Effect of low-cost housing on household and environmental health of residents in Phumlani Village, City of Cape Town

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KEY WORDS

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Low-income housing

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ABSTRACT:

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Many poor households in South Africa find themselves living in informal housing and only become proprietors of formal housing via the government subsidy scheme for core low-cost housing, thereby also realizing their constitutional right to housing. The subsidy is however limited and it largely determines materials, and construction methods used. Obtaining a formal low-cost dwelling means that basic services such as electricity, sanitation, water and waste collection, is available to the home owner. Formal low-cost housing settlements are commonly located in poor areas and recipients of the housing subsidy are commonly unemployed or have low-income jobs, and frequently originate from informal settlements where services, albeit limited and often communal, were provided at no cost.

This study sought to assess the combined effect of relocating from an informal dwelling to a formal low-cost dwelling and receiving individual house-based basic services of electricity, water, sanitation and waste collection, on environmental- and household health. An ecological study design was used whereby data was collected at "baseline" while households were living in the informal settlement, and again at "2 years relocated" i.e. 2 years after moving in to the formal low-cost dwelling. The study population included all households residing in the Phumlani- and Pelican Park- Zeekoevlei Informal area in the year 2000, who were on the waiting list to receive low-cost core housing units in Phumlani Village and were due to be relocated there. Due to the rapid pace at which construction of new homes occurred not all households could be captured whilst living in the informal settlement, i.e. at "baseline". The actual sample subsequently

consisted of 53 households at “baseline”, and all, i.e. 124 households at “2 years relocated”. Data was collected via a structured interview, whereby one respondent per household was interviewed by a trained fieldworker.

Positive health improvements were reported by households in terms of personal and household health. Significant ($p<0.05$) positive improvements were found for households in formal low-cost housing at “2 years relocated” for exposures to: overcrowded living conditions (PR=1.159, 95%CI=1.153 – 3.328); indoor air pollution due to cooking and heating (PR=2.185, 95%CI=1.655 – 2.885); improper household waste management (PR=7.381, 95%CI=4.313 – 12.633 and inadequate sanitation (PR=0.365, 95%CI=0.255 – 0.523). The incidence of childhood diarrhoea episodes decreased significantly (PR=5.588, 95%CI=1.284 – 24.315) at “2 years relocated”. Water access, availability and use also increased significantly (PR=0.212, 95%CI=0.125 – 0.358) 2 years after relocation.

Factors that did not improve include levels of employment for which households were found to be worse off, with 16% of households having no person employed at “2 years relocated” as opposed to only 2% at ‘baseline”. Other factors remaining unchanged included incidences of respiratory, skin and eye infections amongst children ≤ 6 years old. Although exposure levels to indoor air pollution decreased for some households, this remained present for others as electricity in combination with bio-mass fuels are still being used for heating and cooking.

Environmental health conditions for a variety of factors remained unchanged and there was a reversion back to living conditions and habits of the informal settlement. Littering, dumping of waste within the neighbourhood and a high pest presence, remained unchanged.

Subsidised formal housing and associated basic services does have a positive impact on health. However, the amount of free basic services, specifically electricity, provided, in lieu of household energy requirements, does not satisfactorily cover all household needs. Factors such as unemployment and low-incomes hamper the household's ability to maintain the electricity supply as is needed and for this reason alternatives to reliance on electricity should be included in the design and construction of the low-cost house. The manifestation of poor environmental health conditions indicates that provision of low-cost housing by itself is not sufficient to ensure good environmental health. Therefore hygiene promotion should be included as part of the total beneficiary package.

DECLARATION:

I declare that *Effect of low-cost housing on household and environmental health of residents in Phumlani Village, City of Cape Town* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

LOUELLA MARIA DARIES DECEMBER 2011

SIGNED: .....

