

A city-wide study of health and environment at the household level in Port Elizabeth, South Africa: research designed to promote appropriate health development and planning.

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ABSTRACT

South African urban areas exhibit great variability in environmental and health conditions within a given city. These disparities have been exacerbated by the policies of the past which systematically deprived the poor of resources. Local governments now face the challenge of redistribution of resources, for which adequate planning information is often severely lacking. This paper describes a study conducted in Port Elizabeth, which examined environment and health issues at the household level. This information is intended to highlight the current disparities and to allow priorities to be established for future investment in infrastructure and health services. The study design consisted of a questionnaire survey of a multi-stage random sample of 1000 households covering the entire metropolitan area, supplemented by more detailed studies of water quality. The study included the socio-demographic profile of the population; access to basic services; domestic energy sources and amounts paid for services; housing types; health of the primary care givers and children; perceptions of environmental problems and possible ways to address them. The representative data for the entire city had implications for various sectors including health, housing, engineering, finance and energy, and demanded innovative analysis which allowed appropriate information to be made accessible to the local government and communities. A geographic information system (GIS) presentation of the wealth status of households, measured using proxy indicators of wealth, backed up by comprehensive environmental and health data, has been used to highlight inequities and identify opportunities for development investment. In poorer areas there is greater heterogeneity, in terms of wealth, than in the more affluent suburbs, which suggests that uniform approaches to service provision may be inappropriate and that there may be more opportunities for cross subsidisation of service charges in these areas than previously thought. Further analysis is used to integrate data relating to access to basic services with spatial information. The study highlighted the lack of understanding by built environment, health and planning professionals of the often complex health and social outcomes of inadequate environments. The management and policy implications of the results highlight the critical areas to be addressed by local government such as the need for inter-sectoral action, education, and public participation in order to limit the exposure of the poor to risks at a household level. The use of GIS has the potential

to present mapped data to local decision makers in a way which can integrate health and development planning agendas.

Keywords and phrases: health, environment, development, urban planning, GIS, South Africa

1.0 INTRODUCTION

Port Elizabeth (PE) is one of the secondary metropolitan areas in South Africa and has a population of just over one million. It is, in many ways, a microcosm of the rest of the country as it has a similar history of inequality and therefore faces similar challenges to both larger and smaller urban areas. As a result of both the stage of development and the inequitable distribution of resources in the past, the environment and health of the residents show dramatic disparities between the rich and poor. For example, there are widely differing levels of access to basic services such as water and sanitation, health services, education and employment opportunities.

There are a number of encouraging initiatives being undertaken in PE, and throughout South Africa, in order to address the imbalances of the past. These are intended to narrow the gaps between the rich and the poor. The aim of this study was to highlight some of the problem areas in household environment and health and to make suggestions, relevant both to PE and a national level, for appropriate strategies of resource reallocation to improve basic health and wellbeing of the poor. The study followed the format of previous environment and health research, sponsored by the Swedish International Development Co-operation Agency, which had been undertaken in three other cities, namely São Paulo, Accra and Jakarta. These studies focused on the household level of environmental health which is particularly appropriate for providing information for urban development programmes which aim to provide equal access to basic services and opportunities for all. Whilst the four city studies addressed similar issues, each one was tailored for the needs of a particular city (Benneh et al., 1993; Surjadi, et al., 1994; Thomas, et al.1999; Potgieter, et al., 1999).

