/A.

Analysis of "Lumac" used as an index in NSI showed that it did not contribute extra knowledge over and above that gained from age weight and height. NSII. Lumac was therefore not included as an index in this study.

A WHO working Group in 1975 convened to advise on the use of anthropometric indicators of nutritional status in surveys for nutritional assessment recommended as follows.

- (a) In the assessment of nutritional status in cross-sectional studies primary reliance should be placed on weight for height W/H as an indicator of the present state of nutrition and on height for age (H/A) as an indicator of past nutrition.

(b) The data for each individual child in the survey (sex, age, height, weight) should be used to place that child in the appropriate centile category of the reference population of the same age (or in the case of weight for height of the same height). Children are then grouped according to their centile scores..... (see Appendix 1)

1) Suitability of W/H, W/A, H/A as indicators WHO work group recommendations (1975).

(c) In a population where many children lie outside the extreme centiles of the reference population their weight for height and height for age should be expressed as multiple of the standard deviation of weight for height or height for age of the reference population, rather than as percentages of the median as was usual, when using the "Harvard Standards". The advantage of relating results to centiles or standard deviations of the reference population arises from the fact that weight for height in the reference population and probably in all populations has a skewed distribution.

Thus a weight for height of 80% of the median at 12 months does not have the same significance as a weight for height of 80% of the median at 48 months.

(d) The data recommended by the US National Academy of Sciences for use in the USA are most suitable for use as an International reference. (Rather than Harvard Standards). These data are drawn from a defined sample of American children which contains between 300 and 1,600 children in each yearly age group. (46)

Relevance of reference data to children in Kenya:

Part (b) of WHO work group recommendations on indicators for Nutritional Surveys (1975). For example suppose a 15 month old child has a length of 77 cm. From table of the median (Or 50th centile) value of length is 79.4 cm., the 20th centile value is 77.1cm (20% of the 15 month old children in this reference population are shorter than 77.1 cm) and the 10th centile value for length at 15 months is 76 cm (10% of the 15 month old children in the reference population are shorter than 76cm).

The length of the 15 month old child is thus between the 10th and the 20th centiles of the reference population.

More specifically it would be possible to say that the height for age centile score of the child would be 19, indicating that 18% of the reference children are shorter and 81% taller than this child. By a similar process centile scores of weight for height and weight for age can be calculated.

However in this study standard Deviation score was used instead See pg. 71 "Data Analysis".

The WHO working groups did draw a distinction between the use of international reference data for grouping observations so that they are intelligible and comparable and the use of reference data as a standard or target. For the second purpose the question arises whether the growth rate of children in U.S.A., an industrialised country is a realistic target in a country such as Kenya where the population may have different genetic and environmental background.

In the case of Kenya a recent survey of well nourished children in Nairobi Nursery schools provides evidence that children from relatively well off families in Nairobi have weights and heights very similar to those of American children.

Other studies have also proved that there is no genetic difference between caucasian and Africans as to the potential for growth in children. The reference data is therefore relevant to Kenyan children.

Age Assessment

Age was recorded in months to the nearest month

Use of Road to Health code was made to verify age wherever possible.

The CBS Nutritional Survey II (1978/79) stated that a fairly precise knowledge of the child's age was necessary for compilation of age related nutritional indices.

An error of plus or minus three months in the age of a child who was about 18 months of age would yield an error in the weight for age index of about plus or minus 5%. Errors of larger magnitude were possible when birth date is established only by recall. However the results of the first nutrition Survey (NSI (1977) (5) in which a question on the quality of the age information was included indicated that errors in age did not significantly affect the results.

Nutritional status of pre-school children by W/A; -

Using spring balance

Calibrated once a week zeroed each morning

Reading to nearest 0.5kg

Weight Assessment

Weight was be measured using a double spring circular balance calibrated from 0 to 25 Kgs. in 100 gram (0.1kg) divisions. A pair of plastic trousers, a harness for supporting children during weighing was provided.

The weight was read off the scale, once the child had been raised off the ground, to the nearest 0.1kg (100gms) and recorded in the questionnaire in the space corresponding to his/her name.

The spring balance was Zeroed every morning and also was tested with standard weights once a week.

Height Assessment

Use of a centimeter tape measure was made. It was fixed to one side of the door, along the inner jamb for any that could be made to stand without struggling. The child's length was read off the tape measure to the nearest centimeter. The length of children too young or too unco-operative to stand was measured by laying the child on a suitable table in the house. With the feet placed so that the soles of the feet lay flush with the edge of the table, the head was pressed down and a pencil used to mark off the length of the child on the table at a perpendicular touching the caput. The tape was then used to read off the length to the nearest cm. on the table.

In this way the equipment needed was reduced drastically. The length of each child could have been converted to height using the formula $\text{Height} = \text{Length} - (3 - 0.03846 \times \text{Age in months})$.

The equation was derived from the difference between the length and the height of the reference population aged between 24 and 36 months and gives a close approximation of a child's height from his length up to 60 months.

In this study the conversion was not carried out since, "If length is measured only to the nearest cm. the effect of this correction is small and has little effect on the overall results"(24).

Age Chosen for Survey

6 months - below this age the nutritional status is normally good as the baby is breast feed and thus gets first class protein and energy diet. Beyond six months when supplementation and weaning has been started then it is likely that signs of malnutrition may begin to show.

60 months - upper limit of sample group is chosen because by this age the "crisis of weaning" is long over (it occurs between one year to 2 years) (24) (29) and the child is well adapted to the environmental challenges that may have caused much morbidity (diarrhoea and upper respiratory tract Infections URTI) at the younger ages (29). Analysis of CBS 2nd Nutrition Study (1978 - 1979) data confirms this explanation as the proportion of stunted children is highest in the 12 - 47 month age group and lowest in the 6 - 12 months and 48 - 60 months age group.

Analysis revealed that the reduction in stunting in the 48 - 60 months age group is not selective mortality for stunted children in preceding age groups but rather "catch-up growth" in the 48 - 60 months age group.

Hence this implies markedly reduced invulnerability of 5 years old children to their environment, compared to young children, with consequent improvement of growth. (24)

Data Analysis Calculation of Nutrition INDEX

Height for Age (H/A) is an indicator of past nutritional status. H/A was calculated in terms of standard deviation (S.D) score away from the median height of the reference data for each given age. The proportion in each group falling below the score of median minus 1 S.D was taken as being of stunted growth.

The same procedure was used to determine weight for age and weight for height indices as above.

Weight for Age

Is an indicator of nutritional diversion where weight for height maybe normal. (29)

ETHICAL CONSIDERATIONS

It was expected that many sick pre-school as well as older children would be encountered during the survey. Already during the preliminary surveys requests by the group representatives for the investigator to try and deal with some of their health problems had been made. In order to gain their co-operation and also due to ethical considerations, it was proposed that a field office be set up where-in the ill children could be reviewed and treated for minor ailments or else for referral letters to City Commission or Kenyatta National Hospital. Later on the self help groups could continue with "clinic" at their own cost because the consensus for such a facility seemed to be very strong in the organizing committee. Many referrals were made to Kenyatta National Hospital, Jericho Health Centre and Umoja Health Centre.

See the Referral form used for such cases during the course of the Study in Appendix NO. 4

STUDY METHODOLOGY

DATA ANALYSIS:- METHOD USED.

In order to assess each survey group for nutritional status the individual measurements for age, height and weight of the sampled children were compared one by one with the appropriate child in the reference (N.C.H.S.) population. For a child of a given age, the reference data for children of the same age and sex was used to place his/her height (respectively) in the appropriate category ranging from median to Median minus 1 S.D, Median minus 1 S.D. to Median minus 2 S.D. and, Median minus 2 S.D. to Medium minus 3 S.D. Or median height plus 1 S.D.,.....to plus 2 S.D.

This was done for each child by use of computer programme S.P.S.S. (Scientific package for the Social Scientist) which had had the N.C.H.S. standards programmed into it.

In this way height for age (H/A) categorization in terms of the variation of the observations by S.D. away from the reference median height was obtained using appropriate N.C.H.S. (National Centre for Health Statistics) data.

An example to show how a child is classified for weight by height index in terms of standard deviation or "S.D", score with respect to the reference median weight for height of reference population of same height.

Thus a subject NO. 1 is a boy of height 69 cm. weighing 6.3 Kg. The S.D. distribution of weight for height in the reference population is as follows:-

Table (i) a

HEIGHT IN CM	S.D. SCORE	-3 SD	-2 SD	-1 SD	MEDIAN	+1 SD	+2 SD	+3 SD
= 69	WEIGHT	5.6	6.6	7.5	8.5	9.8	11.1	12.4

The value of the S.D. is different below the median and above the median because the distribution of the group W/H is skewed.

Thus in case of NO. 1 weight 6.3 kg. falls below the median (8.5 kg). Thus the relevant value of S.D. = $8.5 - 7.5 = 1.0$.

The individuals' standard Deviation score is thus:-

= SD. Score No. 1 = Weight of subject - median weight for height of

height of reference population
Value of S.D. below median weight for reference
population.

$$= \frac{6.3 - 8.5}{1.0} = - 2.2.$$

This observation (individual) can be placed in the category of median - 3 S.D. to M - 2 S.D. to M - 3 S.D. to M - 2 S.
Another example of how to categorise the weight for height of individuals sampled in terms of S.D. Score vis a vis reference weights for height.

Individual NO. 2 is a girl 93.5 cm high weighing 17 kg. The S.D. distribution of W/H in the reference population for girls 93.5 cm tall.

Table (i) b

HEIGHT IN CM = 93.5	S.D. SCORE	-3 SD	-2 SD	-1 SD	MEDIAN	+1 SD	+2 SD	+3 SD
	WEIGHT KGS.	10.1	11.3	12.5	13.7	15.2	16.7	18.3

The S.D. value above the median = $15.2 - 13.7 = 1.5$ kgs.

The S.D. score for individual NO. 2.

= S.D. Score = $\frac{\text{Weight of subject} - \text{median W/H of ref. population}}{\text{Value of S.D. (above median W/H)}}$

$$\text{S.D. Score} = \frac{(17 - 13.7)}{1.5} = + 2.06$$

This value can be placed in the category of median +

2 S.D. - median + 3 S.D.

When this had been done for all subjects then in each surveyed group the following population of pre-school children was placed into the categories median + 1 S.D. to M+ 2 S.D.

Median to Median + 1 S.D.

Median to M - 1 S.D.

M - 1 S.D. to M - 2 S.D.

M - 2 S.D. to M - 3 S.D.

The indices for nutritional status were calculated for each child representative in terms of S.D. score and grouped (categorized) as above.

Thus a "tool" was created which could be used to test the effect of variation in environmental conditions in the households on the distribution of lowered nutritional status in a population.

The cutoff point chosen to differentiate well-nourished from poorly nourished was Median - 1 S.D. and below for W/A and H/A.

The three different indices W/A, W/H, H/A gave different proportion for malnutrition for the two populations.

Viz:- Table (ii) a Malnourished percentage

W/H, H/A, W/A Compare data with National NCHS and other study results at end.

	Study Group (Slum)	Control Group	Average
Index W/A	15.4% (<M-1 S.D.)	8.4 (<M-1 S.D.)	11.9%
H/A	40.1 (<M-1 S.D.)	23.6 (<M-1 S.D.)	32.8%
W/H	14.9% (<M)	8.9 (<M)	11.9%

Table (ii) a - "Degree of malnutrition in terms of each index, by group and average for combined data.

N.B. For W/H the cut-off point was chosen as the median itself.

For W/H no child was found to be less than M - 1 S.D. and therefore this index was discarded from further analysis.

In this way it was discovered that the study group had 15.4% wasted c/f 8.4% (Control). The study group had 40.1% stunted c/f 23.6% (Control).

Categorization of variables for household environmental conditions. This was done at the time of questionnaire development and pre-coding was done using the categorized and "graduated" or scaled environmental indicators. "Graduations", of the indicators had been placed in descending order from "good" to "bad" where possible in the questionnaire during the design stage. See Annex 2 - Questionnaire used.

During Analysis, where necessary in order to try to clarify trends adjacent graduations were merged. It should be noted that in order to facilitate computer analysis the format of filling in the questionnaire had been designed so that the appropriate number was put in the box adjacent to the question for a given variable. The answers to be chosen from were listed next to each question.

Of all the environmental variables included in the study only some were expected to yield data relevant to the hypothesis "Pre-school child nutrition status is better in non-slum than slum households".

Where-ever the p-value was found to be significant the percentage of malnourished falling under each category of the environmental variable was calculated. Then a histogram was drawn to check what type of correlation had been found to be significant. At times the order of graduations had to be changed in order to get an ascending or descending line in terms of nutrition status.

Where more malnourished fell under poorer conditions, it was concluded that poor environmental conditions probably played a causative role, provided that the level of significant was high ($p < 0.05$).

Those environmental variable found to have qualified on above terms.

(a) for all three nutrition indices - p value significant

i.e. $p < 0.05$ for X squared test.

(1) Type of cooking fuel used predominantly.

- (2) Floor standard.
- (3) Household excreta disposal method.
- (4) Hand washing after defecation.
- (b) for only two indices of nutrition. - p value significant
- (5) wall class.) W/A and H/A
- (6) Small child excreta disposal) W/A and H/A
- (7) Drinking water quality) W/A and W/H

However, all the variables were assessed for trends where ever a significant Chi squared test was found.

DATA MANAGEMENT APPLIED

For the study group out of a total of 252 household sampled in the slum area of Kayole 242 were included at the "data cleaning" stage. The other ten households were excluded for reasons of missing data of crucial aspects like the anthropometric details. However the minimal sample size $n = 240$ was achieved.