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DEFINITION OF TERMS

Terms have the following meaning in terms of this study:

Adequate potable water:

A consistent supply of clean, drinkable water

Adequate sanitation:

At least one water-borne, flushable toilet system per household

Clean energy sources:

Non-polluting fuels which is either gas or electricity used indoors for heating and/or cooking purposes

Dirty pollutant energy sources:

All fuels other than gas or electricity

Low-cost formal housing:

Low-cost formal housing obtained via the SA government grant as per the Housing Act no. 104 of 1997

Informal housing:

All non-formal housing constructed in a non-formalised manner

Indoor air pollution:

Pollution of air inside a dwelling, as a result of using fuels other than electricity or gas for cooking a main meal indoors or due to indoor space heating

Back-yard dwelling/shack:

Any make-shift structure used for habitable purposes on the same property as a formal house, low-cost or otherwise

Basic services:

Services relating to water, electricity, sanitation, waste water disposal, waste collection and disposal

ABBREVIATIONS:

COPD: Chronic obstructive pulmonary disease

DOH: Department of Health

FBE: Free basic electricity

FBW: Free basic water

IAP: Indoor air pollution

IDP: Integrated development plan

LPG: liquid petroleum gas

RSA: (Republic of) South Africa

SANBR: South African National Building Regulations

SECC: Soweto Electricity Crisis Committee

SPM: South Peninsula Municipality (currently South Peninsula Sub-District)

SEA: Sustainable energy Africa

TB: Tuberculosis

UN: United Nations

UNEP: United Nations Environment Programme

WHO: World Health Organisation

CHAPTER 1: INTRODUCTION

The link between housing and health has been well documented and it is accepted that poor housing may inevitably lead to poor health, especially of vulnerable groups which includes the very young, the very old and women. For many poor communities in the Republic of South Africa (RSA), the right to formal housing is only realised once they become the beneficiaries of subsidised low-cost houses (RSA, 1996; Huchzermeyer, 2001; Aigbavboa, 2011). Until such time, i.e. whilst awaiting housing allocation while on the housing waiting list, they resort to satisfying the basic need for shelter by residing in informal settlements.

An informal and/or squatter settlement is defined as '…a residential area in an urban locality inhabited by the very poor who have no access to tenured land of their own, and hence squat on vacant land, either private or public...' (Srinivas, 1994). The United Nations (UN) (1997) defines informal settlements as follows:

- *Residential areas where a group of housing units have been constructed on land to which the occupants have no legal claim, or which they occupy illegally;*
- *Unplanned settlements and areas where housing is not in compliance with current planning and building regulations*

Informal settlements are typically poorly serviced by local authorities, i.e. not formally supplied with sufficient water, sanitation or refuse collection and removal services, or, in most instances serviced through the provision of unsuitable communal facilities.

In Africa, most of the major cities are currently struggling to provide basic services due to increased demands placed on services by population increase amongst those living within the urban environment for decades, as well as by those who are recent migrants as a result of urbanisation (Daniels, 2004). Due to the ensuing population increase, housing and its associated basic services are undersupplied. Urbanisation in South Africa is occurring at a faster rate than in any other African country and therefore we have here, in comparative terms, higher proportions of urban dwellers (Goebel, 2007). A consequence of this is amongst others, 'massive unplanned growth' (Mbiba and Hurchmeyer, 2002). The latter, coupled with a backlog in housing and a 'shortage of housing subsidies' (Richards, *et al.*, 2006) has, as a consequence, the establishment of informal settlements. Ramin (2009) reports that urbanisation in Africa is linked to poverty and that this translates into the development of informal settlements. This sentiment is echoed by David *et al.* (2007) who regard the informal settlement as the 'visible manifestation of poverty at its most extreme'.