In South Africa, access to land in urban areas was one of the key strategies used by the apartheid government to limit the urbanisation of Black people. In addition, other strategies were put in place, including the establishment of 'growth points' in the 'homeland' areas as incentives to keep Black people rurally based. Despite these constraints there was a continuous stream of unemployed work-seekers to urban areas. Since few, if any services were provided for what were regarded as temporary or 'illegal' residents, severe urban overcrowding and the breakdown in basic services became common. In 1986 the White Paper on Urbanization (South Africa, 1986) recognised the impossibility of the State's strategy and recommended that the steady flow of urbanising people should be managed rather than allowed to develop into sprawling squatter settlements on the periphery of urban areas. Thus, while the urban development policy initially focussed on the prevention of and then on managed urbanisation, a real effort began in the late 1980s to address the problems of the existing informal areas. This began by the legalisation of the settlements (granting land tenure) and the provision of basic services. Both resettlement and in-situ upgrading became the accepted approaches in the early 1990s. Before the first democratic national elections, the local government consultation process had begun in earnest under a "One city-one tax base" adage and some local authorities began to proactively rationalise their service provision by working towards amalgamation. PE was the first urban area in South Africa to adopt this approach. The rationalisation of service provision into a single city provides a solid base for improving the provision of services to the under-provided. This, however, has not been without its difficulties (Kroukamp and Meiring, 1997) which have impeded the ambitious attempts by the new city council to address the problems of the past.

Concomitant with the changes in urban planning has been a shift in the health sector from the previous focus on curative services to the Primary Health Care (PHC) approach. Two of the pillars of PHC are the importance of community participation and of multi-sectoral strategies for addressing problems. Participation of the people in health service delivery is nowhere more appropriate than in the delivery of environmental health services (Quoto, 1997).

The present study covered a wide range of social, health and environmental issues and possible ways to address the problems identified. The implications for various sectors including health, housing, engineering, finance and energy demanded innovative analysis which allowed appropriate information to be made accessible to the local government and communities. A Geographic Information System was used to supplement conventional analysis, summarised in tables and graphs, in order to make the results more accessible to policy makers and planners and to identify spatial patterns in the data.

2.0 METHOD

2.1. Research Process

The study was launched at a public forum to which all the key local agencies had been invited. The meeting, which was chaired by a member of PE Municipality's Community Services Committee, agreed to elect representatives from civil society to work with the researchers and representatives of provincial and local government on a project steering committee. The Steering Committee met approximately monthly and was involved in guiding the research process. Local community members who had been trained by an experienced researcher undertook the survey work. A number of report back workshops were held once the preliminary results had been prepared and this process resulted in suggestions about ways in which the research process could be refined.

2.2. Research Design

The study design consisted of a questionnaire survey of a multi-stage random sample of approximately 1000 households covering the entire metropolitan area. The first stage of sampling selected 100 census enumerator areas (EAs) at random from the 1427 EAs in the city and then 10 addresses were selected per EA. The EAs include between 100 and 200 households. Where more than one household was present at a given address, all households were included. The sample included 580 households from the historically Black areas and 210 each from the Coloured, Indian and White areas.

Issues covered in the '1000 household study' included the socio-demographic profile of the population; access to basic services, such as water sanitation and refuse removal services; domestic energy sources and amounts paid for services; housing types; wealth (measured using ownership of consumer durables as a proxy for income); land tenure and housing-related questions; health of the primary care givers and children; perceptions of environmental problems and possible ways to address them.

The 1000 household study was supplemented by a more detailed study of water quality in a subsample of 201 households stratified according to type of water supply (inside tap, tap in yard, communal standpipe). The deliberate stratification of the sub-sample restricts the generalisability of the data and therefore the water results may not be fully representative of the whole population of PE.

The water study was undertaken to determine the differences in access to water supplies and the possible deterioration in water quality associated with domestic and environmental hygiene and water collection and storage methods, for those households which did not have running water in their homes. Water samples were collected from unsterilised taps¹ (to simulate normal use), storage containers, if used, and a drinking vessel. These samples were analysed for microbiological quality (faecal coliforms, total coliforms and total bacterial counts) at the municipal laboratory using standard methods (Clersceri, Greenberg & Trussel, 1989).

2.3. Analysis

The data was coded and entered into an SPSS database from where it was exported and linked to the GIS software, MapInfo, in order to undertake the mapping and spatial analysis. The study took place immediately after the national census of 1996 and the data was linked to the EA boundaries using the unique EA code (Statistics South Africa, 1996).

