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Urban equity and urban health: using existing data to understand inequalities in health and environment in Accra, Ghana and São Paulo, Brazil

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SUMMARY: *This paper describes the methods used to study inequalities in health status and environmental conditions between different groups in the cities of São Paulo and Accra. The studies used existing data, drawn from different sources, and involved staff from different government agencies (from city authorities and higher levels), academics and NGOs in determining how best to use it. The paper also provides a summary of the main findings, including a discussion not only of inequalities in health between the best quality and worst quality zones in each city but also on how health risks differ by age group. The paper begins by considering why information on such inequalities is so important for policy makers and why so little data on this are available in most cities in the South.*

The principal author, Carolyn Stephens, is a lecturer in Environmental Health and Policy at the London School of Hygiene and Tropical Medicine where she has worked since 1988. With a Masters degree in Health Planning and Financing and a PhD in Public Health Medicine, she has worked extensively in the South and has written widely on urban environmental health issues, with

I. INTRODUCTION

THIS PAPER WAS written at the request of *Environment and Urbanization*'s editors, in response to the interest from readers of the October 1996 issue on "urban inequalities". It reports on the methods used for a study of environmental and health inequalities in two cities, Accra in Ghana and São Paulo in Brazil, showing how to use existing data as a means of studying inequality. The paper is written primarily to encourage other research and policy groups to consider comparable studies in their cities and to advise them on the data sources that can be used.

a special interest in inequality. She is a member of the Advisory Board of* Environment and Urbanization *and co-edited the October 1996 issue on "City Inequality".

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1. Stephens, C. (1996), "Healthy cities or unhealthy islands? The health and social implications of urban inequality", *Environment and Urbanization* Vol.8, No.2, pages 9-30; also Stephens, C., I. Timaeus, M. Akerman, et al. (1994), *Environment and Health in Developing Countries: An Analysis of Intra-urban Differentials Using Existing Data; Collaborative studies in Accra and São Paulo and Analysis of Urban Data of Four Demographic and Health Surveys*, London School of Hygiene and Tropical Medicine, London, 128 pages; and Doe, B.K. (1994), "Accra, Ghana: intra-urban differentials" and Akerman, M. and P. Jacobi (1994), "São Paulo, Brazil: urban differentials in an industrial city in the developing world" in Serageldin, I., M.A. Cohen and K.C. Sivaramakrishnan (editors) (1994), *The Human Face of the Urban Environment. Proceedings of the Second Annual World Bank*

The paper describes some of the difficulties encountered in terms of the quality and completeness of the data as well as the opportunities for policy makers revealed by this use of routine information. The paper also includes some of the work's main findings by way of illustration but other papers by the authors present more details on the findings and discuss more thoroughly the policy questions raised by the work.[1]

The study emerged from work commissioned in 1990 by the World Health Organization and the World Bank. Both agencies wanted to know the relative impacts of urban environmental conditions on human health.[2] This was thought to be an important question for future urban policy - to guide priority-setting towards addressing the most harmful urban environmental hazards in terms of human health and to guide policy makers towards more equitable resource allocation and decision-making processes. This work shows the growing recognition, by bilateral and international agencies as well as national and local governments, of the pressing need to develop a more detailed understanding of the inter-relationships between the urban environment and health. This is especially true in the context of the large-scale shifts to urban areas by people, particularly in Africa, Asia and Latin America. Detailed environmental health research in urban areas of these regions can be useful to policy makers in the following ways:

- to fill gaps in knowledge about inequalities in environmental resources and health impacts between groups;
- to add to understanding of the impacts of urban environmental conditions on health;
- to develop broadly replicable methods for identifying priorities on the basis of human health needs; and
- to produce generalizable information on prevailing environmental health conditions in cities in Africa, Asia and Latin America.

Most importantly, such research should point the way to more equitable urban management for local governments and to improved design of programmes and projects for bilateral and multilateral donors.

II. WHY MORE RESEARCH?

OVER THE LAST few decades, there have been many studies highlighting the health problems of the urban poor in the cities of Africa, Asia and Latin America. Yet a review of the international literature reveals that, until recently, the extent of intra-urban differentials in social, environmental and health conditions between groups in cities has been poorly understood. In a broad sense, we are aware that the process of urbanization has different impacts on a city's environmental, socio-economic and political conditions. In most urban areas in the South, between 30 and 45 per cent of the population have incomes or consumption levels below the official poverty line.[3] It is also evident

that, alongside urban poverty, a small proportion of urban residents have lifestyles and living conditions which mirror those of the very affluent in the North. Yet, despite our evidence on the clear differences in conditions between the urban poor and the wealthy in many cities, until recently we have known little about the implications of urban inequality for the health of urban citizens.

Gaps in knowledge are being filled. A 1991 review identified over 100 studies concerned with intra-urban differentials in environmental health.[4] The October 1996 issue of *Environment and Urbanization* focused on urban inequalities. Studies proliferate; for example, recent household studies in Jakarta, Accra and São Paulo identified major differentials between income groups in environmental conditions and reported illness from respiratory diseases and diarrhoeal diseases in children.[5] These studies of inequalities in child health exist alongside a much larger body of research which focuses on the health and conditions *within* particular deprived city communities. Many of these studies demonstrate the complex nature of impacts of the urban environment and poverty on health.

It is important also to understand the scale of the gaps in our understanding of the implications of urban inequalities for health. Work in cities which focuses on conditions within particular tenement districts, illegal settlements or other locations with a high concentration of low-income groups are a useful input to understanding specific communities. However, such studies often fail to place their information on the urban poor within one settlement in the context of the urban system overall. It is important to do this since poor quality social, environmental and health conditions in one part of a city are linked closely to the high quality conditions in other parts of the city. It is useful to have details of the health of children in one community within a city but it is important also to understand this in the context of their conditions and health relative to other groups in the city. It is also important to know the proportion of people in each set of conditions; this information is only available in very few cities.

There are other major gaps in our knowledge - for example, until very recently, there has been very little data on the health of adults in cities and the impacts of urban inequalities on their health. This is true of countries in Africa, Asia and Latin America in general and is not confined to urban groups.[6] In fact, there are almost no comprehensive sources of information on adults and their health for cities in most of the South. In general, by the time data of the type needed to assess differentials within the urban population are available, the city has ceased to be typical of the rapidly developing cities of Africa, Asia and Latin America. We need information on the health of *all* groups within a city's population if we want to understand the impact of urban environmental and socio-economic conditions on the working and elderly populations of cities. We know that working and living conditions for many economically deprived adults in cities are as bad, and potentially worse, than those in the industrial centres of Europe in the nineteenth century. But what is

Conference on Environmentally Sustainable Development, The World Bank:Washington DC.