For the control group out of a total of 255 households sampled in the adjacent site and service scheme at Kayole, 250 were included at the "data cleaning" stage. The five households excluded were due to missing vital data like childs' anthropometric details. However the minimal sample size $n = 240$ was achieved.

The data was analysed by computer using an SPSS programme ("Statistical Package for the Social Scientist").

In order for the computer to be used the data had been fed into it by a computer clerk (Data entry).

(1) Nutritional Status:

The slum group had lower nutritional status than the control (non-slum) group.

The percentage of malnourished children for each group was calculated to give the rate of malnutrition in each group in terms of each of the three indices respectively.

For height for age the cut-off point was chosen as an S.D. score below Median minus 1 S.D. Thus the study group had 40% stunted (97/242) the control group had 23.2% stunted (58/250).

For weight for age the cut-off point was chosen as an S.D. score below minus 1 S.D. as well. The study group had 15.4% wasted (37/242) the control group had 8.4% wasted (21/250).

It was realized that the degree of wasting found was less than expected, according to the weight for age parameter.

N.C.H.S. data would give 16.5% wasting for normal reference population according to ideal Gaussian distribution. For stunting the results were as expected according to other previous studies.

The control group had almost half the rate of malnutrition of the study group in terms of both stunting and wasting. This was as expected since the two groups live very differently though they are adjacent to one another geographically. The next question that arises is:

"Do the environmental conditions prevailing in the households of the two groups differ significantly enough to explain some of the difference in nutritional status"?

Some factors contributing to the households environmental condition that were investigated were:

Those that contributed to:-

Noxiousness of Indoor air quality

- type of cooking fuel
- proximity of cooking place to sleeping rooms
- crowding of sleeping rooms.

<u>DEGREE OF PROTECTION FROM USE OF BIODIESEL</u>			
<u>Degree of Protection from natural elements</u>			TOTAL
-	wall standards	74%	110%
-	roof standards	41%	104%
-	floor standards	21%	101%
<u>Degree of Protection from Contamination with pathogens.</u>			
-	drainage of sewage away from house		101%
-	solid waste disposal		100%
-	excreta disposal (adult and small children both)		
-	hand washing after defecation		
-	water quantity used per capita		
-	water quality used.		

RESULTS FOR STUDY

TYPE OF COOKING FUEL USED

The study group had a more diverse selection of fuels preferred in different households. The control group exhibited less diversity. See Table 1a. below.

Table 1.a.

Fuel used distribution in households of each group.

TYPE	P E R C E N T A G E U S E . B Y G R O U P		
	STUDY GROUP	CONTROL GROUP	TOTAL
PARAFFIN	59.3% (43)	74% (185)	(328)
FIREWOOD	19% (45)	4.5% (9)	(54)
CHARCOAL	10.8% (26)	3.1% (7)	(33)
SAW DUST	9.5% (23)	16% (42)	(65)
OTHERS (GAS)	1.4% (4)	2.4% (6)	(10)
TOTAL	100% (241)	100% (249)	(490)

Chi - square (5) = 46.4 p = 0.0000

Both groups preferred paraffin the most, with control group preferring it more. Second choice for study group was firewood (19.1%) then charcoal third (10.8%) sawdust fourth (9.5%) gas and electricity negligible. The control group had paraffin first (74%) sawdust second (16%) firewood (4.5%) charcoal (3.1%) and others negligible (gas, electricity = 2.4%).

The difference in preferences was high and statistically significant Chi - square = 46.41072, p = 0.0000. See table 1a).

One surprising finding is that charcoal is not the first choice in both groups as the Beijer report (10) found in 1980 in Kenya.

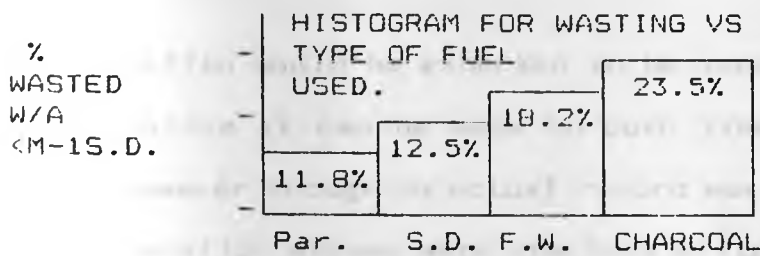
It is however used much more by study group than control group. Also firewood is used widely by the study group as well, four times as much as in the control group.

The sawdust that is second favourite for the control group is also used by the study group.

The control group and the study group showed no correlation between malnutrition and the fuel, when each was analysed separately. However there was positive correlation when the data for both was pooled and Cross-tabulation done together. Thus, the W/A index gave as Chi-Squared (5) = 32.6 p=0.0063.

There was higher incidence of wasting (W/A less than M - 1 S.D.) for households using charcoal (23.51%) than for other fuels arranged in order: Firewood (18.2%), sawdust (12.5%), paraffin (11.8%).

FIGURE 1 b.



This is exactly the order one would expect if these fuel predispose to wasting by causing increase URTI rate through their irritation to respiratory mucosa. (47)

The Cross-tabulation for height for age index H/A gave a non-significant result p=0.08.

Charcoal is traditionally considered as useful for warming the house and is often used even within small rooms and often where no chimneys are available.

Firewood would be unlikely to be brought into a small room unless a chimney was available because of the smoke. Thus it is more likely to be used in such ways that the rate of affected children maybe less, even though it produces more S.P.M. (Suspended particulate matter) upon combustion, compared to charcoal and other biomass fuel. (47)

Sawdust once well lit would burn like a jiko (charcoal brazier) giving off few obvious fumes to irritate the mucosa. On this basis one would have expected it to be as harmful as the charcoal. But possibly due to the need to put in a piece of wood to stoke the fire it was likely that a non-sleeping room fire place would be used. This may have accounted for the lower prevalence rate of wasting in households using Sawdust fuel (12.5%).

Paraffin would be expected to be associated with the least rate of wasting since it can be made to burn like gas if a pressure stove was used. However though no actual record was kept it was noticed that many of the paraffin stoves were the less efficient "smokey" ones which burn with a large (variable) flame and produce copious black smoke. This type of stove still produces fewer S.P.M. than fuel wood (biomass fuel) (47)

Thus the rate of wasting in households using paraffin (11.8%) was about half that for those using charcoal (23.5%). This was an interesting finding because the control group which used the fuels correlating with the least wasting (paraffin 74%, sawdust 16%) did indeed have less wasting viz: 8.4% the compared to 15.4% for the study group.

Table 1.c.

DISTRIBUTION OF FUEL TYPE BY GROUP

Group	Paraffin	Sawdust	Charcoal	Firewood	Other	Total
Study	59.3%	9.5%	10.8%	19%	1.4%	100%
Control	74%	16%	3.1%	4.5%	2.4%	100%

Thus control group having half the rate of wasting had one third the rate of using less desirable fuels (10%) while the study group used these at a rate of (30%), charcoal (10.8%) plus and firewood (19%) giving a grand total of 29.8% of study Households using noxious fuels.

*See Table 1C above.

Cooking Fuel and Height for Age Index

For the other index for nutrition status (H/A), there was found no statistical by significant distribution. There was nevertheless an interesting association which resembled that elicited vis a vis W/A (for which there was statistical significance).

Table 1.d.

Type of fuel vs. rate of Malnutrition for Combined Data
 n = 496

Cooking fuel u s e d	"Degree of Noxiousness"	% stunted (H/A <M-1S.D) in each category
Paraffin	1	30%
Sawdust	2	29.2%
Charcoal	3	41%
Firewood	4	45.4%

Chi-Square (15) = 23.074; p=0.083

The stunted vs fuel correlation seems to confirm the trend though the p-value is too high for statistical significance. It may be fair to comment that some of the householders do change the type of fuel they cook with depending on availability. For example paraffin often runs out at petrol stations in Nairobi and customers have to use other fuels. There is a reversal of the positions of the two most suspect fuels, firewood and charcoal, but the new order is what one would expect according to studies on biomass fuels. (47) Firewood has higher emissions of S.P.M.'s in most conditions compared to that of charcoal. (47).

However what needs to be investigated further is how the use of charcoal is associated with other healthful practices. Possibly use of charcoal may be associated with inability to carry out long term planning. Possibly those using charcoal preferred it because of cold houses that required warming, while food was cooking, for which paraffin would have been inadequate. After the data was pooled for both populations the association showed through much more clearly.

Proximity of Cooking Place to Sleeping Rooms:

More study group (slum) households had their cooking areas located outside the sleeping room/s than the control (non-slum) group households.

Table 2.a.
PROXIMITY OF SLEEPING ROOM TO COOKING AREA BY GROUP

Group	Kitchen within sleeping rooms %	Kitchen outside sleeping rooms %
1 (study)	75%	23.3%
2 (Control)	87%	11%
Chi. square (4) = 9.95	p = 0.04	

This was opposite of the expectations or assumptions on which the study was based whereby those households in properly planned neighbourhoods were expected to have better house plans with kitchen separated from the rest of the house as is recommended for good domestic environment. (29)

It was found that wasting correlated with distance of cooking area from sleeping room in both groups.

But the trend was insignificant statistically at the $p = 0.05$ level, for the control group. This could be explained by the fact that those with high rate of indoor (in bedroom) cooking also tended to use paraffin rather than charcoal or firewood. This is a question that can be further pursued. However for the study group there was significant correlation between the distance of the cooking area away from the sleeping room and wasting.

The closer the cooking place to the sleeping room, the higher the wasting. See Table 2c and 2 d (ii) below.

The control group showed a hazy trend confirming that in the study group, but two options were available with most doing their cooking within the sleeping room. Because their housing was nearly all characterized by being a block of single rooms facing onto a narrow corridor in a double row with the toilets and standpipe at one end of the corridor and outer access door at the other end. The windows opened out onto the corridor because each block was planned to be back to back with neighbouring blocks on three sides. The second option was to cook in courtyard or in sitting room in the few that had 2 roomed apartments. This lack of variation in possibilities open to control group households regarding the location of cooking place could account for the poor correlation of cooking distance from sleeping room, with wasting.

Table 2.b.

Frequencies for Location of cooking area with households sleeping room by group

GROUP	LOCATION OF COOKING AREA					TOTAL
	NOT IN COMPOUND	SEPARATE HUT	IN OPEN	SEPARATE ROOM IN	WITHIN SLEEPING	
STUDY	-	5	2	47	167	221
CONTROL	1	2	2	23	175	203
TOTAL	1	7	4	70	342	424

Chi squared = 9.95 D.F. = 4 P = 0.041

Table 2.c.

Cooking area proximity to sleeping room vs. W/A index S.D. Score for study group n = 221

DISTANCE OF COOKING AREA	W/A S.D. SCORE GROUPING				
	> MEDIAN+1SD	MEDIAN - MEDIAN+1S	M TO > M-1SD	M-1SD- M-2SD	TOTAL
Separate hut	-	3	2	-	5
In Open	1	1	-	-	2
Different room Same House	-	22	18	7	47
Within Sleeping Room	6	68	66	27	167
Total	7	94	86	34	221

Chi squared = 18.2 D.F. = 9 p = 0.0323

Table 2.d.(i)

Cooking Area Location	% Wasting W/A < M-1SD
Separate hut	0%
In Open	0%
Sep. room same room	14.4%
Within Sleeping room	16.1%
TOTAL	

Table showing proximity of cooking area vs. % wasting, (W/A < M - 1 S.D.) For Study Group n = 221. Calculated from data in Table 2c above.

Table 2 d.ii showing proximity of cooking area vs. wasting, W/A < M-1S.D.

For Control group n = 201. Extracted from table 2d iii below)

	Wasting W/A < M - 1SD
Cooking Area	W/A < M - 1SD
Seperate Hut	0% 0/2
In Open	50% 1/2
Sep. room same hs	0% 0/23
Within Sleeping R	8% 14/173
TOTAL	

Table 2.d.iii

	W/A Index S.D. SCORE GROUPING			
Cooking Area	> Medium	Medium -M-1SD	Medium-2SD	TOTAL
Separate Hut	-	2	-	2
In open	1	-	1	2
Kitchen House	18	5	-	23
Within Sleeping Rm.	117	42	14	173
Total	137	49	15	201

Chi square (&) = 14.33 p = 0.0735

CROWDING INDEX:

88

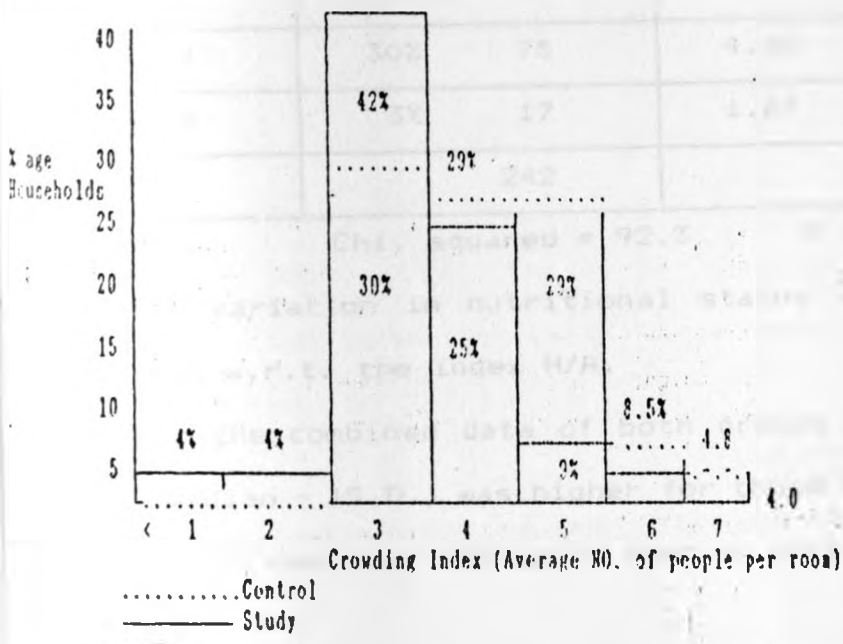
Table 2.e. Crowding Index by (percent) frequency intervals
Distribution by Group.