In the past, many South African studies used legally defined constructs of race as a proxy for social class. While it is helpful to use race as a classification category to be able to monitor the extent to which access to resources and opportunities is being equalised, it can be misleading with regard to the disparities in wealth in the population. As a result, and based on the other three city studies, a wealth-based set of criteria was prepared and the analysis has been undertaken primarily according to wealth categories. Since it is very difficult to ascertain income, especially in areas where a large proportion of people is unemployed or working in the informal sector, proxies for income were used. Five wealth categories (quintiles) were devised based on a points system derived from the total value (reduced to a monthly repayment where necessary) of the selected consumer durables owned by the household (see Table 1).

¹ Routine water quality testing, as carried out by most local health departments, requires that taps are 'flamed' in order to eliminate local contaminants of the water. By omitting the sterilisation process, the samples collected in this study reflect quality of water as used by a typical consumer.

Table 1 Weighting system for consumer durables as a proxy for wealth

Consumer durable (wealth indicator)	Weighting
Iron	1
Radio	2
Black & White TV	4
Microwave oven	8
Telephone	8
Colour TV	15
Video machine	15
Refrigerator	15
Car	60
If no electricity and car battery owned (power for TV or lighting)	2
If electricity: monthly cost/10 to a max of 10 (Rand ²)	0-10

3.0 RESULTS

3.1. Wealth

Using a frequency distribution of the proxy indicators of wealth used above (Table 1) allowed the sample to be divided into five approximately equal quintiles (Table 2). Those in the lowest quintile had very few possessions, e.g. they might own an iron and a radio but could not have had an iron and a TV as this would have given them sufficient points to enter the next category. The wealthiest owned a wide range of consumer durables such as refrigerators, televisions, video machines and cars. Based on the proportionate socio-economic distribution of the PE population provided in the PE Municipality Housing Report (1996), the quintiles can also be allocated to the estimated household income (Table 2). It must be stressed that while this is a rough estimation, the concept is valid and can be confidently used.

Table 2: Distribution of the sample according to wealth quintiles and estimated income

Wealth quintile	Weighting score	% of sample	Estimated monthly income (Rand) ²
Low	<5	18.2	<R800
Lower-middle	5-21	20.6	<R800
Middle	22-47	20.2	R800 – R1500
Upper middle	48-123	22.8	R1500 – R3500
High	>123	18.8	>R3500

Figure 1 shows a map of metropolitan PE with sampled enumerator areas highlighted according to wealth. Wealth is represented on this map using pie diagrams showing the variation in wealth among sampled households (sampling frequency: mean 9.81, s.d. 2.96, range 1 – 20 households per EA). Pie charts were used on the map in order to spatially analyse more than one variable at a time, whilst also giving insight into the total number of samples in that EA (indicated by the relative diameter of the pie). The map indicates higher average wealth in the southern suburbs of the city (previously White 'group areas') but much greater heterogeneity in the poorer EAs in the northern half of the city (previously mostly Black, coloured and Asian group areas).