2. Bradley, D., C. Stephens, T. Harpham et al. (1992), *Urban Management Program Discussion Paper 6: A Review of Environmental Health Impacts in Developing Country Cities*, The World Bank:Washington DC, 58 pages; also Stephens, C., T. Harpham, D. Bradley et al. (1990), *Health Impacts of Environmental Problems in Urban Areas of Developing Countries: An Analysis of the Epidemiological Evidence for the WHO Experts Committee on Urbanization*, World Health Organization:Geneva.

3. UNCHS (1996), *An Urbanizing World: Global Report on Human Settlements 1996*, Oxford University Press:Oxford and New York.

4. See reference 2, Bradley, Stephens, Harpham et al. (1992).

5. Benneh, G., J. Songsore, J.S. Nabila et al. (1993), *Environmental Problems and the Urban Household in the Greater Accra Metropolitan Area (GAMA) - Ghana*, Stockholm Environment Institute:Stockholm; also Jacobi, P. (1994), "Households and environment in the city of São Paulo: problems, perceptions and solutions", *Environment and Urbanization* Vol.6, No.2, pages 87-110; Suryadi, C. (1993), "Respiratory diseases of mothers and children and environmental factors among households in Jakarta", *Environment and Urbanization* Vol.5, No.2, pages 78-86.

6. Feachem, R., T. Kjellstrom, C. Murray et al. (1990), "Adult mortality: levels, patterns and causes" in Feachem R., T. Kjellstrom, C. Murray et.al (editors) (1990), *The Health of Adults in the Developing World*, World Bank:Washington DC.

the impact of these conditions on the health of urban adults? What is the extent of inequalities in urban health impacts between adults in cities? It is impossible to answer this question for most cities in the South.

The work reported here was conceived because of these information and policy needs. Both the methods and the results have revealed new insights into urban inequalities. The results have exposed the extent of inequalities in environmental conditions and in health impacts between groups in two major cities. Along with our attempt to answer a major research and policy question, we approached our research in an unusual way. The methods for gathering and analyzing case study data for this project were developed on the basis that urban environment and health relationships are complex and they warrant multisectoral and integrated interventions. In recognition of this, we sought to use research to cross sectoral divides between those who plan resource allocation in cities. We did this because we were all aware that there are many sectoral divisions within professionals who work in and on cities - for example, between those working on health, environment, water and waste, transport, social policy and local government. There are also divisions between the research and policy community and between politicians and technicians. We tried to cross some of these boundaries and to set up a method which would drive a set of complementary policies between sectors and towards equity. The authors of this work are from academic and policy institutions - researchers and practising local planners - and our larger team was formed from practitioners from many sectors. We are also from different disciplines representing epidemiology, town planning, demography, social science, engineering and political science. We also approached our information sources with a pragmatic policy focus. Rather than attempting to collect primary data for entire cities (almost impossibly expensive), we made maximum use of existing data collected by the service and planning agencies within cities. We did this for two reasons. First, we felt such an approach tested the idea that it was possible to develop a simple method to understand urban inequalities which could be used in other cities. Secondly, and perhaps more importantly, we felt that if planners and practitioners in local government agencies within cities could collaborate with researchers and use their own routine information to identify environment and health inequalities, they would feel more ownership of the problems of urban equity - and the solutions to it. This is perhaps a more strategic approach than relying only on academic studies to collect such primary data on such sensitive questions. Also, we felt this was an important way of exploring the concerns of many practitioners who plan and provide services within local government in cities - people who would often welcome the opportunity to collaborate and to shift resource allocation to those facing the greatest environmental and health deprivation. Finally, we were trying to see if it was possible to use information as a catalyst to break down boundaries between sectoral agencies which traditionally use separate information systems to drive often contradictory policies.

7. Descriptive epidemiology is defined as: concerned with the description of suggestive characteristics (health, circumstantial, behavioural) of individuals or groups. Mainly of persons, places, time, e.g. infant mortality rates in different areas of a city.

8. Morbidity can be defined as a departure, subjective or objective, from a state of well-being. It can be measured in three ways: number of persons who were ill; types of illnesses experienced; and duration (days, weeks etc.) of illness.

The study reported here was undertaken in more than one centre - in order to provide information from contrasting regions. In assessing potential cities, a mixture of technical and pragmatic criteria was applied. The cities should both have information systems that allowed the work to be undertaken and they should also reflect the diversity within cities in the South. São Paulo and Accra were chosen. São Paulo is the largest and wealthiest city in one of the South's largest, wealthiest and most industrialized economies whilst Accra is the capital of one of the lowest-income and least industrialized countries in the South. Brazil and Ghana are also countries where information systems and environmental conditions are at different stages. The choice of Accra and São Paulo allowed the comparison of results on differentials in poverty, environmental and health in two cities in countries with very different levels of urbanization and per capita incomes. The studies were undertaken in 1992-1994. Table 1 shows summary data on the two cities.

Table 1: Basic Data on Accra and São Paulo

Indicator	Accra (metropolitan area)	São Paulo city (municipal area)
Land area	1,079 sq.km	1,577 sq.km
Population	1.2 million (1984 projection)	9.7 million (1991 census)
Annual population growth rate	5.6%	1%
% of national population in city	9.8%	6%
Five most important causes of ill-health (data in Accra based on morbidity data from hospitals)	Malaria, diarrhoeal disease, upper respiratory tract infections, malnutrition, road traffic accidents	Heart disease, external causes, respiratory diseases, neoplasms, nutritional and infectious disease.

SOURCES: Ministry of Local Government, (1992), *Strategic Plan for the Greater Accra Metropolitan Area*, Department of Town and Country Planning, Ministry of Local Government Ghana, pages 1-202; SEMPLA, (1992), *Base de Dados para o Planejamento*, SEMPLA, São Paulo.

III. AIMS AND METHODS

a. Developing the Methodology

9. Mortality or deaths can be measured in overall units (ie. number of persons dying) or by cause. Distribution of deaths can be further described by age, sex or place of residence.