GROUP	CROWDING INDEX INTERVALS								TOTAL
	< 1.0	< 2.0	< 3.0	< 4.0	< 5.0	< 6.0	< 7.0	> 7.0	
STUDY	11 (4.2%)	11 (4.2%)	84 (42%)	65 (26%)	26 (9%)	12 (4.2%)	9 (4%)	10 (4.1%)	242
CONTROL	3 (1.3%)	11 (1.3%)	75 (30)	72 (26%)	50 (29%)	20 (8.5%)	12 (4.8%)	6 (2.1%)	249
TOTAL	14	36	36	159	137	76	21	21	491

Chi Squared = p =

HISTOGRAM 2.f.

Frequency Histogram for crowding index intervals vs frequency distribution of household (percentages) by groups.



There was found to be no significant correlation for each group between crowding index and nutritional status measured by any nutrition index.

Roof Class and Nutritional Status.

Roof Class definitely differed between the study group and the control group households.

Table 3.a.

TABLE SHOWING DISTRIBUTION OF HOUSEHOLDS ROOF CLASS BY GROUP.

	STUDY GROUP		CONTROL GROUP		COMBINED
EXCELLENT 1	59.%	130	92%	230	92% 360
GOOD 2	8%	20	2%	5	25
FAIR 3	30%	75	4.4%	11	17.5% 86
POOR 4	3%	17	1.6%	4	4.3% 21
TOTAL		242		250	(100) 492

Chi. squared = 92.3 P = 0.000

The variation in nutritional status was correlated to the roof standards w.r.t. the index H/A.

For the combined data of both groups it was found that stunting (H/A < median - 1S.D.) was higher for those households with poor or fair roofs (37%) than for those with good or excellent roofs (30%) see table

Table 3b (H/A by roof standard) Chi. squared = 14.3 p = 0.0264

Table Showing Distribution of Height for Age Standard Deviation (SD) Score by Roof Class for combined data n = 492

		Height for Age Index S.D.			Score	% stunted
Roof class	Score	> Median	Median - -1S.D.	Median - M - 2SD	Total	H/A < M - 1SD
Excellent	7 - 8	163	91	106	360	30%
Good	5 - 6	6	10	9	25	36%
Fair	4	28	29	29	86	33.7%
Poor	2 - 3	4	6	11	21	52%
Total	-	201	136	155	492	-

Chi square (6) = 14.3 p = 0.0264

The comparison of roof standard versus nutritional status in terms of weight for age showed no correlation. However for Height for age there was correlation but this became apparent only after data was correlated as one unit instead of two.

Possible Explanations:

It was noted that the survey was carried out during the dry season. Secondly it is possible that categories do not classify the roofs in the best possible manner.

In conclusion:- Though not much inference can be made from the results on roof class there is hope that under slightly altered conditions and possibly very large sample sizes, more significant correlation may be found.

Wall classes versus Nutritional Status:-

There was significant difference in the class of walls to be found in the households of the two groups. The study group had the modal class as NO. 2 (good walls) = 48%. The control group had the modal class as NO. 1 (excellent walls) = 81%.

Table 4.a.

Table of wall class Distribution by Group

WALL CLASS	1	2	3	4	TOTAL
GROUP	EXCELLENT	GOOD	FAIR	POOR	
STUDY (1)	(12%) 29	(48%) 117	(32.5%) 79	(7.5%) 17	242
CONTROL (2)	(91%) 228	(6.4%) 16	(2.5%) 6	-	250

Chi. Squared = 310

P = 0.00

In the case of the study group, the household wall class was correlated significantly with wasting in the household. When measured by weight for age index the rate of wasting was highest in class 1 households, 24.1% median in class 2 and 3 households (13.6% and 15.1% respectively), and rate of wasting was lowest in class 4 household (11.8%). This is somehow opposite of expected. Chi Squared = 27.7 p = 0.0011.

Histogram 4.a. (ii)

wasted versus each class of walls for Households of Study Group.

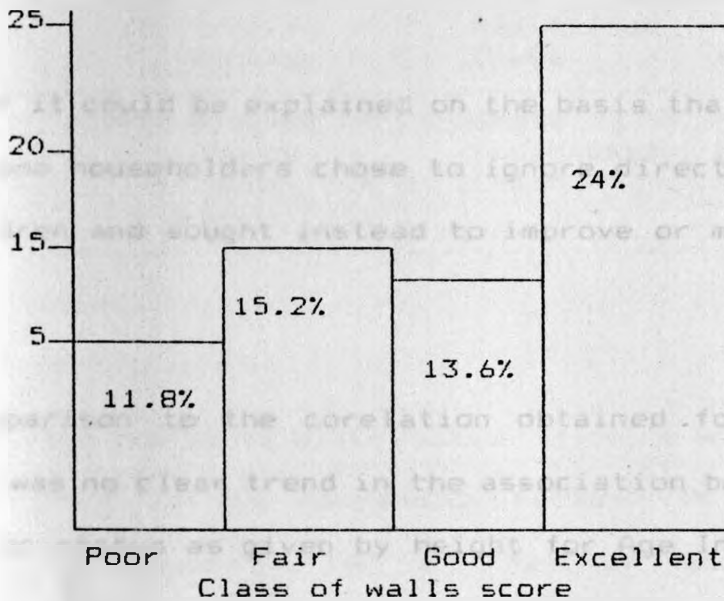


Table 4.a. (iii)

Table Showing Distribution of weight for Age Index (W/A by wall class for Study Group % wasted (W/A < M - 1 SD) Calculated for each class.

Class of Wall	Score	Weight for Age Index				Total	% Waste
		M+ 2SD -M+2SD	M+ 1SD M	M - M - 1SD	M-1SD -M-2SD		
Excell.	8-9	-	14	8	7	29	24%
Good	5-7	2	52	47	16	117	13.6%
Fair	4	2	30	35	12	79	15.2%
Poor	2-3	4	6	5	2	17	11.8%

Chi Squared (18) = 27.7, P = 0.0011

However it could be explained on the basis that with the same level of Income some householders chose to ignore direct health requirements of the children and sought instead to improve or maintain their walls

In comparison to the correlation obtained for wasting using W/A index there was no clear trend in the association between wall class and low nutrition status as given by height for Age Index.

If no re-categorization is done then it appears that households with fair walls and excellent walls share a common factor in that order that results in less wasting than in households with "good" walls or poor walls. This could mean that those with "good" walls in many cases include those with "cracks" in brick or stone walls. These would be difficult to repair because of cost and may be would tend to remain longer in disrepair than "fair" walls, (mostly of mud, mabati and grass) which are cheaper to replace or repair.

Table to Show Scoring for walls was done to obtain wall class.

Table 4.b.

Sco	WALL	WALL	COMBINATIONS	
	CLASS	CONDITION	MATERIAL	SCORE
8-9	Excellent (1)	Straight = 5 Leaning = 4	Brick/Stone = 4 Brick/Stone = 4	9 8
5-7	Good (2)	Straight = 5 Leaning = 4 Straight = 5 Patched = 3 Patched = 3 Cracked = 2 Gaping = 1	Mud/Mabati = 2 Mud/Mabati = 2 Grass = 1 Brick/Stone = 4 Mud/Mabati = 2 Brick Stone = 4 Brick/Stone = 4	7 6 6 7 5 6 5
4	Fair (3)	Cracked = 2 Patched = 3	Mabati/Mud = 2 Grass = 1	4 4
2-3	Poor (4)	Cracked = 2 Gaping holes = 1 Gaping Hls = 1	Grass = 1 Mud/Mabati = 2 Grass = 1	3 3 2

On studying the above distribution it is no wonder that class 2 got the lowest share of the households because it carries about seven combinations as opposed to two or three for each of the other three classes. Redistribution of the combinations and possibly dividing class 2 into two may help to clarify which factors are most relevant to nutritional status. Possibly even correlating for condition and material separately may bring some factors to light.

In contrast to the study group, the control group showed no correlation with wall standards at all. This was expected because approximately 91.2% the households in the control group fall in class 1 (or excellent class) as they all comprise fairly new stone walled buildings.

In fact, though non-significant, the correlation was opposite to that for study group (excellent walls had less wasting good walls had more). p value = 0.87.

In conclusion it may be argued that wall condition did indeed relate with the nutritional conditions of a given household amongst the slum community. The two correlate inversely with good walls having higher rate of poor nutritional status and poor walls having lower rate of good nutritional status, that is significant statistically p value = 0.001.

However in this survey the classification of household walls left a lot to be desired because the second class (class 2) ended up with wrongly assigned households due to the use of score summation to group the households by wall class; secondly the third class was denuded of membership because some of the types of walls that should have been apportioned to it ended up in class 2.

An improvement might be made by re-assigning the scores so that class 1 and class 3 get a greater assortment of (appropriate) wall combinations at the expense of class 2.

Note must however be made of the curious finding that in the slum (study) group there was inverse correlation with good walls associated with higher rate of wasting than poor walls which were associated with lower rate of wasting. A tentative explanation was that in order to achieve the better class (1 & 2) of walls in slum conditions the house holder had to choose between good diet, health practices, etc, and spending on the housing from a limited income. This last deduction needs testing and if found to be true can have an important bearing on

exposing some of the hidden costs of living in a slum.

Namely that those who strive to achieve "admirable" housing in the view of the larger society (both slum & Non-Slum) may do so at the expense of nutrition status of the pre-school children, the future generation.

The modal type for the control group was type 2 i.e. "good" (concrete floor) but not protected either by polish, carpet

Table 1: Floor Type distribution by Group

Floor Type	Group	Group % Households		Total
		Study	Control	
1. Polished	1 (Poor)	7 (13%)	63 (25%)	70
2. Good	2 (Good)	27 (32%)	171 (68%)	198
3. Fair	3 (Fair)	148 (49%)	13 (5%)	161
4. Poor	4 (Poor)	30 (16%)	3 (12%)	33
Total		210 (100%)	250 (100%)	460

Chi-Squared = 194 p = 0.000

We found that the nutritional status did not correlate for any of the groups with the floor type.

Floor Standards

The two groups had different type of floors (see table NO. 8). The modal type of floor for study group was type 3 i.e. "fair" meaning temporary but hard and clean.

The modal type for the control group was type 2 i.e. "good" meaning permanent (concrete) but not protected either by polish, carpet or tiles.

Table 5.a.

Floor Type distribution by Group						
Group % Households						
Floor Type			Study	Control	Total	
Permanent, Protected	1	Excell.	7 (3%)	63 (25%)	70	
Permanent, not Prot.	2	Good	77 (32%)	171 (68%)	248	
Temporary, Clean, Smooth and Dry	3	Fair	118 (49%)	13 (5%)	131	
Temporary, dirty wet, Rough	4	Poor	38 (16%)	3 (2%)	41	
Total			240 (100%)	250 (100%)	490	

Chi. Squared = 194 p = 0.000

It was found that the nutritional status did not correlate for any of the indices for any of the groups with the floor type.

Table 6.a.

Drainage Facility by Height/Age (stunting) in Study Group.

Nutritional Status

Type of drainage	Above Med.Height/Age	Above M - 1 S.D.	Above M- 2 S.D.
Good Order	8	2	4
Eroded	-	1	-
Blocked	16	11	12
Non Existent	53	52	80
TOTAL	77	66	96

Chi squared = 9.6 D.F. = 6 p = 0.1390

Table 6.b.

Drainage Facility by Height for age (stunting in control group.

Nutritional Status

Type of Drainage	Above Median Height	Above M - 1 S.D. H.	H. Above M - 2 S.D.
Good Order	87	47	34
Eroded	2	3	2
Blocked	21	12	13
Non Existent	5	5	5
TOTAL	115	67	54

Chi squared = 4.37 D.F. = 6 p = 0.6259

Draining Facility and Nutrition status.

There was completely differing levels of catering for drainage of waste water in the two group neighbourhoods. 77% of the study group had "non-existent" drainage or type 4 while 71% of the control group had "in good order" drainage or type 1.

Table 6.c.Drainage Facility by Group

Type of Drainage	Study Group		Control Group	
1 = In Good Order	14	(6.6%)	168	(71%)
2 = Exist/Eroded	1	(0.4%)	7	(3%)
3 = Exist/blocked	39	(16%)	46	(19%)
4 = Non-Existent	185	(77%)	15	(7%)
TOTAL	239	(100%)	236	(100%)

The first conclusion is that this scale succeeded quite well in clearly contrasting the two groups with respect to this condition of the environment (drainage of waste water), which was what all the scales designed were aiming to do. For correlation with Nutritional Status.

There was no significant correlation between the nutritional status and the drainage facility within each community taken respectively. See Table 6.b.

Solid Waste Disposal vs. Nutritional Status:

The methods most favoured by the two groups overlapped, so that while:-

85% of control group fell in grade 2 and 3

57% of study group fell in grade 2 and 3

30% of study group fell in grade 4 compared to 7% of control group. See Table 7.a.

Comparable proportions of the two groups fell into grade 1 method of disposal (5% study and 7% control group). The difference in distribution of methods used was significant. (See Table 7.b.)

Table 7.a.