² 1 South African Rand = US \$ 0.22 in January 1997

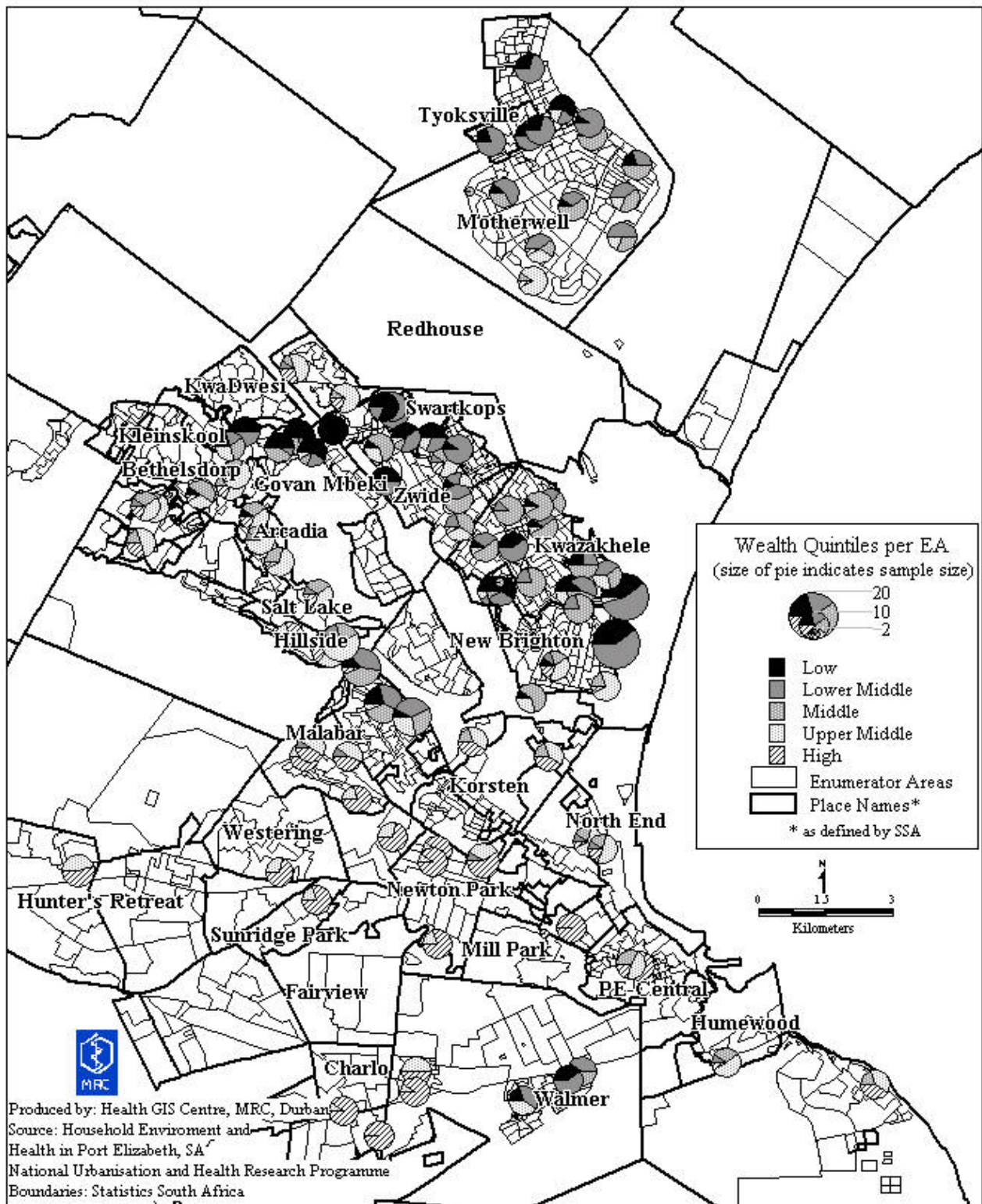


Figure 1: Variation in wealth within sampled enumerator areas based on consumer durable ownership

3.2. Water

From the 1 000 household survey, 56% of the population of Port Elizabeth had piped water inside their homes. The remainder rely on piped water in their yards (24%) or communal supplies (20%). Figure 2 shows the location of sampled households without an indoor water supply. The quality of the water supplied is generally good with about 99% of routine samples from sterilised taps conforming to national water quality guidelines (J de Leeuw, personal communication). However, the samples collected in this study from unsterilised taps, containers and cups showed extensive contamination (Figure 3). In general, water samples collected from the tap were much cleaner than those from containers and cups.

The degree of contamination of water samples from drinking vessels (Figure 4) shows a relatively poor correlation with the type of supply. Contrary to expectations, there were numerous samples from fully serviced areas which had high levels of contamination. The two highest levels of contamination shown, namely 'poor' and 'unacceptable', are considered by the national water quality guidelines (Water Research Commission et al, 1998) to be likely to cause clinical infections, even with once-off consumption, and serious health effects in all users, respectively.

4.0 DISCUSSION

The representative data for the entire city had implications for various sectors including health, housing, engineering, finance and energy, and demanded innovative analysis which allows appropriate information to be made accessible to the local government and communities. A spatial representation of the wealth status of households, measured using proxy indicators of wealth, backed up by comprehensive environmental and health data, has helped to highlight inequities and identify opportunities for targeted development investment. In poorer areas there is greater heterogeneity, in terms of wealth, than in the more affluent suburbs, which suggests that uniform approaches to service provision may be inappropriate and that there may be more opportunities for cross subsidisation of service charges in these areas than previously thought. Further analysis, integrating data relating to access to basic services with spatial information regarding health outcomes can provide further support for targeted investments and interventions.