10. Numbers of cases of morbidity or mortality provide the *numerator*. The *denominator* is the population at risk in the calculation of the rate.

THE AIM OF our study of urban inequalities was to use existing data to explore and describe the intra-urban distribution of health and environmental conditions within the two cities. The investigation of intra-urban health differentials using existing data is essentially a form of *descriptive epidemiology*[7] where the unit of analysis is the group (i.e. describing health events occurring in different groups within the population). The two health events which one can analyze are *morbidity*[8] and *mortality*.[9] Distribution of events is analyzed largely through rates.[10]

Results were depicted through geographic mapping of overall and cause-specific mortality rates and through comparison of death rates between groups living in different socio-environmental conditions. The analysis compiled data on the whole population of each city, in particular, the analysis sought to add to our understanding of the impact of urban conditions on adults as well as children and to quantify the complete extent of health inequalities within cities.

As a basic priority we wanted to put together disaggregated information from the different sectors on the ways in which the sectors routinely focused their information and resource allocation within cities - by district, sub-district, residential areas etc. Another tenet of the research was to try to keep methods and analysis relatively simple and transparent to planners and policy makers within each city, since this means much greater potential for replication and policy application. This was particularly important as the analysis was undertaken using existing data collected and utilized routinely by planners and service providers. Part of the study involved a critical appraisal of existing data and the study also involved a collaborative effort to combine data from diverse sources. Both of these elements required the confidence of city planners in both the research aims and methods.

We therefore decided to develop a composite index of socio-environmental deprivation, on the basis that such a composite would be more likely to drive policy towards integrated initiatives to address inequalities. As a result of the study philosophy, the first step was to develop a consensus on study design and on what information to use. This was done in each city using a workshop involving key local planners and academics. The aim of these initial workshops was to develop a consensus within the group of local planners and key actors in the urban environment on the specific environmental and social variables which would be locally relevant for inclusion in a composite index of "urban deprivation" specific to the health of either Accra or São Paulo. We also used the workshop to agree on the level of disaggregation of the information - at district and sub-district level.

b. Creating an Index of Socio-environmental Deprivation

The idea of using composite indices to document inequalities is not new. Small area analyses of differentials in the United Kingdom have produced a number of useful studies which combine several indicators of social and material deprivation into a composite deprivation index.[11] Studies have then analyzed the interaction of deprivation factors implicated in poor health over time and within small areas.[12] These studies have been used to develop sensitive indicators to predict areas of social deprivation and to guide policy. In addition to their methods, these studies have highlighted the complex and multi-factorial relationship between health and the environment.[13]

Indices of deprivation which highlight inequality are largely specific to the characteristics of each culture and context. There

11. Jarman, B. (1984), "Underprivileged areas: validation and distribution of scores", *British Medical Journal* Vol.289, pages 1587-1592.

12. See, for instance, Eames, M., Y.B. Shlomo and M. Marmot (1992), *Health Education Authority Project: Area Deprivation and Premature Mortality: (Part B) Data Analysis of Phase II of the Health Mappint Project, Final Report All Cause Mortality, Coronary Heart Disease and Smoking Related Deaths*, unpublished.

13. Elford, J., P. Whincup and A.G. Shaper (1991), "Early life experience and adult cardiovascular disease: longitudinal and case-control studies", *International Journal of Epidemiology* Vol.20, No.4, pages 833-844.

is much debate about the relative merits of variables used to compose social and environmental indices. Depending on the city context, certain variables will be more important than others for identifying areas of environmental or health deprivation and privilege. It may also be that a composite of physical variables is most important for exploring infant deaths and ill-health (related to water, sanitation, nutrition and housing conditions) while a composite of social variables is more important for understanding health impacts on adults and the elderly (related to work environments, social opportunity and mental health).

To derive the index, the workshop participants were first given a list of available disaggregated[14] data collected in the city (gathered beforehand by the team). The members of the workshop judged two aspects of the data. The first was the *validity* of each variable (ability of the variable to measure "deprivation" in each city). The second was the *quality* of each variable (including completeness and accuracy of the existing information). In each city, this workshop was small (12-20 core participants). The participants represented diverse fields. In Accra, participants included the district medical officers of Accra (Ministry of Health); the city medical officer (Accra Metropolitan Assembly); a planner from the Urban Planning and Development programme of the Ministry of Local Government in Accra; an environmental planner from the Environmental Protection Council of Ghana; a demographer and epidemiologists, expert in specific diseases (respiratory infection and accidents); a professor of geography at the University of Legon; Ghana's chief Registration Officer for Births and Deaths; and two Brazilian representatives and an advisor from the World Health Organization. In São Paulo, the meeting was attended by representatives of the *Secretaria de Planejamento* (planning), *Educacão* (education) and *Habitacão* (housing); water and sanitation (SABESP); the environmental monitoring agency (CETESB); the University of São Paulo School of Public Health; the State Institute of Health (Epidemiology); the Municipal Health Secretariat; CEDEC (a policy analysis group responsible for a sister study of household environment and health) and a representative of the national Ministry of Health (Health Analysis Unit) from Brasilia.

Working groups were formed in both cities. The main purpose of the groups' discussions was to derive the socio-environmental index of deprivation based on variables identified as the "most important predictors of ill-health and death within the city". The index was derived by the whole group using a modification of the Delphi technique.[15] The Delphi method allowed the group to reach a transparent consensus decision on the socio-environmental variables to be used which "experts" in the local setting felt to be valid and available in good quality existing data as "predictors" of areas of deprivation. To some extent, the Delphi method was also used to give planners in each setting a sense of ownership over the design of the work and a sense of mutual responsibility for the definition of deprivation.

Table 2 lists the available existing data in each city. There was a surprising congruence in existing data available in the two very different cities in the study. This list is the revised

14. In Accra, the workshop was also used to define the outer boundary of the study and the level of disaggregation to be used within the city. In São Paulo, the outer boundary was decided by pragmatism: the time available limited the outer boundary to the city rather than the larger metropolitan area and the level of disaggregation was fixed by the division used for registration of deaths.

15. So called after the oracles of Delphi in Ancient Greece who were reputed to be able to see the future. The technique is used to develop forecasts of future events based on the collective opinion of knowledgeable experts. Members provide opinions independently; these are then summarized collectively and represented to the individuals who may then revise their opinions. These then go on to form a modified group opinion.