Solid Waste Disposal grade by Group

Grade or Method Used		Study Group		Control Group		Total
1	Dustbin	14	(6%)	20	(8%)	34
2	Private Pit	63	(26%)	115	(46%)	178
3	Communal Pit	73	(31%)	97	(39%)	172
4	Anywhere	73	(30%)	18	(7%)	91
5	Stool Contamination	17	(7%)	Nil	-	17
Total		242		250		

Chi squared = 69.2 D.F. = 4 P = 0.000

For the control group there was no significant correlation demonstrated between grades of solid waste disposal and nutritional status. For the study group there was significant correlation only for stunting (H/A) versus grade of waste disposal practiced. $p = 0.027$ But for wasting there was no significant correlation.

See Table 7.b. and 7.c.

Table 7.b.

Solid Waste Disposal Method by H/A in Study Group.

Method	Grade	Nutritional Status (H/A)			Total
		Above Median	M to M - 1SD	M-1SD to M-2SD	
Dustbin	1	8	3	3	14
Private tip	2	18	20	25	63
Communal tip	3	34	15	26	75
Anywhere	4	14	22	37	73
Stool contam.	5	5	6	6	17
TOTAL		79	66	97	242

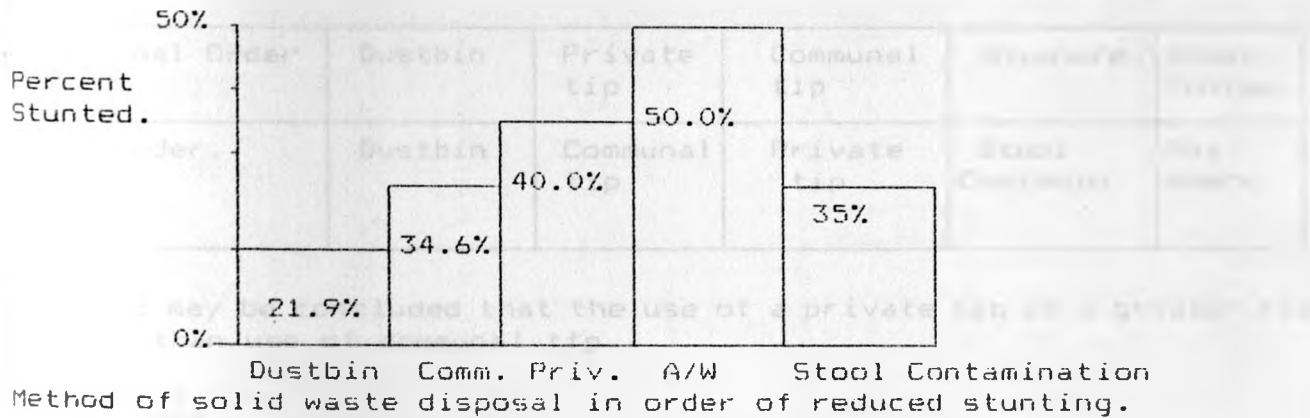
Chi. squared = 17.3 D.F. = 6 P = 0.0269

Table 7.c.

Solid Waste disposal method by percentage stunted for each method. In Study Group

Method	Stunted W/A < Median- 1 SD
Dustbin	21.4%
Communal tip	34.6%
Private tip	40.0%
Anywhere	50.0%
Stool Contam.	35.0%

Histogram (7.d.) for correlation of Solid Waste Disposal vs. rate of stunting (% stunted) in study group.



Solid Waste Disposal and Nutrition Status.

Upon cross tabulating the combined data for both groups it was discovered that against Height for age (H/A) index the correlation had increased statistical significance $p < 0.0006$ C/F $P = 0.0269$. See Table 7.e.

Upon drawing a histogram to show the distribution of stunting by method of solid waste disposal it was found that stunting prevalence rate increased with lowered "grade" of method employed for solid waste disposal.

There are no significant correlation between waste disposal method and wasting prevalence as measured by the other index, W/A.

Upon studying the histogram (Table 7.g.) and 7.c., it is plain that the choice originally made in grading the five methods in order of better to worse was wrong. This has been corrected in the drawing of the histogram and is as follows.

Table 7.e.

Comparison of Expected Descending order of Solid Waste Disposal methods with actual order upon Analysis.

Original Order	Dustbin	Private tip	Communal tip	Anywhere	Stool Contam.
New Order.	Dustbin	Communal tip	Private tip	Stool Contamin	Any-where

It may be concluded that the use of a private tip is a greater risk factor than use of communal tip.

Table 7.f.

Solid Waste Disposal Method by height for age (H/A index for combined data of Study & Control Groups. With % stunting for each method

Height for Age						
Solid Waste Disp. Grade Method	Above M-(H/A)	M - M-1SD	Median- M-2SD	M -2SD- M-3SD	Total	% Stunted H/A <M-1SD
Dust bin	1 21	6	5	3	35	23%
Private tip	2 64	56	42	16	178	32.5%
Communal tip	3 78	49	33	25	175	27.4%
Anywhere	4 22	28	20	23	93	46.2%
Stool Contam.	5 5	6	2	4	17	35.3%
TOTAL	190	145	102	61	498	

Chi. squared = 34.2 D.F. = 12 P = 0.0006

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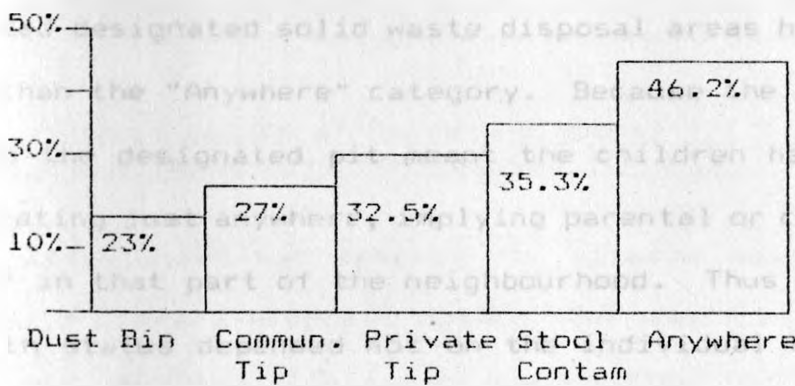
Table showing solid waste disposal method by prevalence rate of stunting (H/A < M - 1SD) for combined data n = 492

Table 7.g.

Solid Waste Disposal Method		% Stunted H/A < Median - 1 S.D.
Solid Waste Disposal	Dust bin	23%
	Communal Tip	27.0%
	Private Tip	32.5%
	Stool Contamin.	35.3%
	Anywhere	46.2%
Average		32.7%

Histogram showing Solid Waste disposal method by prevalence rate of Stunting H/A < M - 1SD for Combined Data n = 492

Table 7.h.



Solid Waste Disposal and Nutritional Status

Another notable finding is in table 7.g. where the prevalence rate of stunting is lower for "Stool contaminated solid waste disposal areas" than for households strewing solid waste "anywhere". This is also contrary to the expectations during design of the protocol of this study.

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Upon further reflection the two anomalous findings can be explained simultaneously in that the important denominator is whether there is community co-operation to keep the neighbourhood tidy or not.

Where a private householder has to set up his own private tip in a crowded (urban) setting there must most likely be lacking an appropriate communal solution to the problem (whether Dustbin, communal tip etc). This lack of co-operation would mean that the pre-school children who tend to play together on common grounds (roadside, empty lots, etc) would tend to get into contact with undesirable waste to be found near any neighbouring household that does not bother to set up a private tip. Evidence of this is that the "Anywhere" category has the highest rate of stunting. The inverse case applies to the anomaly of stool contaminated designated solid waste disposal areas having lower rate of stunting than the "Anywhere" category. Because the fact that stool was noticed on the designated pit meant the children had been discouraged from defacating just anywhere, implying parental or communal interest in the matter in that part of the neighbourhood. Thus it can be concluded that health status depended not on the individual household practices alone but to a large extent on the neighbourhood's practices concerning solid waste disposal. This can be compared to the case for excreta disposal.

	1974-75	1975-76	1976-77	1977-78	1978-79
Stunting (%)	21.2	18.5	15.8	13.7	11.2
Diarrhoea (%)	28.5	25.1	22.3	19.8	17.4
Worms (%)	35.2	32.8	30.1	27.9	25.6
Total	112	107	104	107	104

Excreta Disposal and Nutritional Status

The study group had a lower rating on proper excreta disposal than the control group. Where-as 78% of the latter group used safe clean toilets (186/237) only 13% (94/227) of the study group did so. Furthermore the distribution of the households of the study group amongst the four methods of stool disposal could be said to be almost indiscriminate, or random.

Table 8.a.

Group	Latrine Safe and Clean	Safe but dirty latrine	Unsafe when & unclean latrine	Non existent latrine	TOTAL
Study	12.6% (34)	30% (63)	24.4% (56)	33% (76)	100%(229)
Control	78.5%(186)	13% (31)	4.5% (11)	4.0% (9)	100%(237)

Table 8.a. - distribution of Excreta Disposal facility vs households in percentage and (frequency), controlling for group.

When correlation was checked for between Nutritional status and usage of safe excreta disposal method none was found for the study group. There was very significant correlation for the control group.

Table 8.b.H/A status versus excreta disposal in household in Control Group

Excreta Disposal Method	Nutritional Status Height by Age (H/A)				TOTAL	% Stunted H/A<M-1SD
	H/A Abv Median	H/A Abv. M-1SD	H/A Abv M-2SD			
Clean safe lat.	91	56	39	186	21%	
Dirty safe lat.	13	7	11	31	35.5%	
Unclean unsafe	6	-	5	11	45.5%	
Non-existent	2	6	1	9	11.1%	
TOTAL	112	69	56	237	-	

(75.9%)

(23.4%)

Chi. Squared = 14 D.F. = 6 p = 0.021

Excreta Disposal and Nutritional Status Conclusions

The fact that significant correlation was only found for the control group, rather than for study group is not surprising for the following reasons. The study group living in slum conditions was more likely to have to children wondering or playing in a neighbourhood contaminated with excreta because a larger percentage of the households had poor excreta disposal methods than in the control group. Conversely the latrines being used in the control group neighbourhood were communal and shared by a whole block or floor of single (rented) rooms. The children from the same block or floor. Thus once a latrine was designated as clean or unclean, the pre-school children living in that block would tend to be more or less constantly exposed to that environment.

It is very improbable that the better nourished control group were the only ones affected while the study group was totally spared from the influence of bad excreta disposal methods. The more likely situation is that the very dirty environment of the slum had had a blanket (negative) influence on the nutritional status of the study group regardless of the disposal method in each of the respective households.

On combining the data of the two groups this came out very clearly. Not only stunting (H/A index) but also wasting (W/A index) was then found to be correlated to the type of excreta disposal method of the household. The "better" the latrine usage the lower the rate of stunting. See Table 8.c. below.

Table B.c.

Distribution of Nutritional status H/A with Excreta Disposal facility in Combined Group Data. n = 472

Excreta Disposal Method	H/A Above Median	H/A Above Median-1std.dev	H/A Above M -2SD	H/A Above M - 3S.D	Total	Percent Stunted H/A Less than M - 1 S.D.
Clean safe lat.	10	65	39	17	222	25.2%
Dirty safe lat.	32	27	23	14	96	38.5%
Unclean unsafe	17	16	21	12	66	50%
Non-existent	29	32	17	14	88	35.2%
TOTAL	175	140	100	57	472	-

Chi. Squared = 23.3 D.F. = 9 P = 0.0055

Table B.d.

Histogram to show, distribution of stunting with Excreta disposal facility for combined groups, n = 472

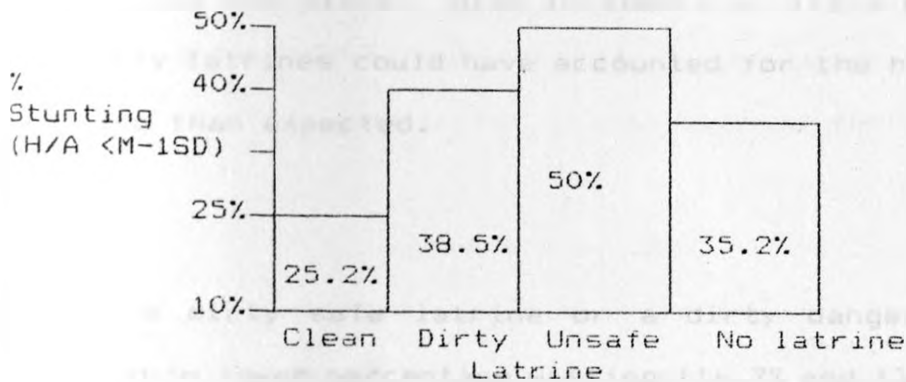
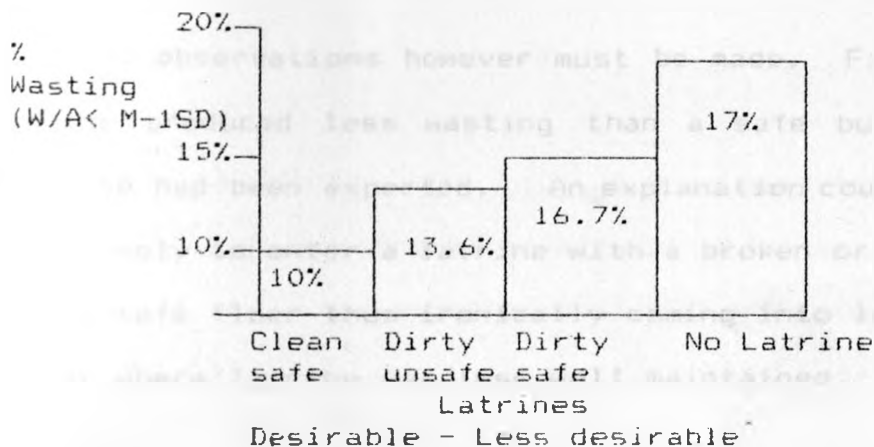


Table B.e. Histogram to show Distribution of wasting (W/A < M - 1 S.D) with excreta disposal facility for combined groups, n = 472



The percentage of stunting increased with the increasing degree of poor latrine maintainance and usage.