Provision of adequate water and sanitation has been given a high priority in South African development programmes (South Africa, 1994; Department of Water Affairs and Forestry, et al., 1994) on the assumption that this will improve quality of life and reduce water related diseases. However, the poor correlation between types of water supply and final water quality for end users indicates that there are many factors apart from the mere availability of water which can impact upon health. Evidence from other countries suggests that providing water and sanitation is insufficient in itself to avoid water related health problems (Esrey, Feachem and Hughes, 1985; Feachem, 1984; Haggerty, Muladi, Kirkwood et al., 1994) and that health promotion initiatives are essential if the full benefits of infrastructural investments are to be realised.

It seems that to improve the quality of the water that people drink and use for food preparation, the target should not be the quality of the water in the pipes. It is more critical to have sufficient water readily available so that hygienic uses of water, such as for hand washing and cleaning of kitchen utensils and homes, are not compromised. While no water supplier can take responsibility for the water quality at the time of ingestion, a more developed and targeted concern for these issues could induce progressive policies aimed at the end users rather than narrowly defining compliance with water quality guidelines as an end in itself.

Exact mechanisms of water contamination were not investigated in this study but it is likely that domestic environments, especially back yards, are contaminated with human, especially infant, and animal faeces. Taps and cups are likely to be contaminated both by hand contact and through airborne matter, especially in a dry and often windy environment such as found in PE. In the poorer, overcrowded suburbs of Port Elizabeth there is both inadequate waste removal and a tendency to keep livestock in residential areas (mainly pigs, goats and chickens). This combination inevitably leads to the environment being contaminated with faecal material and also the breeding of vermin such as rats. Although space does not permit inclusion in this paper, data collected on the two week prevalence of diarrhoea in children under six years of age also showed a poor correlation with water quality. There was, however an inverse association between wealth and diarrhoea. Thus children whose households are economically better off are less likely to experience diarrhoea, despite contaminated drinking water, than those who are further disadvantaged by their social and built environments.