Table 2: Types of Existing Area Based Social and Environmental Data Available in both Cities (with the concensus definition of the deprived state)

***INCOME*:**	Accra:	An area with a low average household income = deprived. e.g. on area basis, the area with the lowest average household income within the city is the most deprived
	São Paulo:	An area with a low average per capita income= deprived
EMPLOYMENT:	Accra:	An area with a high proportion of unskilled or unemployed workers = deprived
	São Paulo:	An area with a high proportion of unemployed people=deprived An area with a high proportion of the population who are economically inactive=deprived
GENDER BALANCE OF THE AREA:	Accra:	An area with a high female to male ratio = deprived.
	São Paulo:	An area with a high proportion of female headed households=deprived
***EDUCATION*:**	Accra & São Paulo:	A low level of education (none or incomplete primary) in head of household in an area = deprived
***HOUSEHOLD SIZE*:**	Accra:	A large household = deprived
DENSITY **(three optional measures):**	Accra & São Paulo:	An area with a large number of persons per house = deprived. ie. the area with the highest number of persons per house is the most deprived
	Accra & São Paulo:	An area with a large number of households per house = deprived. ie. as above
	Accra:	An area with a high proportion of persons per room = deprived. ie. the area with the highest number of persons per room is the most deprived
***LAND QUALITY*:**	Accra:	Using a proxy for land quality of land cost, an area with a low land value for the area = deprived
	Accra & São Paulo:	An area with a large proportion of land vulnerable to flooding and erosion=deprived
***HOUSING QUALITY*:**	Accra & São Paulo:	A high proprtion of sub-standard (walls and roofs in disrepair) houses in an area = deprived
***WASTE DISPOSAL*:**	Accra:	An area without a regular waste collection service = deprived
***SANITATION*:**	Accra:	An area with a low proportion of the population with access to individual or shared toilets (in the house) = deprived
	São Paulo:	An area with a low proportion of households connected to the central sewerage system=deprived
***WATER ("ACCESS")*:**	Accra & São Paulo:	An area with a low proportion of people with a supply of potable (clean/drinkable) water in the house = deprived

version of available variables on which the participants worked and the definitions of the deprived state were arrived at by consensus in group discussion. The list also formed the basis of the subsequent ranking exercise and includes both social and environmental variables - the mix being defined by the workshop participants.

Table 3 presents the final results of the ranking exercise and the first round results for comparison. The research team facilitated but did not participate in discussions or ranking. Perhaps surprisingly, the same list of five variables was selected in each city, with income and education being deemed the most important predictors of deprivation and consequent ill-health within the cities. Measures of density and the water/wastes complex were seen as the other important variables for predicting poor health.

Table 3: Summary of Final (and Initial) Group Ranking of Indicators of Deprivation According to their Validity for Accra

List of social and environmental variables chosen to make up index of deprivation in Accra and São Paulo (in order of rank)	Final Ranking	
	Accra	São Paulo
Income	1	1
Education of head of household (proportion without primary education)	2	2
Number of persons per room	3	5
Sanitation	4	3
Water access	5	4

SOURCE: Stephens, C., I. Timaeus and M. Akerman et al. (1994), *Environment and Health in Developing Countries: An Analysis of Intra-urban Differentials using Existing Data. Collaborative Studies in Accra and São Paulo and Analysis of Urban Data of Four Demographic and Health Surveys*, London School of Hygiene and Tropical Medicine, London, pages 1-128.

c. Data Collection

In each city, data were gathered on demography, deaths by area and on the agreed variables in the social and environmental indices by area. Almost all data were from unpublished and published reports from the planning and service agencies relating to each city. Table 4 summarizes the data sources in each city.

In both cities, the data source for health was (predominantly) the mortality statistics compiled by the local authorities from the compulsory registration of deaths (for 1991 in Accra and 1992 in São Paulo). The studies focused on mortality data rather than morbidity data despite the data quality issues outlined below. In both cities, these data are more complete and thus representative of the whole population. For example, up to 50 per cent of the population in Accra rely on private practitioners or self-treatment in cases of illness and this makes official routine morbidity data very incomplete. Mortality data are derived from the registers of births and deaths which are compiled manually using cause of death certificates issued by medical practi-

Table 4: Main Data Sources in Each of the Case Study Cities

DATA	ACCRA	SÃO PAULO
Demographic	* 1984 census. * 1989 Demographic and Health Survey * 1990 Demographic Studies and Projections for Accra Metropolitan Area. Department of Geography & Resource Management, Accra * SEI/University of Legon (1991) Zone-based age distribution based on sample survey.	* Fundação IBGE-FIBGE 1991 census * 1992 *Fundacão Sistema Estadual de Analise de Dados* (SEADE) (routine vital statistics bureau): estimated zone based age distribution from PCV study (1990)
Mortality	* 1991 Statistical Service Accra * Ministry of Health. Health Annual reports at district and national level * Registry of Births and Deaths: registers of deaths, cemetery records	* 1992 SEADE. Routine mortality data * 1992 PRO-AIM *Programa de Aprimoramento das Informacoes de Mortalidade no Municipio de São Paulo*
Socio-environmental	* 1991 Amuzu, Leitman. Environmental profile of Accra * 1990 Housing Needs assessment. Housing and Urban Development Associates. * 1989 Ghana Living Standards Survey. Republic of Ghana, Statistical Services * 1989 Demographic and Economic characteristics. Stats. service, Accra * Min. of Local Gov, Ghana (1992) Accra Planning & Development Programme Strategic Plan for Greater Accra Metropolitan Assembly Area	Secretaria Municipal de Planejamento - SEMPLA (income and education data disaggregated by districts and sub-districts) *1990 Philippi Arlindo. Urban Management and the Environment: São Paulo City Environmental Profile. *1990 census - data on household socio-economic status * 1990 EMPLASA. *Summary de Dados da Grande São Paulo* * 1988 Municipal Council of São Paulo Secretariat of Housing & Development. *Censo de Favelas do Municipio de São Paulo*

SOURCE: Stephens, C., I. Timaeus and M. Akerman et al. (1994), *Environment and Health in Developing Countries: An Analysis of Intra-urban Differentials using Existing Data. Collaborative Studies in Accra and São Paulo and Analysis of Urban Data of Four Demographic and Health Surveys*, London School of Hygiene and Tropical Medicine, London, pages 1-128.