An interesting finding was that having no latrine (defacating in the bush or open (near by vacant lot, etc), was associated with less stunting (35.2%) compared to use of either unsafe latrine (50%) or dirty latrine (38.5%). (see histogram 8.d.)

It was possible that members of a household who had accepted to live without using a latrine of any sort had resorted to defacting far away from the household compound altogether e.g. on the river banks.

However those who had a dirty/unsafe latrine may possibly have gone just behind the place. Also incidence of flies breeding in the unsafe and dirty latrines could have accounted for the higher association with stunting than expected.

Having a dirty safe latrine or a dirty dangerous (unsafe) latrine resulted in lower percentage wasting (16.7% and 13.6% respectively) than for those households having no latrine (17% wasting).

Two observations however must be made. Firstly the unsafe dirty latrine produced less wasting than a safe but dirty latrine. The opposite had been expected. An explanation could be that children were less likely to enter a latrine with a broken or rusting floor than one with a safe floor thus ironically coming into less contact with faecal matter where latrine was less well maintained.

Secondly for wasting and stunting a different order is seen for which mode of excreta disposal (latrine use) contributes more. The easiest explanation for this is that the group of children who are wasted are the (smaller) subset of those who are stunted, or completely separate from those who are stunted.

In view of the fact that wasting should normally precede stunting in early life it probably means that the group of households rated as wasted most often had the younger age group sampled and the group of households rated as stunted had the older age group representative child sampled there. There is therefore probably no inconsistency in the different order seen for malnutrition vs. excreta disposal method when the two different indices (W/A and H/A) are used respectively.

In conclusion it was clear that the type of facility for excreta disposal was only one factor in the outcome for the pre-school child's health.

The other concomittant factor was the type of behaviour by both adults and older children as well to ameliorate or enhance any problem posed by the physical facility.

This may explain why having no latrine was associated with lower rate of stunting than expected.

Those households with "dirty" or "unsafe" latrine had higher rate of stunting instead. One alternative explanation that needed to be ruled out however is the possibility that a lower concentration of flies would result near the household due to lack of a latrine nearby for breeding purpose.

But the more likely explanation was that feco-oral contamination was lower in those households without latrines. Evidence of this was that the households with clean, safe latrines (thus well maintained & properly used) had the lowest percentage of stunted or wasted (H/A & W/A) pre-school children.



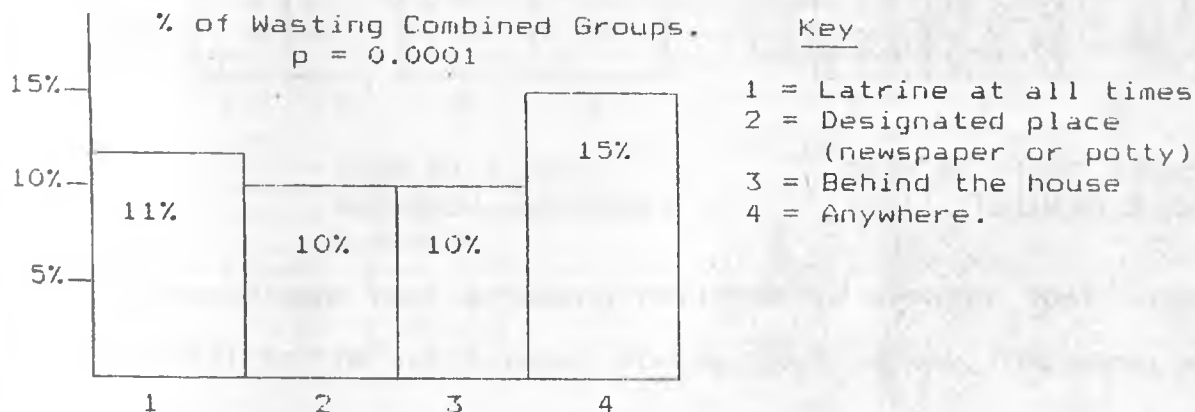
The chart illustrates the relationship between latrine usage and child health outcomes. It shows that households with clean, safe, and properly used latrines have the lowest percentage of stunted and wasted pre-school children. This suggests that improved sanitation through the use of latrines can lead to better child health outcomes, likely due to reduced feco-oral contamination.

Excreta Disposal for Small children

The small children were taken as under two year olds who would be expected to be soiling themselves and/or unable to visit the pit latrine even when accompanied for fear of falling into the hole.

Figure B.f.

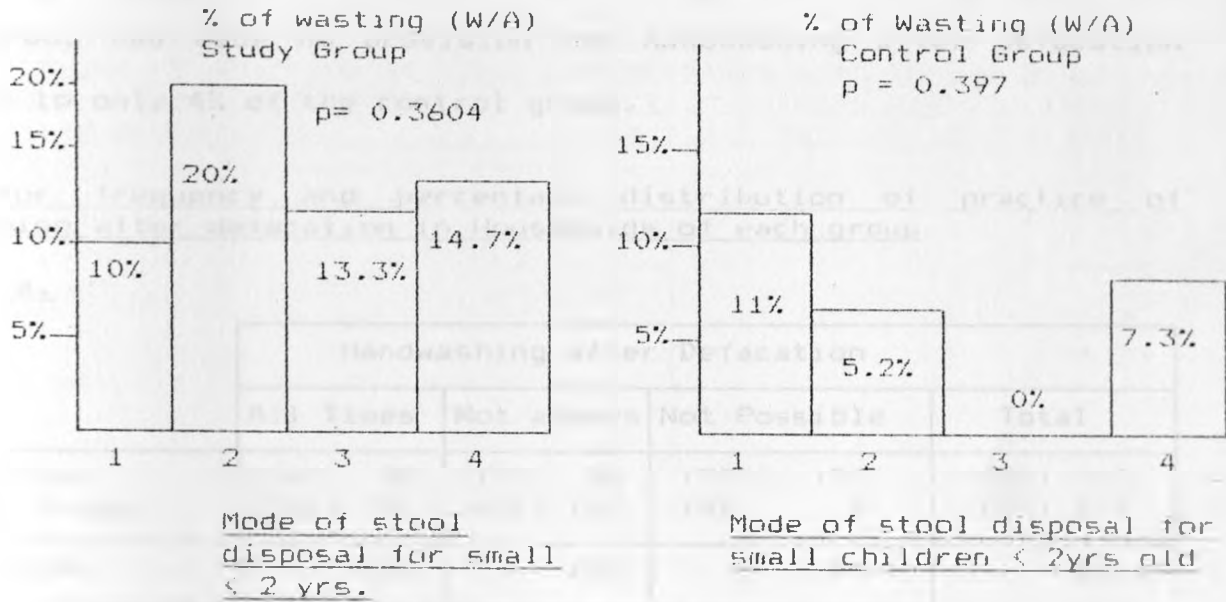
% of Wasting vs. Excreta Disposal mode for small children (<2years old) in Study group and Control Group respectively.



In the control group the adults supervised the habit of the children to a great extent; 80% defacated either in a designated place or the latrine (water closet "Indian" type or other) 17% defacated anywhere " and 3% behind the house". Quite in contrast, the adults of the study group supervised the habits of the children far less; only 17% in the latrine or in a designated place or in a latrine. 75% defacated "anywhere" and 8% behind the house.

Figure 8.g.

Histogram to show % Wasting versus Mode of Stool Disposal for < 2 years Children in Study Group and Control Group respectively.



It was concluded that allowing children to defacate just anywhere was detrimental to the nutritional status of children. The other modes had better influence which was about equal.

Table 8.h. Table for % wasting vs Excreta Disposal for Under 2 years old children in combined groups.

EXCRETA DISPOSAL FOR SMALL CHILDREN	HOUSEHOLD DISTRIBUTION & (PERCENTAGE)				
	STUDY GROUP		CONTROL GROUP		TOTAL
Latrine at all time	20	(8.5%)	99	(41%)	
Designated place	24	(10.2%)	95	(40%)	
Behind the house	15	(6.3%)	5	(2%)	
Anywhere	176	(75%)	41	(17%)	
Total	235	(100%)	240	(100%)	

Chi. Squared = 183.7 D.F. = 3 P = 0.00

Neither group showed any significant correlation between any index of nutritional status and the mode of stool disposal for small children for the separate groups. The p values were all greater than 0.05.

Handwashing After Defecation.

The study group had smaller percentage of homes practising this habit at all times (16%) than the control group (53%). The 72% of the study group had made no provision for handwashing after defecation compared to only 4% of the control group.

Table for frequency and percentage distribution of practice of Handwashing after defecation in households of each group

Table 9.a.

	Handwashing after Defecation			
	All Times	Not always	Not Possible	Total
Study Group	(16%) 39	(12%) 28	(72%) 175	(100%) 242
Control Group	(53%) 133	(43%) 107	(4%) 9	(100%) 249
TOTAL	172	135	184	491

Chi. squared = 247

D.F. = 2

P = 0.00

On tabulating against nutritional status in terms of s.d score for any index each of the group showed no significant correlation. However on combining the data of both groups, significant correlation was found for W/A and H/A. See table 9.d. & 9.e.

Pattern of Distribution of Malnutrition with Practice of habit of handwashing after Defecation for combined Data of both groups n = 497

Figure 9.b.

Histogram showing distribution with the level of practice of hand washing after defecation for combined group data.

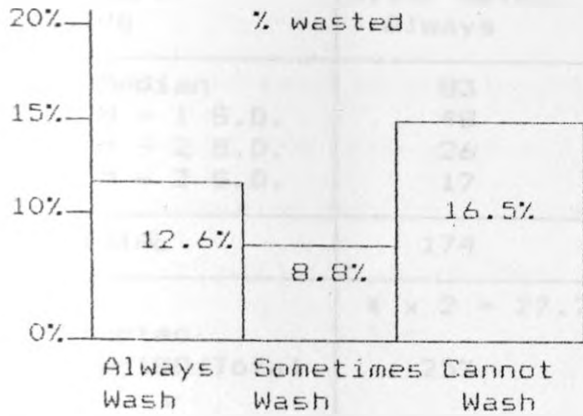


Figure 9.c.

Histogram showing the distribution of stunting with the level of practice of Hand washing after defecation for combined groups.

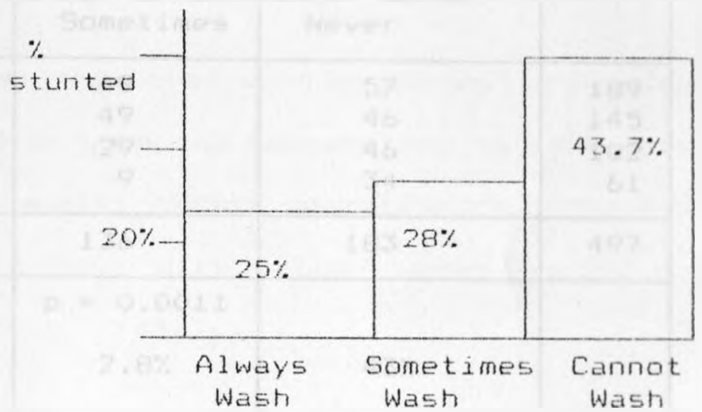


Table 9.d.

Tabulation for level of practice of handwashing after defecation vs weight for age index of each Household expressed as S.D. Score for the combined Group Data n = 497.

Chi squared = 32.96, p = 0.0001

Weight for Age W/A SD Score Grps.	Grade of Hygiene Practiced			Total
	Handwashing After Defecation Always Prac.	Handwashing after Defecation Sometimes Practiced	Handwashing after Defecation Not possible	
W/A > Median	112	85	75	274
W/A > Median- 1SD	40	39	78	158
W/A > M-2 SD	18	7	18	43
W/A > M-3 SD	4	5	12	22
Total	174	136	183	497
W/A < M -1 SD/x100 % Wasted under each category	chi. squared = 32.96 12.6%	p = 0.0001 8.8%	16.5%	

Table 9.e.

Table showing the level of practice of handwashing after defecation vs height for age index of each household expressed as S.D. Score for the combined group data n = 497.

Height for Age H/A S.D. Score Grouping	Grade of Hygiene Practiced.			Total
	Handwashing after defac. Always	Handwashing after defac. Sometimes	Handwashing after defac. Never	
H/A > Median	83	49	57	189
H/A > M - 1 S.D.	48	49	46	145
H/A > M - 2 S.D.	26	29	46	102
H/A > M - 3 S.D.	17	9	34	61
TOTAL	174	136	183	497
H/A Stunted H/A < M-1SD/Total	X x 2 = 27.7 25%	p = 0.0011 2.8%	43%	

Handwashing after Defecation (Figures 9.b. and 9.c.) show that correlation exists between the nutrition status and hygiene practice. Good nutrition status correlates with good hygiene practice especially for height for age index (H/A). Weight for age index also correlates but those who wash hands only sometimes after defecation seem to have better nutrition status (W/A) than those who wash every time. This was unexpected result. One plausible explanation could be hypothesized for this finding. Perhaps those who said they wash only sometimes were more truthful and actually washed at times. Whereas some of those who stated that they washed all the time did not do so at all, but knew what expected answer to give.

By "hand washing not possible" it was meant that no provision had been made by the householder to provide a basin of water and soap near the latrine for use after defecation.