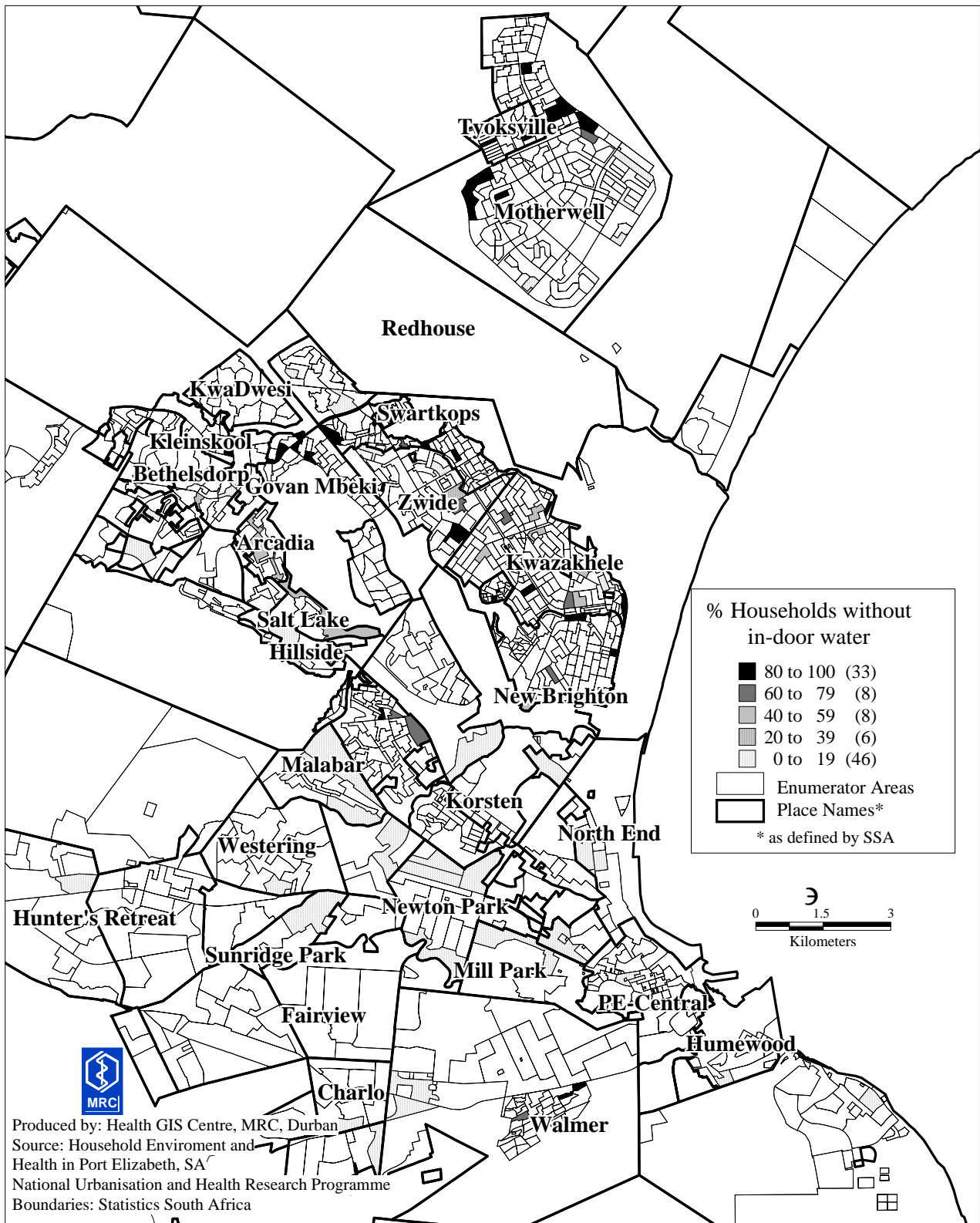


Figure 2: Distribution of households without an indoor water supply

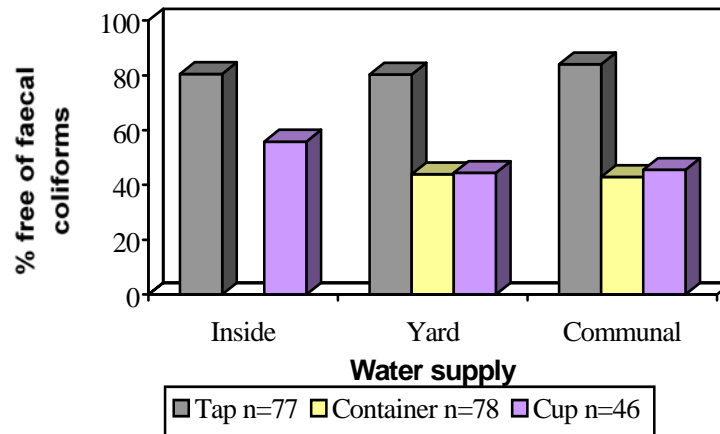


Figure 3: Domestic water quality: percentage of samples which were free of faecal coliforms (representing “ideal” water quality) by type of supply and sampling point.

The use of GIS mapping to present data of this kind in a format which is readily accessible to policy makers and planners should help to de-mystify the overall research process and assist in highlighting specific clusters of EAs requiring intervention. When presented to local interested groups, the extent of unacceptable water quality found in the survey came as a surprise. In terms of public awareness leading to action, the biggest surprise was that poor water quality was found in many areas which already enjoy full waterborne sewerage and indoor water supplies. This confirms that broader environmental interventions are required.

5.0 CONCLUSION

The study highlights the lack of understanding by built environment, health and planning professionals of the often complex health and social outcomes of inadequate environments. Mere technical solutions such as the provision of water will not solve health problems which are a combination of technical, social and economic factors. The management and policy implications of the results highlight the critical areas to be addressed by local government such as the need for inter-sectoral action, education, and public participation in order to limit the exposure of the poor to risks at a household level.