tioners. The following information was extracted from the registers: age at death, cause of death (primary), sex, place of residence, place of death and date of death. We excluded data on all those who had died in the cities but were not residents as well as those who had died prior to or post the study years. Demographic data were derived from the most recent census, 1984 for Accra and 1991 for São Paulo. Population distribution by age, sex and geographic area was calculated for each city. Data on the environmental and socio-economic variables were compiled from routine and *ad hoc* surveys, and organized into a database based initially on the geographic boundaries which the workshop participants had selected. This is discussed further below.

d. Data Quality

Data sources were diverse and dated from different periods. To some extent, they addressed different populations - for instance environmental information was derived largely from rou-

tine service data and sample household surveys whilst population and mortality data were based on recorded events in the whole population. The study was very careful to check data quality and to limit the analysis to a descriptive review of inequalities - highlighting data quality problems where they were important. This kind of information cannot be used to impute specific causes of health impacts. This is a general problem of area based or *ecological* data which cannot be avoided no matter how reliable the data sources. This is a problem of relating area based and individual data, i.e. disaggregated census data on population are area based whereas mortality data refer to individual events within areas. In other words, an individual may be registered on a census in one area at one time but may die in another area at another time. It may be possible to trace broadly the area of residence for the dead person but not to relate each individual to their census registered self. Thus, the data do not relate directly to each other and calculated death rates by area can only be approximate. With caution, such data can be used to describe the spatial associations of health with environmental and socio-economic conditions but causal analysis of specific health/environment relationships is inappropriate.

Aside from the general problems related to the use of ecological data for understanding environmental health impacts, perhaps the main data quality problem with this kind of area based information is completeness. *Completeness* of information affects the validity of the description of urban inequalities. Box 1 summarizes these problems. Incomplete denominator (population) and/or numerator (deaths and disease) analyzed in relation to geographically disaggregated environmental data can be misleading. In both cities, we discarded the idea of looking at inequalities in ill-health rather than death since up to 50 per cent of people in each city do not use routine government services to treat illness. In Accra, routine data for both deaths and population were problematic. Data in São Paulo on deaths were excellent overall with only limited area-specific problems. Thus, in Accra there was significant under-reporting of infant deaths and possibly of deaths of children under the age of four; we estimated that the scale of under-reporting for this age group was up to 50 per cent in 1991. However, reporting of deaths of those over the age of five was approximately 75 per cent.[16] Using the same method to estimate completeness of mortality registration in São Paulo, mortality data are approximately 99 per cent complete overall. In terms of area-specific completeness, we estimated that there was significant geographical under-reporting of deaths in the peripheral areas of Accra - the Teshie-Nungua area to the east of Accra seems particularly affected, in part due to the absence of convenient registration points and in part due to lack of control of burials. In São Paulo, Parelheiros, another peripheral area may also be affected. Also in São Paulo, area based data, particularly in the central areas, were affected by deaths of the homeless who were not registered in the census but appeared in mortality figures (making rates appear high in these areas).

16. Estimates of completeness based on a method by Courbage Y. and P. Fargues (1976), "A method for deriving mortality estimates from incomplete vital statistics", *Population Studies* Vol.33, No. 1, pages 165-180.

Box 1: Factors to be Considered when Assessing the Quality of Individual Data Sources

Completeness	•total •area specific •social group specific •cause specific •sex specific • age specific
Accuracy	• age specific • cause specific • area specific

There were also problems with population data. The last population census of Accra was 1984 and this census had still not been analyzed to the level of statistical area disaggregation within Accra by 1991. We thus estimated population projections to 1991. These made assumptions about migration and natural increase which are probably valid for areas of Accra which have been occupied for many years (allowing ratio projections based on two or three census enumerations) but which are questionable for peripheral areas which have developed rapidly since 1984. In São Paulo, the most recent census was 1991 providing up-to-date overall figures on population, disaggregated to the level of sub-district and district. In both Accra and São Paulo, at the time of the study, age and sex structure information was available from sample surveys but not from census.

Mobility of people within cities can also severely confound any analysis of the relation of area based environmental conditions to area based health outcomes. Residential mobility in Accra is reportedly low, with over 57 per cent of the surveyed population from all zones in the city having lived only in their current dwelling and 24 per cent having lived in two houses. Residential mobility is highest in the migrant areas of town.[17] Data on population mobility within São Paulo is largely unknown but it will be possible to derive it from the new census.

Bearing these caveats on data quality in mind, broad cause groups were selected for analyzing the distribution of deaths in both cities, selecting a range of infectious and chronic urban environmental health problems. All deaths registered in Accra and in São Paulo in one year (1991 and 1992 respectively) were analyzed. The data was disaggregated by age, sex, area of residence and cause. The differences in overall death rates between areas and in age-specific causes were then analyzed, based on chapters of the International Classification of Disease and Disability (ICD9). We looked at diseases of the circulatory system, diseases of the respiratory system, and infectious and parasitic diseases. In São Paulo, a chapter on external causes (homicides and road traffic accidents) was included because of their overall importance as causes of death in the city.

In Accra in 1991, there were 7,360 deaths in a population of 1.2 million people; in São Paulo in 1992, there were 62,355

17. Benneh, G., J.S. Nabila, J. Songsore et al. (1990), *Demographic Studies and Final Projections for Accra Metropolitan Area (AMA)*, UNDP/UNCHS/Ministry of Local Government: Accra, 90 pages.

deaths in a population of 9.6 million. The deaths and population were mapped by 56 residential areas in Accra and by 56 districts in São Paulo. For geographic mapping of differentials by area, we presented crude rates (i.e. unadjusted for age distribution) due to data quality problems. We lacked age and area based population data at fine levels of disaggregation. Social and environmental conditions were also mapped. The social and environmental data were then used to rank each area on the basis of the socio-environmental index. Four socio-environmental zones were derived in each city using a method developed by the United Nations (1992) - the Human Development Index (HDI) - based on the average of values[18] given to each variable.[19] For an analysis of mortality rates by socio-environmental zone (in which areas are grouped by conditions), we were able to surmount data quality problems by estimating (approximately) age distribution for each zone from sample surveys. In São Paulo, five broad age groups were used for overall age-specific analysis: 0-4, 5-14, 15-44, 45-64 and 65+ years. In the light of the limitations of Accra's data (particularly under-registration of infants) three age bands were used for the final analysis: under-14, 15-44 and 45+ years. *Ad hoc* studies and routine data from cemeteries were used to cross-check our primary sources.