The housing crisis in South Africa has its roots in the first major emergence of urbanisation in the 19th century, during the period 1870 and 1886 (Transnet, 1998) with the discovery of diamonds, and later the discovery of gold. Urbanisation in South Africa was then largely spurred by migrant workers occupying areas where mining employment opportunities were available, such as Kimberley and Johannesburg. The development of the railroad connecting Johannesburg to most of the port cities in South Africa, i.e. Cape Town, East London, Durban and Port Elizabeth (*ibid*), further encouraged migrant workers to inhabit these cities (Labour Research Service, 2010). The subsequent development of the manufacturing industry from the 1920's onwards, overtaking the mining industry as an employer by the 1940's - and showing

'unprecedented growth' in the S.A. economy during the 1960's - (*ibid),* meant that even more people flocked to the cities where employment opportunities were a greater possibility.

Squatter settlements increased around Johannesburg post 1945 with families occupying land on the periphery of Johannesburg, later becoming Soweto (Stadler, 1979). In Cape Town, from the 1950's onwards, '*Black*[1]' migrant male workers were encouraged, and allowed to live and work in the city. They were accommodated in single-sex hostels, as '*Black'* females and/or the rest of their family members were not allowed to live in the hostel. This resulted in insufficiency of formal family housing units, with subsequent 'illegal' squatting in informal settlements. '*Black'* women were 'endorsed' out of the city as 'illegals' (Bray, 2008). Thus, in instances where families wanted to live in the city, it happened in the form of 'squatter' accommodation in 'squatter settlements', which were largely trapped in a cycle of 'destruction' by officials, and followed by 'rebuilding' by residents' during the period 1950 -1980's. This cycle of *destruction-and-rebuilding* continued until the development of Crossroads in 1975 which was meant to be a transient camp, but proved better than the hostels as families had more 'scope' for building respectable homes, which were regarded, by affected families, as better than the hostels (*ibid*).

During the era of racial segregation in South Africa, certain minority groups were favoured over others. A direct consequence of this was unequal distribution of all resources and amenities, and denial of socio-economic freedom, including access to subsidized housing, ownership of residential property of choice, as well as dictating to the '*Black'* majority - which includes *'Africans', 'Coloureds'* and '*Indians'* (Harsch, 2001), where they could live and work, and even

[1] The use of formal apartheid era race classification terms are used for descriptive convenience only and do not imply the existence of separate races.

prohibited them from owning property (Worger and Byrnes, 2011). This situation was further exacerbated by laws which were in place to limit, or even prevent these groups from obtaining access to, amongst others, proper schooling facilities, job opportunities and access to housing subsidies.

South Africa's past policy of segregation, in terms of land-use and ownership, has had a profound influence on the housing crisis in its urban centers today. Some of the past policies which have directly and indirectly influenced the manner in which housing policies are devised and implemented include the following:

Natives' Land Act (also referred to as the Black Land Act), act no. 27 of 1913 (Union of South Africa, 1913) and was justified as an attempt to stifle *'Black'* encroachment upon land in *'White areas'* of RSA, but in reality translated into mass displacement of *'Blacks'* off of their traditional land, and displaced them from land and housing which they already occupied.

The Group Areas Act, act no. 41 of 1950 (Union of South Africa, 1950), of which the main aim was to implement the *Homelands system*, favoured separate development based on racial classification of RSA citizens. It further prevented *'Blacks'* from accessing and owning developed land. Occupation of houses in urban areas only occurred where permission was granted by the then minister and was only permitted if the house/property had previously been inherited or bequeathed to them by their father. Furthermore, *'Blacks'* could only enter urban areas for purposes of employment for which they were compelled to have proof via the *'Pass-Laws'.* This resulted in insufficiency of formal housing units with 'illegal' squatting in informal settlements.

The Free Settlement Areas Act, act no. 102 of 1988 (RSA, 1988) came about as a result of ever-increasing housing backlogs in all the *'Black'*, i.e. *'Coloured', 'African'* and *'Indian'* communities. The then government brought about a relaxation in the apartheid system, as it pertained to land ownership in urban areas, and implemented the act which designated areas where limited racial integration was allowed (Davenport and Saunders, 2000). However, this act was regarded as a 'poor attempt' of the then government at 'crisis management' and thus did not meet the needs of the majority of people moving into cities in South Africa (Saff, 1990).