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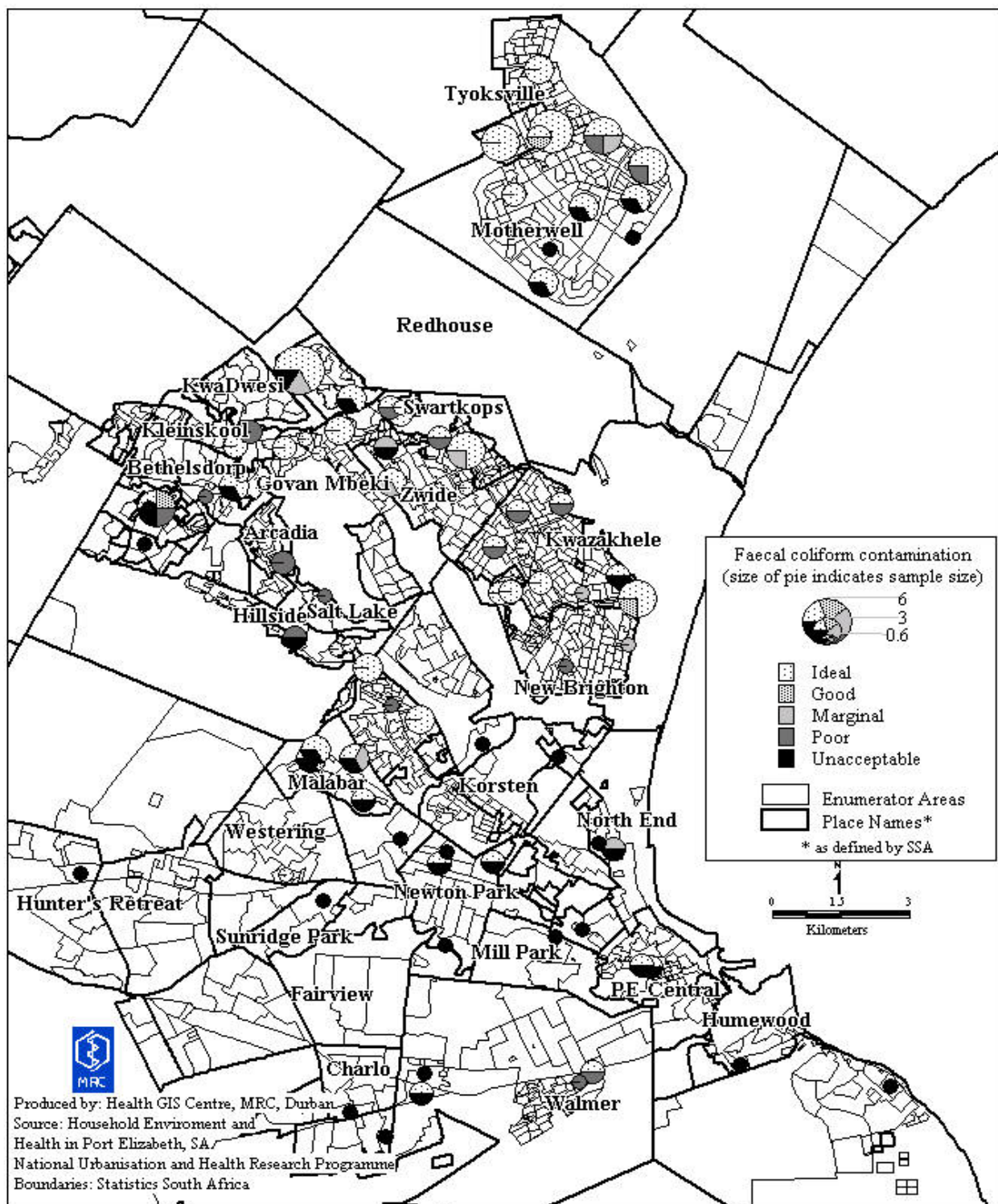


Figure 4: Distribution of contaminated drinking water - samples from cups (faecal coliforms)

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