The final section of this paper presents some of the results of the two-city studies. It begins with a brief description of socio-environmental inequalities followed by a brief discussion of selected urban health inequalities that the studies found. It ends with a section focusing on local conclusions and policy implications.

18. These values range from 0 to 1, where 0 indicates more deprivation and 1 less deprivation.

19. Variables used to compose our index were average per capita income, percentage of illiterates, percentage of houses linked to central sewerage, average per capita water consumption and average number of persons per house.

IV. RESULTS

THE PROJECT SHOWED that it is possible to use existing data to identify the extent of intra-urban differentials in environmental and health conditions. In addition, it was possible to identify major inequalities in conditions and in health outcomes for adults as well as children in the two cities. Both these results are important. The first enabled local planners and policy makers to establish new ways of using their databases and the second allowed a better understanding of the differential impacts of urban development on the urban population as a whole.

a. Exposing the Myth of Urban Benefits - The Unequal Distribution of Socio-environmental Conditions

One of the major aims of the research was to document thoroughly the differential impacts of urban environmental and social conditions on people in the two cities. Results revealed both the scale of inequality and the proportions of people who have and have not experienced the benefits of living in urban centres. In national terms, in Ghana and Brazil, this is important. Both Accra and São Paulo are considered within their national contexts to be privileged. In Ghana, Accra is the nexus

Map 1: Socio-environmental Zones in the Municipality of São Paulo and Accra Metropolitan Area

NB: Zones with a score of 1 have the worst conditions while zones with a score of 4 have the best conditions

The Municipality of São Paulo (1992)

Accra Metropolitan Area (1991)

of economic wealth; the Greater Accra Metropolitan Area (GAMA) has 11 per cent of Ghana's population and is estimated to contribute 15-20 per cent of Ghana's GDP. It also has 56 per cent of Ghana's employment in finance, insurance and real estate, 31 per cent of employment in construction, 30 per cent of employment in transport and communication, 22 per cent in wholesale/retail trades and 18 per cent of employment in the manufacturing industry.[20] São Paulo is similarly privileged in national terms. With 12 per cent of Brazil's employees, the São Paulo metropolitan area accounts for 18 per cent of Brazil's GDP, 31 per cent of industrial domestic product and has 25 per cent of the industrial labour force.[21]

This overall picture conceals huge differences in living conditions and health impacts between groups within Accra and São Paulo. Table 5 summarizes inequalities between zones in socioeconomic and environmental variables. This is shown graphically in Map 1. Perhaps the most important thing to note is that urban inequalities in the two cities have very different patterns and that the approach to these inequalities is very different. In general, the spatial distribution of inequality in São Paulo shows the pattern familiar to analysts - overall, a deprived periphery and a privileged core. This pattern is still a gross simplification of reality, covering as it does a population of over 9 million. In addition, pockets of deprivation exist in the privileged areas of São Paulo. In Accra, patterns of disadvantage have a different distribution, reflecting the city's history as a traditional indigenous fishing village and as a colonial capital. Deprived areas exist alongside privileged areas, distinguished by overall conditions. The most deprived live in the traditional fishing villages and in areas prone to flooding to the west of the city.

It is also important to explain the differences in the character of inequality in the two centres as well as the proportion of people in each set of conditions. In Accra, 46 per cent of people live in the two most deprived zones. These areas accommodate people with the lowest educational standards, the lowest incomes and the poorest facilities in terms of water, sanitation and housing. The conditions for another 20 per cent of Accra's population are not substantially better. One-third of Accra's 1.3 million population live in adequate or excellent conditions and have good educational status and incomes. In Accra, a substantial proportion of those living in areas where good educational standards exist have poor levels of access to reasonable living conditions measured by access to basic water and sanitation facilities.

In São Paulo, the picture is different. Overall, access to water and sanitation facilities is good for all areas: 95 per cent of households have access to a household or neighbourhood water supply and 80 per cent of households are connected to a sewerage network. In Accra, by contrast, a substantial number of households in all areas do not have access to even basic sanitation facilities let alone connections to a sewerage system. In both cities, inequalities in water consumption between zones are considerable, with those living in the best areas consuming much more water than those in the least advantaged areas. In São

20. Ministry of Local Government (1992), *Strategic Plan for the Greater Accra Metropolitan Area*, Department of Town and Country Planning, Accra.

21. Emplasa (1990), *Sumario de Dados da Grande São Paulo*, Emplasa:São Paulo.

Table 5: Summary Data on Inequalities in Socio-environmental Conditons between Zones in Accra in 1991 and São Paulo in 1992

Zones 1 = worst	% in each zone		Per capita income (a)		Water (b)		Sanitation (c)		Density (d)		Education (e)	
	Accra	São Paulo	Accra	São Paulo	Accra	São Paulo	Accra	São Paulo	Accra	São Paulo	Accra	São Paulo
1	26	44	15	2	37	4	37	36	4	50	17	40
2	19	34	17	3	43	6	43	18	4	50	23	36
3	21	14	23	4	14	12	14	6	3	51	0.00	33
4	33	9	29	7	11	21	11	1	3	21	0.00	28

(a) Accra: (Cedis in '000s per month); Sao Paulo: (number of minimum wages per month)
(b) Accra: (% without water in house); Sao Paulo (per capita water consumption in cubic metres)
(c) Accra: (% without toilet (any type) in house); Sao Paulo (% without connection to sewer network)
(d) Accra: (% households in one room); Sao Paulo (Number of people per house)
(e) Accra and Sao Paulo: % illiterate or incomplete primary school

SOURCE: Stephens, C., I. Timaeus and M. Akerman et al. (1994), *Environment and Health in Developing Countries: An Analysis of Intra-urban Differentials using Existing Data. Collaborative Studies in Accra and Sao Paulo and Analysis of Urban Data of Four Demographic and Health Surveys*, London School of Hygiene and Tropical Medicine, London, pages 1-128.