With the disbandment of the apartheid laws in 1994, when the democratic government came into power, all of the above laws were repealed. Land invasion, mostly in the form of 'illegal' occupation of privately or state-owned land increased (Bray, 2008). Entire families, previously compelled to reside in 'Homelands' flocked to urban areas in search of better lives for themselves, often ending up in informal settlements (Barry, 2006).

In RSA the right to housing for all has been immortalised in the Bill of Rights, in section 26 of the RSA Constitution (1996). The latter, coupled with the repeal of discriminatory legislation and policies mentioned earlier, is government's attempt to realize this right to housing. Rectifying plans included amongst others, the Reconstruction and Development Program (RDP) (ANC, 1994), a program specifically geared at addressing unjust issues of development, including the construction and provision of housing to all. The size of the housing backlog which this program needed to address was vast. Pre-1994 figures for housing demand in the townships were mere estimations; in 1994 the difference between the actual and estimated housing demands had to be adjusted (Niemann, *et al.*, 2003) to obtain a more realistic figure of 1.5

million houses in 1994 (DOH, 1994). The 2001/2002 South Africa census suggested an increase of 97% in the numbers of informal housing resulting from urbanization with numbers of people requiring housing standing at 9.1 million (Stats SA, 2001 cited in Wekesa, *et al.*, 2011). Currently this figure stands at 12.5 million people, which roughly translates into 2.1 million houses (Sexwale, 2011).

Health in informal settlements is affected by the nature of the environment as well as the socio-economic living conditions of the household (Pugh, 2000). Diseases vary in that the informal dwellers are more exposed to various infectious diseases, affecting especially children, as well as more exposed to conditions affecting emotional and psychological well-being of, especially, women.

Informal shacks are typically constructed of make-shift materials (Fadare and Mills-Tettey, 1992) and thus do not conform to any standards regarding structural safety or comfort for its inhabitants. Thus, the informal dwelling does not, in terms of the physical structure, provide adequate protection for inhabitants and this may prove costly for health and safety of its occupants (Wekesa, *et al.*, 2010). For this reason the informal shack is therefore regarded as inferior in quality (Akhmat and Khan, 2011) and lacks adequate infrastructure (Ooi and Pua, 2007). Informal settlements are often unsanitary and lack adequate water supply and waste removal, which may impact on the health of all its dwellers, especially children. Pugh (2000) states that, in such an unsanitary environment, as much as 66% of ill-health that children suffer from is preventable. Thus, improved water supply and adequate sanitation may positively impact on the attainment of *all* the millennium development goals (Harvey, 2008). Birch (2001)

documents that the physical environment, amongst others, may impede the attainment and maintenance of good health in populations, meaning conditions in informal settlements are not conducive to health or well-being of those living therein. For the settlement, i.e. the total informal environment, and houses in informal settlements, the combined presence of pests (rodent infestation), rust, cold and dampness, can be a permanent feature (Oldewage-Theron, *et al.*, 2006).

Social well-being is affected negatively by being exposed to crime, violence, overcrowding, stress and poverty (Shaw, *et al.*, 2001 cited in Richards, *et al.*, 2006). However, social connectivity due to social networks and support systems in the community in the informal settlement is strong (Richards, *et al.*, 2006).

Shack dwellers are also more exposed to indoor air pollution due to the fuels they use for cooking and heating, i.e. mainly wood and paraffin (Thomas, *et al.*, 2002). Waste collection, in instances where it occurs, is dependant on informal dwellers ability to get waste to a communal collection point, meaning waste has to be handled by the person carting it and the possibility of infection is increased. In instances where this service is not provided, open dumping and improper disposal occurs (Wilson, *et al.*, 2006). Open waste dumps inevitably also attract a variety of pests, thereby making the informal settlement and its environment a breeding ground for a host of infectious agents, as well as aiding their spread.