Though there is water in homesteads this would have been easier to do in the site and service scheme where piped water and sinks were already provided by the landlords, about half (43%) of the control group (107 out of 249) had failed to establish the habit. In comparison, 16% (23 out of 242) of the slum householders had managed to organize a basin and soap for the purpose even without piped water.

It is possible to conclude therefore that with or without provision of piped water the onus will still be upon the householder to institute the good hygienic habits. Consequently health education could have a significant part to play hand in hand with proper water supply to improve community hygienic practices. (43)

Drinking Water Quality.

There was much difference in the proportions of the two groups that used safe water or otherwise. 99% of control group used safe water 71% of study group only used safe water. About 29% of the study group used "surface body" water which was considered unsafe. The safe water comprised, water from mains, water from borehole and rain water tank. Surface body water in most cases meant tapping water illegally from sections of underground mains piping using a piece of hose pipe.

Those practicing this were many of the slum dwellers who could not afford the fifty cents fee for each twenty litre-container of water sold at water kiosks and by vendors. The water thus tapped was thought liable to contamination because of the mode of tapping.

Analysis of Data on Water Usage vis a vis Nutritional Status

From NS 111 analysis of data mostly concerning rural households a positive correlation between source of water supply and availability of sewage facility with nutritional status (stunting) was found. Those households with either individual piped water or year round rain tank supply also had sewage disposal facility and the prevalence of stunting in children of such households was less (15%).

Those households which used rainfed tank supply only in wet season had higher prevalence of stunting (21%) in children of these households compared to those with year round supply of tank water. To obtain water from a rain tank all year round indicates a sophistication beyond the ordinary rural household and so it is understandable that an average (28) these children would be better off nutritionally.

Though quality of water is thought to be less relevant as a factor for water washed diseases (e.g. diarrhoea) which affect nutrition status than water quantity the NS 111 survey found some correlation between source of water and prevalence of stunting in rural Kenya. (28). The correlation may be even more in an peri-urban region. (see dummy table).

Water samples taken to the Ministry of Water laboratories for analysis from such a collection site however revealed no pathogenic bacteria or indicator bacteria (i.e. Escherechia Coli).

Water from the boreholes was also found to be of good quality and absolutely safe as well. See Appendix NO. 4

Upon cross tabulation no correlations were found that were significant except for the combined group data vs. H/A. Stunting ranged as follows 20% (rain water), 30.7% (piped) 47% (borehole) surface body (30%) with Chi squared = 28.7 D.F. - 12 P = 0.0043.

Per Capita Water Consumption.

The quantity referred to was that for normal domestic uses as reported by the housewife or other care taker most concerned with care of the child in the household.

It was estimated in buckets per day (taking word of the interviewer and taking the quantity given in buckets for a day when no clothes washing was to be done). During the analysis stage the number of buckets per day was converted to litres and divided by the number of household members recorded under variable (question) (4) in the questionnaire. See Appendix 2. The control group was found to use more water per capita than the study group.

Table 10.a.

Per capita water consumption per day in litres for the two groups on a non-laundry day

Group	Quantity of water per capita per day (percentage of group)				TOTAL
	>60-M	31-60L	11-30L	0 - 10	
Study	Nil (0%)	5 (2.1%)	72 (30.5%)	159 (67.4%)	236 (100%)
Control	1 (0.5%)	5 (2%)	216 (87%)	26 (7.5%)	248 (100%)
Total	1	10	288	181	484

Chi. squared = 168.4

D.F. = 3

P = 0.0000

In study group most households used 0-10 L per head. In Control group most households used 11 - 30 Litre per head. This difference in water consumption was statistically significant. It can be explained on grounds of cost in time and money and risk and effort, which is more for the study than control group.

For study group, there was significant correlation between water consumption and nutritional status as measured by W/A.

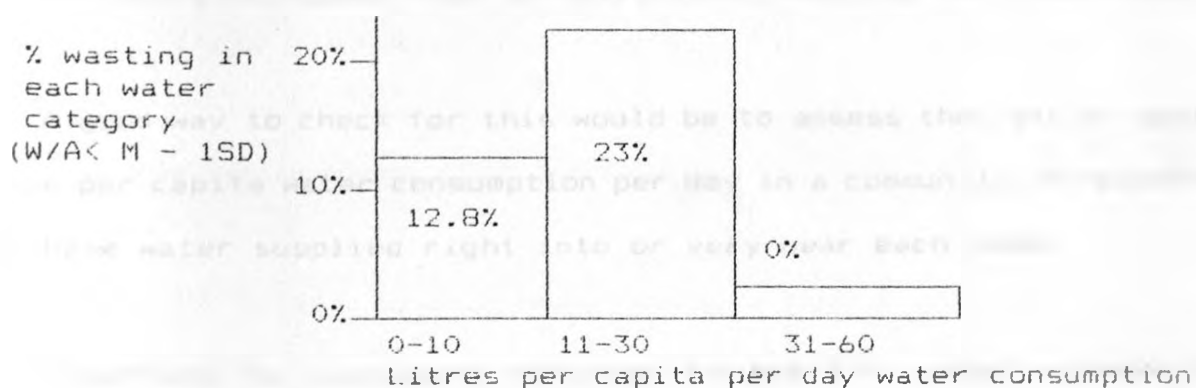
Thus wasting was correlated to per capita water consumption but in an unexpected way.

Table 10.b. Water Consumption by W/A for study group. n = 228

Water Consumed per capita per day	Weight for Age (W/A) rating of Household in terms of S.D. Score				% Wasted W/A < M-1SD
	> Median	M - M 1SD	M - 1 SD - M- 2 SD	Total	
31 - 60L	NIL	5	NIL	5	0%
11 - 30L	34	20	16	70	23.0%
0 - 10L	68	66	19	153	12.8%
Total	102	91	35	228	

Chi. Squared (4) = 13.8 P = 0.0078

Histogram 10.c. Figure Showing Water Consumption by wasting for Study Group. n = 236



The household using 11-30 litres/head/day exhibited more wasting than those using 0 - 10 litre/head/day.

In view of the fact that this group largely had to fetch the water entailing expenditure of time, effort and/or spending money it may be that those who had established the need to use more water than the bare minimum failed to benefit their children.

Those in both the slum and the site and service neighbourhoods who chose to use more water per capita seem to have failed to benefit their pre-school aged children's health thereby. It may be hypothesised that the time and money spent in either fetching the water (for study group) or in washing utensils and clothes at the stand pipe (for control group) actually detracted from the time and attention given to the pre-school child in terms of nutrition or preventing infection etc.

In many instances the village well-head is known to constitute a socialization point for women/girls charged with caretaking of the children and home.

Those who spend a long time washing their clothes or utensils at the communal stand pipe or water collection point (or going several times in a day) may be the ones who ended up with higher per capita consumption of water and also higher risk of nutritional wasting for their charges.

A good way to check for this would be to assess the rate of wasting versus per capita water consumption per day in a community of households that have water supplied right into or very near each home.

According to literature reviewed by W.A.S.H. other authors have also concluded that a positive health benefit is produced in interventions that provide piped water into or near a home.

Those that only provided communal "safe" sources of water (protected well, tube wells, and stand pipes) had no positive benefit w.r.t. mortality, malnutrition (for particular age groups) or morbidity. (44)

In light of the above reference it was no longer surprising to find that in this study the improved water quantity was found to influence nutritional status either insignificantly (w.r.t. stunting) or where significant in a negative fashion (for wasting W/A in case of study group).

The conclusion of the W.A.S.H. literature review report p - 13 is apt for this study also in that "use of more water following installation of water supplied for improved hygiene is not automatic and health education is necessary as part of a package to ensure improved hygiene with improved water supply".(45).

The Non Environmental Factors - Results:

As for the non environmental results. It is perhaps not surprising that out of some fifteen factors considered under Q 25, a - v in questionnaire; those that were found to correlate with malnutritional status of the pre-school children were found to do so only in the non-study or scheme population. (see Appendix 2)

The only exception to this rule was wasting versus H.R.T.1. and wasting versus stool cysts. These showed correlation with the study group nutrition status.

Those that were significantly correlated with the wasting of the control group were:

- * educational status of the mother
- * duration of stay in the scheme.

These two relationships were expected for both the study group and the control group.

A real surprise however was the correlation of both wasting and stunting with sex of the child in the control group.

It was found that girls had a statistically significant lower rate of stunting than boys (p value = 0.0374). They also had statistically significant lower rate of wasting than boys (p value = 0.034) See Table 11.a. and 11.b. respectively, below.

Table 11.a.

Table showing % stunted versus sex of child in Control Group

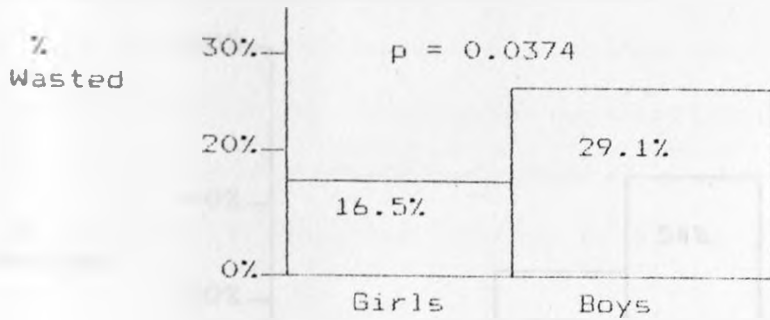


Table 11.b.

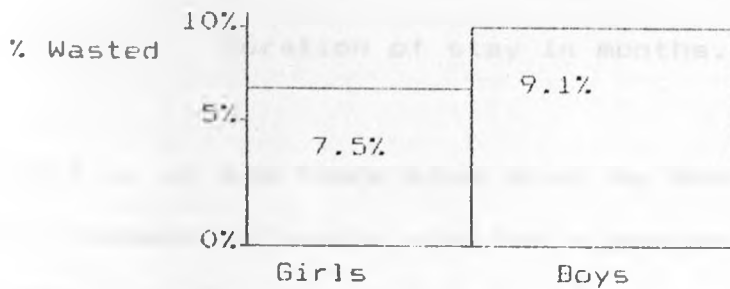
Table showing % wasted versus sex of child in control group Kayole Site & Service Scheme $p = 0.034$ 

Table 11.c.

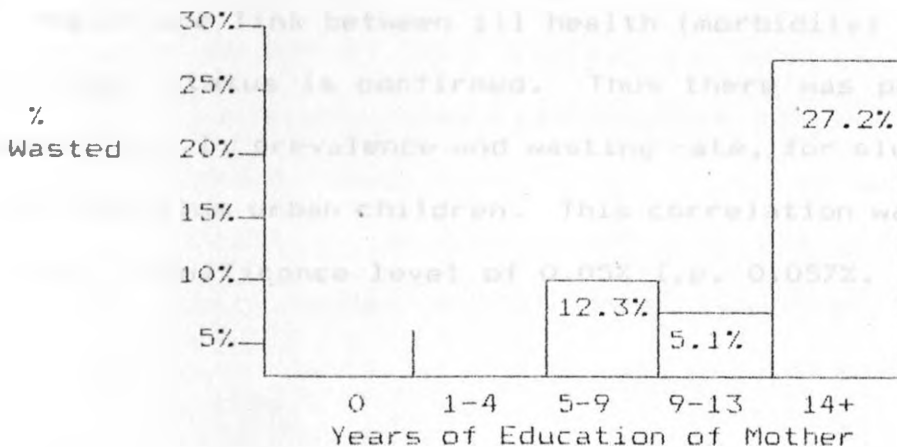
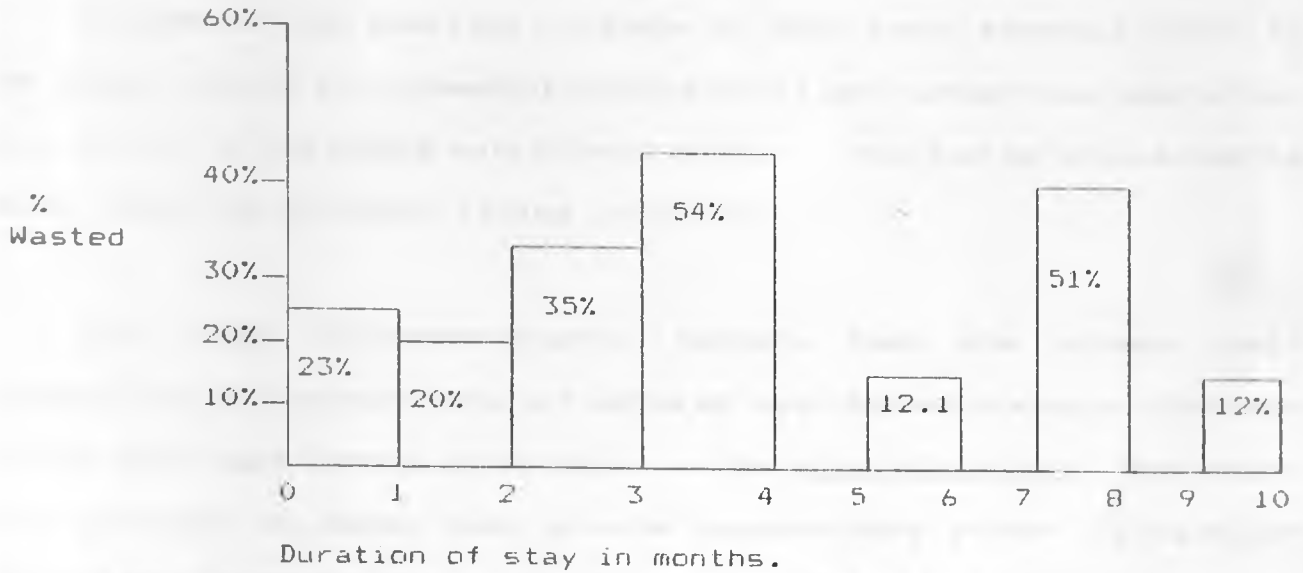
Table showing Educational status of mother versus wasting in control group of Kayole Site & Service Scheme $p = 0.0279$ 

Table 11.d.