Table 6: Summary Age-adjusted Mortality Differentials between Socio-environmental Zones in São Paulo, Brazil and Accra, Ghana in 1992 and 1991 Respectively. Mortality Rates (per 10,000) and Relative Risks (RR)

Zone	Circulatory diseases rate (RR)		Infectious and parasitic rate (RR)		Respiratory diseases rate (RR)		External rate (RR)
	S. Paulo	Accra	S. Paulo	Accra	S. Paulo	Accra	S. Paulo
1(worst)	23.0 (1.2)	16.4 (2.3)	2.7 (1.9)	9.2 (2.0)	8.4 (1.2)	7.6 (1.9)	11.0 (1.8)
2	22.4 (1.2)	14.6 (2.1)	2.2 (1.6)	14.4 (3.0)	7.7 (1.1)	7.5 (1.9)	7.7 (1.3)
3	19.1 (1.0)	13.5 (1.9)	1.9 (1.4)	10.1 (2.1)	7.1 (1.0)	6.5 (1.6)	6.8 (1.1)
4(best)	19.4 (1.0)	7.0 (1.0)	1.4 (1.0)	4.7 (1.0)	7.2 (1.0)	4.0 (1.0)	6.0 (1.0)

SOURCE: Stephens, C., I. Timaeus and M. Akerman et al. (1994), *Environment and Health in Developing Countries: An Analysis of Intra-urban Differentials using Existing Data. Collaborative Studies in Accra and São Paulo and Analysis of Urban Data of Four Demographic and Health Surveys*, London School of Hygiene and Tropical Medicine, London, pages 1-128.

Paulo, the 9 per cent of people living in the best areas consume five times as much water per capita than the 41 per cent of people living in the worst areas. In Accra, water consumption per capita is three times higher for the one-third of people living in the best living conditions in the city compared to those living in the worst areas.

In São Paulo, the most severe inequalities exist not in basic living conditions but in income. Overall, 44 per cent of the population live in areas of São Paulo where per capita incomes are 3.4 times lower than incomes in the most privileged zone. These summary statistics do not reveal the full extent or complexity of inequalities between people in the two cities; they do, however, paint a picture which is more revealing than gross figures suggesting that Accra and São Paulo provide privileged homes for all their population. This inequality is reflected strongly in health terms as summarized in the final section of this paper.

b. Exposing the Myth of Urban Health - Inequalities in Life Chances between Groups in São Paulo and Accra

The results of the study revealed very large inequalities in death rates between people living in different socio-environmental conditions in both Accra and São Paulo. Overall, age adjusted death rates are up to three times higher in the most disadvantaged areas compared to those with the most advantaged socio-environmental conditions. The case studies examined differentials in all age groups and in four broad cause groups. The disadvantaged in most age groups had consistently higher rates of mortality than their more advantaged neighbours. The most pressing conclusion for the study group was of the reality of Rossi-Espagnet's "double burden" of disease.[22] In other words, not only do the poor in Accra and São Paulo die more from infectious diseases affecting children but also, it appears, from the diseases of adulthood. The second, related, conclusion must be to confirm the complex health impacts inflicted by the "web of insecurity" entailed in urban deprivation. Table 6 shows a summary of the age adjusted death rates by cause and zone in both cities.

22. See Tabibzadeh, I., A. Rossi-Espagnet and R. Maxwell (1989), *Spotlight on the Cities. Improving Urban Health in Developing Countries*, World Health Organization:Geneva.

This table conceals great complexity, covering as it does over 7,000 deaths in Accra and 63,000 deaths in São Paulo. It is important to highlight which of the results we expected and which we did not. We expected to see inequalities in deaths from infectious diseases, bearing in mind the differences in basic living conditions between groups in the two cities and the findings showed these differences. In Accra, death rates from infectious diseases are much higher overall than in São Paulo. In both cities inequalities exist. In Accra, death rates are up to three times higher for those living in deprived areas compared to those in the most privileged areas. This is highest for children under 14 years of age but it is also pronounced for adults over 45 years of age. Respiratory diseases also kill people differentially in both cities. Interestingly, inequalities in age adjusted death rates from respiratory diseases show less variation *between* these two very different cities than they do be-

tween groups within each city. We did not expect inequalities in death rates from diseases of the circulatory system. They exist in both cities although rates of mortality in São Paulo are higher overall than in Accra. This, in part, reflects the competing nature of cause of death: in São Paulo, few people die of infectious diseases especially in the adult population. Inequalities in respiratory disease mortality in Accra are most severe in adults, both in the 15-44 years group and in the over-45s, potentially reflecting the extremely dense living conditions experienced by many people.

We did not expect to see a pattern of inequality in mortality rates in diseases of the circulatory system, partly because few other studies have been undertaken within cities to reveal such inequalities. In addition, many health specialists have retained a notion that infectious diseases hit the urban poor whilst chronic heart diseases hit the rich. Even after adjusting these rates for inaccurate reporting, the inequalities in both cities remained, surprising the epidemiologists in both cities. Another unexpected and perhaps more disturbing inequality was that in external causes in São Paulo. External causes were included in our analysis because of their importance as a cause of death in the city. However, the degree to which these causes of death concentrate in the poor areas is shocking, implying as it does that even if poor children survive the infectious diseases of early childhood, they graduate into inflated risks of death from traffic accidents and, more importantly, homicides.

To pursue this a little, it seems that those growing up in disadvantaged conditions within Accra and São Paulo are caught in a double trap of socio-environmental risk. Even if an individual survives childhood, the health threats of communicable disease appear to be succeeded by inflated risks of non-communicable diseases, particularly circulatory diseases, in adulthood. Threats to adult health from circulatory disease are combined in Accra with persistent risk of death from infectious disease and, in São Paulo, with risk of death from trauma including violent accidental death and homicide. Finally, in Accra, evidence suggests that inflated risks of death from infectious disease re-emerge in the elderly.

V. CONCLUSIONS

THE RESULTS OF the study of São Paulo and Accra have relevance in both environmental and health terms. They also put debates on overall water scarcity in cities into perspective - highlighting that while the urban poor consume minimum quantities of often polluted water, those in privileged areas consume much more, per person. In health terms, this means that some people have less and some have far more than is necessary for good personal health.

A large range of risk factors is implicated by analytic studies as being associated with the non-communicable and communicable diseases groups analyzed in the case studies (as outlined above). The descriptive evidence of consistent differentials in

Graph 1: Age Adjusted Mortality Differentials by Socio-environmental Zones for São Paulo and for Accra

Mortality Differentials in the Municipality of São Paulo (1992)

Mortality Differentials in Accra Metropolitan Area (1991)

NOTES: External injuries were analysed only in São Paulo due to their public health importance in the city. **Infectious and parasitic diseases** covering the ICD9 codes 001-139 including: Cholera (ICD9 001); Tuberculosis (ICD9 010-018); Malaria (ICD9 084); and Hepatitis (ICD9 070). **Diseases of the respiratory system** covering ICD9 codes 460-519 comprising: acute respiratory infections (ARI) (ICD9 460-466); pneumonias (ICD9 480-487); and chronic respiratory conditions (ICD9 490-519). **Diseases of the circulatory system** covering ICD9 codes 390-438 comprising: heart failure; hypertensive heart disease (ICD9 401-405); cardiovascular disease (ICD9 430-438). **External injuries** covering ICD9 codes for traffic accidents (E810-829) and for homicides (E960-E969).

ICD9 - International Classification of Disease Version 9 (1977).

mortality substantiates a view that urban poverty is a complex mix of material and social deprivation for groups within cities and that both elements have intricate and possibly synergistic effects on individual and group health. But more importantly, in the context of cities, where the rich and the poor, with their very different levels of assets and environments, often live and interact closely, material deprivation is not an isolated phenomenon experienced in absolute terms.

One of the main achievements of this work was to introduce a method that allows planners and policy makers to work together using existing data. If sufficient care is taken over ensuring and using good quality data, the methods presented here could be used to suggest a framework of diversity which planners and policy makers in a city can use to devise their own complex definitions of deprivation and to actively resist choosing a single variable of analysis or a single route of policy interpretation. These methods of the case studies in this study were, to some extent, unexpectedly successful. Also, the study makes explicit the intuitive understandings of the planners and policy makers who devised the interpretations of deprivation used to guide the case studies.

Section III highlighted an unexpected congruence in definitions of deprivation in Accra and São Paulo. The choice of indicators (income, level of education, water, density and sanitation) reflects common current understandings and awareness of available data but also the understanding of the interplay of social and physical features of deprivation. The consensus was not gained easily but the attempt was valued. It is worth noting that the participants chose both social and physical indicators to express deprivation - reflecting perhaps the importance of allowing such a freedom of definition. A purely physical, biomedical or biological interpretation of environmental health risks would see these features as "confounding" the real relationship between exposure to physical risks and health outcomes. Yet, in policy terms, this flexibility in defining health risks is important - São Paulo's data suggest that a shift in economic and political justice is as, if not more, important than the provision of physical facilities to alleviate urban health impacts.

One limitation clear to all those who plan with routine data is that they do not reflect fully the political and social complexity of a city's situation. This study sought to alleviate this problem by making explicit the problems of the information available to planners as well as revealing the merits of the information to expose inequalities in the urban environment. It is important to say that this kind of epidemiology was necessary but not sufficient to understand and plan equitable policies. Qualitative information supplemented quantitative information extensively, allowing the interpretation of the results to be filtered and complemented by detail and complexity.

From a practical and policy oriented point of view, using and putting together existing data had the merit of drawing value from statistics that were already available using a process which itself drew support from diverse planners. But, more importantly, the method was using the routine information base for

actual decision-making in each city. We would suggest that this kind of strategic information exercise is another move to the so-called post-normal, interactive kind of science called for by some analysts.[23] If the academic community working on cities is to contribute to the pursuit of a more equitable society, researchers also need to understand their role in facilitating or mediating political will. Conversely, if planners and practitioners within different agencies in cities are to facilitate equitable policies, they need to work with researchers to develop ways of using their own information bases in a collaborative way. This project put researchers and practitioners from different disciplines and sectors together to pursue the same goal. This is important as it has the value of making explicit the role of political will in decision-making within cities. The form of inquiry outlined in this paper has used, as its database, the information bank of city planning, and the inquiry was designed by a collaborative team of researchers and planners within local government. It cannot be argued that information on urban inequalities is not available within the planning agencies of Accra or São Paulo. Nor is the only external information available from potentially parochial, interpretative sources. It is possible to refute the information from an outside organization (for instance from academic studies) but it is arguably more problematic to refute the evidence drawn from one's own planning databases, partly drawn up by one's own planners.

23. Kreiger, N. (1994), "Epidemiology and the web of causation: has anyone seen the spider?", *Social Science and Medicine* Vol.39, No.7, pages 887-903; also Wing, S. (1994), "Limits of Epidemiology", *Medicine & Global Survival* Vol.1, No.2, pages 74-86; and Ministry of Local Government (1992), see reference 20.

Finally, it should also be pointed out that these are not hypothetical arguments for the merits of the approach. The chief planning officer of Accra, speaking in 1994 of the impact of the project on his work, stated that:

> "One good aspect of the study was that the department that supplies water to the city, since we (representatives of the Ministries of Health, Environment and Local Government) have gone together and shown them the results of the study, have begun to change their policy on provision of water to the low-income areas."[24]

24. See reference 1, Doe (1994).

In São Paulo, the study was received even more warmly as a step towards collaboration and political transparency in planning and governance. In 1994, following the study's completion, a councillor used the methods and results to sponsor a bill to routinely monitor and publicize inequalities and she commented:

> "It is essential to have access to data and information to construct a just society. Your study puts this issue in a very clear manner. I would like to ask your collaboration in helping us to draft a bill which enforces the municipal authorities to divulge data related to quality of life in a systematic way."[25]

25. Personal communications, June 1994 and November 1996.

Since then, the same councillor has gained re-election in São Paulo, partly through her use of a platform of commitment to routinely using information in the city to expose inequalities in resource allocation.

Using information in this way is clearly only a small part of the answer to the problems of inequalities in environmental conditions, social and economic opportunities and health in cities in the South. It is an advocacy tool - part of a set of advocacy tools which must be developed in collaboration with disciplines, professions and sectors. There is no one way to go forward on the development of policies to alleviate urban inequalities. This paper proposes that inquiry aimed at improving quality of life for urban dwellers in the South "has to create and make available a rich store of vividly imagined and severely criticized possible actions, so that our capacity to act intelligently and humanely in reality is thereby enhanced."[26] This includes complex and diverse forms of information to shift the policy process. The challenge is to provide complementary ways of using a critical mix of scientific thought combined with an understanding of how information can influence a complex and inequitable urban reality.

26. Midgely, M. (1992), *Wisdom, Information and Wonder: What is Knowledge For?* Routledge, London.