Table showing % wasted versus - Duration of stay in the Control group (Kayole Site Service Scheme) $p = 0.024$



Just as in the Poone slum study by Meera Bapat (39) it seems that the environment in Kayole slum had a greater impact on the malnutrition rate than non-environmental factors such as "material education level, breast feeding" etc.

In the same way it seems that agreement between the Bapat study and this one on the link between ill health (morbidity) the environment and nutritional status is confirmed. Thus there was positive correlation between U.R.T.I. prevalence and wasting rate, for slum children but none for the non-slum urban children. This correlation was just short of the necessary significance level of 0.05% i.e. 0.057%.

CONCLUSION

In general the positive findings of this study strongly point to the importance of environmental sanitation of peri-urban slum habitation as a factor in childhood nutritional status. This can be translated to mean, health of children living in slums.

The other socio-demographic factors that are already well established as having strong influence on nutritional status of children do not show such strong correlation in the slum situation. This study also provides evidence that private householders effort to maintain sanitation standards are unable to overcome the effect of low standards in the neighbourhood in the slum (unstructured) village. It is possible that such efforts may, ironically, detract from nutritional well-being of the children in the slums.

However, one of the main aims of the study, to try and characterize the building standards to be found in slums and relate these to the level of malnutrition found was not achieved for some aspects. Nevertheless it seemed that instead of good walls correlating with better nutrition status, there was negative correlation. This suggested that in poor urban communities forced to either put up their own homes or rent exorbitantly, the cost of doing so detracted from the family's income so that higher malnutrition (wasting) resulted. Better classification of walls, as suggested above, might bring out better any relationship that may exist.

A major drawback was that the index weight for height (W/H) was found not valid for use in the case of this study. No child was found

to be wasted in terms of this Index. Yet it is the index of choice according to W.H.O. The reason for this failure was not clear. W/A and H/A were used instead.

DISCUSSION

It was clear that there was an influence on nutritional status of pre-school children by the type of environmental condition of the households (i.e. the neighbourhoods) in peri-urban Nairobi and the nutritional status differ very significantly. In the legal, site and service scheme having valid title deeds, laidout roads, water mains, etc, the percentages of stunted and wasted were half those of the adjacent Soweto slum village.

However the spread of wasting and stunting within the two neighbourhoods was not homogenous, reflecting the many different styles of life adopted in each. There was greater variation in the Soweto slum village than in the Scheme, as would be expected. The Soweto dwellers were in a transitory phase either awaiting further allocations of land since they missed the first one (to the scheme) or the building of permanent houses through self help groups. The Scheme dwellers were in a more permanent phase with few anticipated social transformations of their habitat.

This factor, in itself had played a role in determining the environmental conditions that prevailed in the two villages. Thus nearly all the households of the scheme had stout, intact walls (of stone) and intact roofs and permanent floors. They also had latrines, stand pipes for treated water in each compound and storm drains along permanent, tarmacked, roads.

The households of the Soweto slum village nearly all had dirt floor, many had patched up roofs that are sagging and walls with gaps in them.

Many had no latrines either literally or because they were always filled up, water had to be bought in cash, daily, or poached.

There were no proper storm drains and the pathways between homesteads also served as the littering grounds and latrines.

In this study it was seen that though health education could help improve the childhood nutritional status, correct communal action to solve some household problems was probably indispensable in order to achieve most of the improvement as seen in Scheme village.

Those factors of household environmental condition that seemed to be overshadowed by the respective neighbourhoods standards as regards their influence on the nutritional status of the child were two.

(1) Solid Waste Disposal

The better communally organized this service was the better seemed to be the nutritional status. Thus where dustbins were used and rubbish hauled away, the nutritional stunting was low. In areas using communal tips that were not stool contaminated the nutritional stunting was higher; in areas using private rubbish tips wasting of children was higher still, in areas using communal tips that were stool contaminated had yet higher wasting. The worst were areas not attempting to confine the location of rubbish dumps. (Solid waste disposed off "anywhere").

(2) Excreta Disposal for the household

The use of latrine or not in the slum groups was not correlated to the level of nutrition status.

But in the scheme group, who all had latrines, it was.

This indicated that where latrines were not widespread in a community the use of a private one made little difference to how much stool contamination was occasioned by a pre-school child living in that neighbourhood.

The difficulty of digging latrines in the slum terrain explained the lack of latrines there. In the scheme area, connected to the main sewage line, this problem did not arise. All households had access to latrines. It was here that the different levels of hygiene practiced in usage made a difference to the Malnutrition rate of the children at a household level.

For these two factors of household environmental condition it was concluded that communal or civic action was indispensable in reducing the risk they pose to nutritional status of pre-school children.

The complete solution to the risk that is posed by solid waste disposal and proper excreta disposal would need health education to ensure correct usage of the latrines.

The same coupling between communal supply (availability) and health education for proper private utilization, in order to reduce malnutrition applied to some other environmental -linked factors in housing.

It was discovered that in the slum village, households with better walls were associated with more wasting than those with poor walls.

This was surprising. Because income earning capacity was assumed to be reflected by the type of walls.

It was concluded that maintenance (or renting) of better walled housing took too much out of the meagre incomes of slum dwellers so that it compromised the parent's ability to properly feed and care for the pre-school aged children.

Also higher per capita use of water domestically was surprisingly linked to higher wasting. This was for both groups but significantly so for the slum group. The location of the waterpoints in both cases in communal standpipes was taken to explain this phenomenon in line with the Conclusion of W.A.S.H. (43). These two factors of wall and communal standpipes illustrated how the lack of subsidy to the peri-urban dwellers could result in nutritional compromise for their children, the future producers.

On the other hand some of the benefit of subsidization that had been financed by the government were seen where paraffin fuel supply was concerned. The urban poor had appreciated this facility by converting from charcoal preference in 1980, (according to Beijer report), to paraffin in 1990. In this study over 60% used this fuel predominantly. It was also estimated that wasting and stunting were lower in these households whether in the slum or in scheme area. Thus a communal benefit had trickled down to the future producer generation in terms of improved nutrition status.

It was difficult to determine from this study whether improved air

quality (with reduced incidences of respiratory infection and reduced malnutrition etc.), was the way the benefit occurred. It could have been that improved purchasing power on using the more cost effective fuel resulted in better diet and better spending patterns for those families. This could bear more research. The price of charcoal had more than tripled since 1980 (33/= per bag versus 120/= per bag of 40 kg. charcoal, wholesale price in 1990).

Those who had not converted to paraffin could constitute a group that needed education on this aspect of rational spending decisions. Due credit was also given to the City Commission for supplying water to kiosk owners who sold it to the slum dwellers, but it was also be noted that the pricing was exploitative and that much less health benefit was achieved than if house to house supply had been effected.

The importance of Health Education in any intervention that proposes to upgrade health status in slum and other peri-urban poor communities was seen when "hand-washing after defecation" was considered.

Tables 9d and 9e clearly demonstrated that higher hygiene (washing habitually after defecation) was associated with lower stunting and wasting in the children. Yet the households in control group, with almost 100% running water, achieved only 53% households answering that they washed hands all the time.

By contrast, in the slum with almost zero % running water supply 16% households still had achieved 16% households answering that they

washed hands all the time after defaction. An element of health education was therefore considered to be necessary after slum conditions were improved communally

In conclusion, the evidence elicited in this study showed that there was negative effect on childhood nutritional status associated with growing up in neighbourhoods deprived of infrastructural amenities. There was also the deficit that could be attributable to bad choice by their parents who possibly needed health education to correct this. But those who practiced or attempted to implement accepted norms of healthy habitations were defeated by the prevailing neighbourhood conditions, in the slum.

Community improvement of communally pervasive factors was probably a prerequisite before individual household decisions could begin to have their own enhancing impact on pre-school nutritional health status.

This community interaction should normally be at the level of local government and so the policies governing their activities would need to be altered and geared towards the objective of improving the capacity for productivity of both children and adults. Ways of enabling legal land tenure, to be secured for slum squatters or their landlords should be sought. This would clear the way for utilities and other organizations to plan and provide services which the slum dwellers were already consuming and paying for or which they were ready to pay for. In turn this settling of the issue of right to habitation would clear the way for producers, current and future to concentrate on improving their productivity, according to their own talents, for the good of all.

RECOMMENDATIONS FOR FUTURE EVALUATION AND RESEARCH

- (1) A repeat of this study using as a study group the same Soweto Mungano Women's self help Group once they have settled into the house now being built on self help basis in Kayole.

This can be in form of a follow-up study possibly in 1993/94 to act as an evaluation of this intervention already being brought about by Shelter Afrique.

- (2) A study on the cooking fuel situation to confirm or refute the finding that the urban poor when given the choice can choose rationally the type of fuel most advantageous and that in Nairobi at least some in Kayole have done so.

- (3) A wider study encompassing some of the more well to do in higher class suburbs of Nairobi to confirm or refute that household conditions do indeed influence Health status of the community as measured by nutritional status of pre-school children, or other indices.

This should concentrate especially on:-

- (i) Level of hygiene practice (handwashing after defecation)
- (ii) Solid Waste disposal facility.
- (iii) Type of fuel used for cooking.

RECOMMENDATIONS

- (1) Strengthening of Health talks in clinics to mothers should be done to ensure that issues of importance of latrine use for defecation are discussed; also should be discussed the "home economics" aspect of making decision rationally in light of economic constraints.
- (2) Where self help groups have organized themselves such talks and teaching should be organized to reach the menfolk and influence spending patterns for the better, both on the housing costs (rent and repair and even choice of materials) as well as household costs.
- (3) Where stringent housing by-laws prohibit use of otherwise rational material the government should allow change to be actuated as per the advise of various Non-Governmental Organizations e.g. Shelter Afrique, Habitat, etc and other progressive authorities e.g. S. Yahya et al publication recommending change to By Laws on Housing in Kenya.
- (4) The Policy of government that people should be hindered from migrating into urban areas should be overhauled after 3 decades of failure to help us achieve the development of productivity in the nation.
- (5) The District Focus strategy should be democratized so that members are not appointed but popularly elected to the DDC and DVDC. Then, the DDC and DVDC should be focused into Neighbourhood and Community Development Committee.

DISTRICT VILLAGE

EDWETU/KAYOLI

NAME OF HOUSE HOLD HEAD

JOSEPH NDIUGU GITII

HOUSE HOLD NUMBER

132

NAME OF THE GROUP

LUCY / 204

DATE OF INTERVIEW

5/1/90

1. Are you a member of any group?
How much monthly dues?

1 = Yes

2 = No

1

- 1 = NOT APPLICABLE
- 2 = 0-20 (KSHS.)
- 3 = 21-40 "
- 4 = 41-100 "
- 5 = > 100 "

3

1. INDOOR AIR CONDITION

2. Number of Children 6 - 60 months

2

3. How many sleeping rooms in the household

2

4. How many people slept in these rooms last night

6

5. Average number of persons sleeping per room

6. Which type of Fuel 0 = Electricity 1 = Gas
3 = Paraffin 4 = Charcoal
5 = Firewood 6 = Others

3

7. Distance of cooking area with respect to household

- 2 = Separate building
- 3 = In the open
- 4 = Outside on Veranda
- 5 = A room in the house
- 6 = Within the sleeping room
- 1 = Other (specify)

5

8. Indoor Air Class score (ADD Q 6 to Q 7 Score)

- 1 = Excellent (1-2)
- 2 = Good (3-5)
- 3 = Fair (6-7)
- 4 = Poor (8-9)
- 5 = Very Poor (10-14)

9. STANDARD OF ROOFING

Roof Condition
Score

- 1 = Leaking
- 2 = Sagging & Parched
- 3 = Patched
- 4 = Sagging
- 5 = Good Condition

1

10. Roof Material
Score

- 1 = Temporary (Thatch, Plastic, Cartonn)
- 2 = Semi Permanent (Tar Paper),
- 3 = Permanent (Tiles, galvanized Iron sheets)

11. Roof Class (Add score from
r. Q9 and Q10)

- 1 = Excellent (score 7 - 8)
- 2 = Good (score 5 - 6)
- 3 = Fair (score 4)
- 4 = Poor (score 2 - 3)

3. WALL STANDARD

12. Wall condition
Score

- 1 = Gaping holes
- 2 = Cracks visible
- 3 = Patched with different material
- 4 = Leaning
- 5 = Good

13. Wall material
Score

- 1 = Temporary (Grass, Plastic, Plywood, etc)
- 2 = Semi-Permanent (mud, Nabat1)
- 4 = Permanent (Brick, stones)

14. Wall Class (Add Score from QN 12 and QN 13)

- 1. = Excellent (score 8 - 9)
- 2 = Good (score 5 - 7)
- 3 = Fair (score 4)
- 4. = Poor (score 2 - 3)

15. Floor Standard

- 1 = Excellent (Permanent, Covered, or Polished)
Tiles, bricks, stone, wood and concrete.
- 2 = Good (permanent but not Protected)
- 3 = Fair (Temporary - mud,) smooth or clean
- 4 = Poor (Loose material stones or soil)

16. Drainage System (Sullage and/or tap in cpd)

- 1 = In good order
- 2 = Eroded
- 3 = Blocked with or without stagnant pools
- 4 = Non Existent

17. Solid Waste Disposal

- 1 = Into Dust Bin
- 2 = Designated Pit or Dip (private)
- 3 = Designated Communal Tip or pit
- 4 = Thrown anywhere
- 5 = Contaminated with human faeces

18. Solid Waste Treatment

- 1 = Hauled away by civic body
- 2 = Buried
- 3 = Burnt
- 4 = Not treated

19. Excreta Disposal

- 1. - Clean safe toilet/latrino
- 2. - Safu latrina
- 3. - Unsafe latrina
- 4. - Non-Existent latrina
- 5. - Bucket system

7

20. Excreta disposal for small children > 2 years of age.

- 1. - Latrina used at all times
- 2. - Designated hygienic place (piece of paper or pot)
- 3. - Behind the house
- 4. - Anywhere

7

21. Handwashing after Defecation

- 1. - Possible and Practiced
- 2. - Possible but not Practiced
- 3. - Not Possible

3

22. Drinking Water Quality

- 1. - Rainwater tank
- 2. - Treated water (piped)
- 3. - Borehole
- 4. - Protected Spring
- 5. - Protected well
- 6. - Surface Water body (river, stream, lake etc)
- 7. - Vendor

2

23. Water Consumed per day (drinking & Cooking needs)

- 3. - 1 to 2)
- 2. - 2 to 4) Buckets (20 litre containers)
- 1. - 4+)

3

24B. Water Consumed per capita per day divide 0 23 by NO of Household members.

- 1. - > 60 litres
- 2. - 31-60 litres
- 3. - 11-30 litres
- 4. - 0-10 litres

24. How much paid for water per bucket

- 1. - 50 cents
- 2. - 50 to Kshs. 1/-
- 3. - >Kshs. 1/-
- 4. - Not applicabl

4

Below 1/100

25. HEALTH STATUS OF PRE-SCHOOL CHILDREN 1ST CHILD

- Q25 = 1st child Q26 = 2nd child
- Q27 = 3rd child
- 25A Age in months to the nearest month
- 25B Sex 1 = Male 2 = Female
- 25C Duration of stay in village (months)

4

1

24

25V EDUCATIONAL STATUS OF MOTHER

- 1. NONE
- 2. STANDARD 1 - 4
- 3. STANDARD 4 - 8
- 4. STANDARD 8 - 11
- 5. POST GRADUATE

3

25D Relationship of Caretaker to child
 1 = Mother 2 = Grandmother
 3 = Sibling (over 12 years)
 4 = Sibling under (12 years)
 5 = Maid > 12 years
 6 = Maid < 12 years
 7 = Others (specify)

25E Length of child in cm to nearest 0.5cm

25F Height of child in cm convert as per formula

25G Height for age Index (in multiples of Standard Deviation) (S.D.)

25H Weight in Kgs. (Nearest 0.1kg)

25I Weight for age Index in (Multiples of Standard deviation)

25J Weight for height Index (in multiples of S.D.)

25K URTI in last 2 days
 1 = Nil 3 = Moderate
 2 = Mild 4 = Severe

ASCARIS/Hookworm)

25L Ova in stool 1 = Nil 2 = Light
 3 = Moderate 4 = heavy egg load
 (as per the lab results)

25M Diarrhoea disease occurrence in the last week (more than 3 bowel motions per day) 1 = yes 2 = NO

25N Duration of Breast feeding
 1 = < 4 months of age 2 = 4-12 months of age
 3 = > 12 months of age

25P Date of introduction of weaning diet
 1 = < 4 months 2 = 4 - 6 months
 3 = 6 - 12 Months 4 = > 12 months

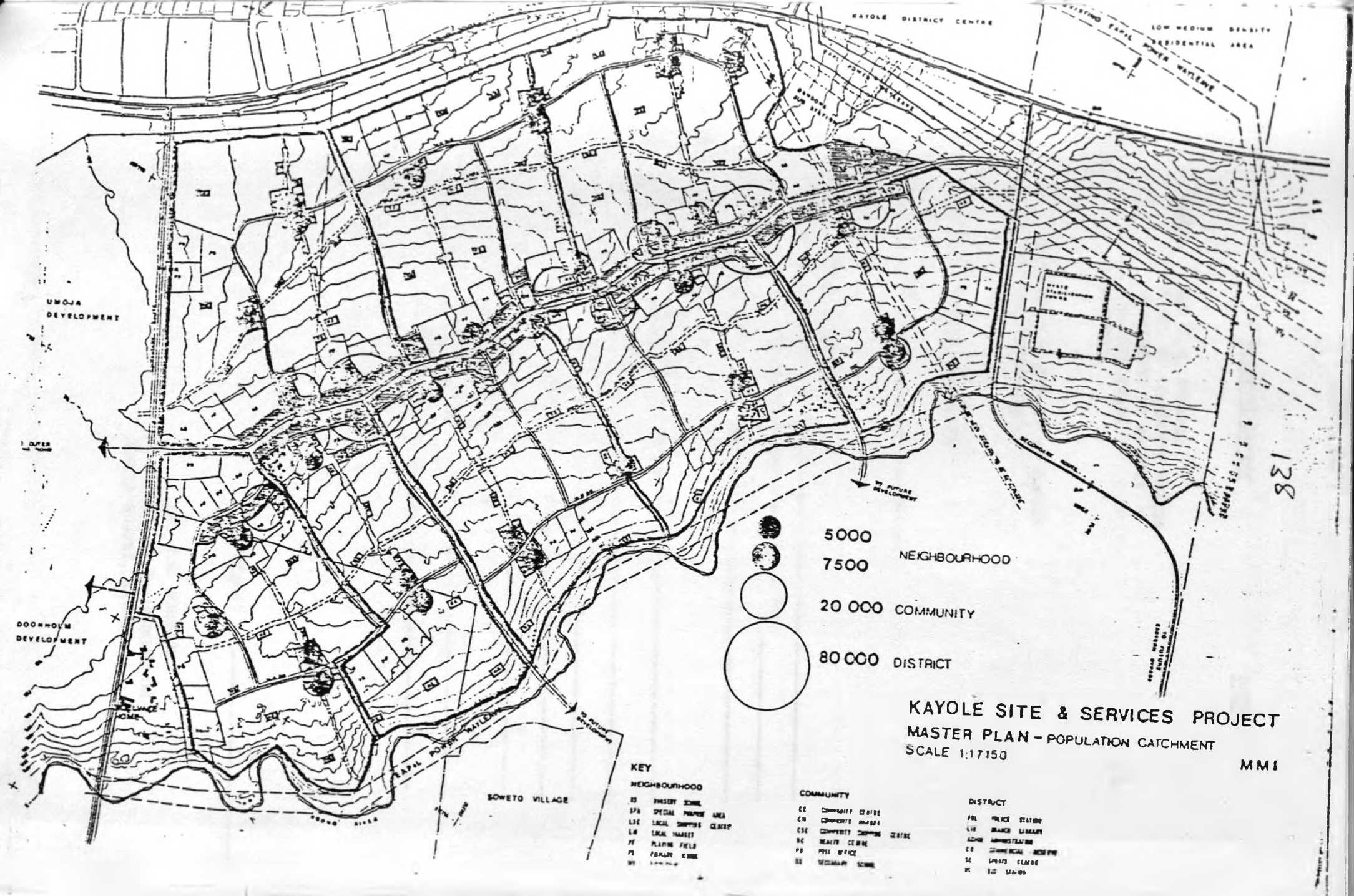
25Q Number of visits by child to health facility since previous three months.
 1 = nil 2 = less than two
 3 = three to four
 4 = more than four

25R Is the mother living with child in this household? 1 = yes 2 = No

25S Mothers age in years.
 1 12 - 14 years 2. 14 - 19 years
 3 20 - 24 years 4. 25 - 29 years
 5 30 - 35 years 6. > 35 years

25T Marital status of mother
 1 = Single 2 = divorced
 3 = Separated 4 = Polygamous married
 5 = Monogamous married 6 = widowed

25U Birth position of this child amongst the living siblings (whether in this household or not)
 1 = 1st 2 = 2nd - 4th 3 = 5th - 6th
 4 = more than 6th



UMOJA DEVELOPMENT

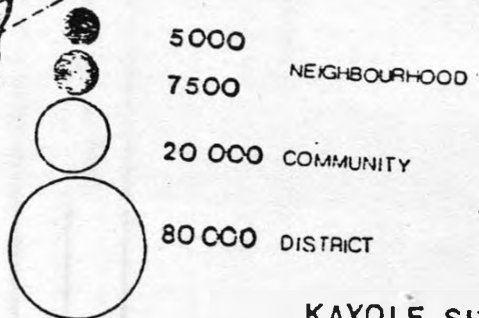
OUTER RING

DOORHOLE DEVELOPMENT

KAYOLE DISTRICT CENTRE

EXISTING PAPAL POWER WAYLEAVE
LOW MEDIUM DENSITY RESIDENTIAL AREA

138



KAYOLE SITE & SERVICES PROJECT
MASTER PLAN - POPULATION CATCHMENT
SCALE 1:17150

MMI

KEY

- NEIGHBOURHOOD**
- ES PRIMARY SCHOOL
 - SFA SPECIAL PURPOSE AREA
 - LSC LOCAL SHOPPING CENTRE
 - LH LOCAL MARKET
 - PF PLAYING FIELD
 - PS PAVILION BUILDING
 - W1 WATER POINT

- COMMUNITY**
- CC COMMUNITY CENTRE
 - CM COMMUNITY MARKET
 - CSC COMMUNITY SHOPPING CENTRE
 - HC HEALTH CENTRE
 - PO POST OFFICE
 - SS SECONDARY SCHOOL

- DISTRICT**
- PUL POLICE STATION
 - LIL LIBRARY
 - ADM ADMINISTRATION
 - CO COMMERCIAL CENTRE
 - SC SPORTS CLUB
 - ST STATION

SOWETO VILLAGE

PAPAL POWER WAYLEAVE
KAYOLE RIVER



EXISTING PAPAL POWER WAYLEAVE

TO FUTURE DEVELOPMENT

TO FUTURE DEVELOPMENT

MINISTRY OF WATER DEVELOPMENT

Water Quality and Pollution Control Directorate

Referral Letter

DATE

FROM: DR. J.M. NJORGE
DEPT. OF COMMUNITY HEALTH
UNIVERSITY OF NAIROBI
P.O. BOX 19676,
NAIROBI.

C/O Medical Officer of Health
City Commission.

TO: MEDICAL IN-CHARGE

AT -----

REF: Name of patient

Age ----- Sex -----

Address -----

Diagnosis -----

Features elicited -----

Reason for referral -----

Thank you. *

Signed -----

DR. J.M. NJORGE
ON FIELD WORK IN HOUSING ON
HEALTH SURVEY, KAYOLE.

MINISTRY OF WATER DEVELOPMENT

Water Quality and Pollution Control Laboratory

Tel. No. 557008, Ext. 93
P.O. Box 30321
NAIROBI.

Date.....

WATER ANALYSIS REPORT

Sample No.....
Source.....
Date of Sampling.....

Date Received.....
Submitted by.....
Purpose of Sampling.....

PARAMETERS	UNIT	RESULTS	REMARKS
pH	pH Scale		
Colour	mg p/l		
Turbidity	N.T.U.		
Permanganate No. (20 min. boiling)	mgO ₂ /l		
Conductivity (25°C)	µS/cm		
Iron	mgFe/l		
Manganese	mgMn/l		
Calcium	mgCa/l		
Magnesium	mgMg/l		
Sodium	mgNa/l		
Potassium	mgK/l		
Aluminium	mgAl/l		
Total Hardness	mgCaCO ₃ /l		
Total Alkalinity	mgCaCO ₃ /l		
Chloride mg Cl/l	mgCl/l		
Fluoride	mgF/l		
Nitrate	mgN/l		
Nitrite	mgN/l		
Ammonia	mgN/l		
Total Nitrogen	mgN/l		
Sulphate	mgSO ₄ /l		
Orthophosphate	mgP/l		
Total Suspended Solids	mg/l		
Free Carbon Dioxide	mg/l		
Dissolved Oxygen	mg/l		
TDS	mg/l		
Others			

COMMENTS:

Senior Chemist
Water Quality Laboratory
MINISTRY OF WATER DEVELOPMENT

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LIST OF ABBREVIATIONS

B.O.D	Biological Oxygen Demand
B.R.	Birth Rate
C.S.D.	Child Survival and Development
C.M.R.	Child Mortality Rate
C.B.S.	Central Bureau of Statistics (in Ministry of Economic Planning)
D.R.	Death Rate
D.C.'s	Developed Countries
D.F.	Degrees of Freedom
e.g.	for example
etc	"and others"
FAO	Food and Agricultural Organization
H/A	Height for age (Index)
IMR	Infant Mortality Rate
i.e.	that is
L.D.C.'s	Less developed Countries
M.O.E.	Ministry of Education
M-1 S.D.	Median minus one Standard deviation
N.I.C.'s	Newly Industrialized Countries
NCHS	National Council for Health Statistics (U.S.A.)
N	Number
P.A.	Per annum
P.VALUE	Probability value of a distribution occurring by chance statistically
S.E.	South East
S.A.P.'s	Structural Adjustment Programmes
S.D.	Standard Deviation

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S.P.S.S.	Statistical package for the Social Scientist
S.P.M.	Suspended Particulate Matter
U.S.A.	United States of America
U.K.	United Kingdom
UNICEF	United National Children's Fund
U.R.T.I.	Upper Respiratory Tract Infection
Vs	"Versus"
WHO	World Health Organization
W/H	Weight for Height (Index)
W/A	Weight for Age (Index)
W.A.S.H.	Water and Sanitation for Health
w.r.t.	With respect to.