The highest law of this country, the South African Constitution (RSA, 1996) spells out the right to housing in Chapter 2 of the Bill of Rights whereby it states that:

1) *Everyone has the right to have access to adequate housing.*

2) *The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of this right.*

3) *No one may be evicted from their home, or have their home demolished, without an order of court made after considering all the relevant circumstances. No legislation may permit arbitrary evictions*

Section 28 of the Constitution, (RSA, 1996) which focuses on children, further states that:

1. *Every child has the right:*
   b. to basic…shelter…

and:

2. *A child's best interests are of paramount importance in every matter concerning the child.*

The Constitutional court re-affirmed this right, in the Grootboom case whereby it decided that if parents are unable to 'realize the child's right to basic shelter, the obligation rests upon the state'. It further found that the 'parents should be able to live with their children in the shelter as it was not in the best interests of children to be separated from their families' (IDASA, 2002).

In response to this, the government established a core-low-cost housing provision program. Core low-cost housing units are so called because they are regarded as core/start-up structures (Gilbert, 2004), forming the core for future expansion of the house. All houses, intended to be used for human occupation have, to comply with legislation, paramount amongst which is the South African National Building Regulations and Standards Act no. 103 of 1977 (RSA, 1977), thus ensuring that the structure is stable, and that it will not become a health or safety risk to the inhabitants. Because of unemployment and low-income jobs, and because of misconception regarding the start-up-structure-status on the side of beneficiaries, these houses often remain 'start-up' in nature (Cortès-Ballerino, 2002) as inhabitants do not have funds to increase the dwelling in size, in accordance with pre-approved plans and utilizing specified building

materials. A concern derived from the rush by the newly elected democratic government to decrease the housing backlog is the focus on quantity, and to a lesser extent quality of the dwelling (Jongeling, *et al.*, 2002), and therefore also the impact that low-quality housing would have on household- and environmental health is ignored, or simply not considered at all.
In order to meet the housing demands, the structural requirements of a building used for residential purposes- specifically as it relates to providing low-cost housing to the poor- has been neglected to satisfy economic, technological, and political priorities. This was due to the housing subsidies being reduced by about 25% during the period 1995-1998 (BESG, 1999 cited in Cortés- Ballerino, 2002). This essentially developed into a 'cost-quality-size' juggle as reported by Cortés-Ballerino (2002), meaning that housing size had to be reduced, and low-quality building materials and inferior construction methods were used in order the remain within cost parameters (Walker, *et al.*, 2000) .

The core low-cost housing units in Cape Town, which are supplied to recipients, vary, in size from $18m^2$ to $28m^2$ (Walker *et al.*, 2000). This size depends entirely upon the region and municipality in whose area of jurisdiction the beneficiaries are located, as similar low-cost housing in Port Elizabeth, Eastern Cape may be as large as $40m^2$. When determining the final dwelling size, household size is not considered, and all the persons within, and possessions of the household, have to be accommodated in this space. Overcrowding in the formal housing could thus be higher than that of informal housing, simply because of limited usable space for household activities and people. Indeed, studies assessing quality of the house and beneficiary satisfaction indicate that although beneficiaries are satisfied with the status of owning a home, the size of the house is not satisfactory (Gilbert, 2004; Walker, *et al.*, 2000; Aigbavboa, 2011). In

addition, restrictions exist on extensions of houses. This indirectly impacts on the health risks associated with overcrowded housing conditions (Hardoy, *et al.*, 1990), such as incidences of accidents e.g. scalds and burns as a results of having to cook in a small overcrowded space, inter-personal transfer of communicable diseases, and stress due to limited space available for privacy between individual household members.

The low-cost houses are reported to lack energy and water efficiency, and due to the materials used in its construction, as well as the method of construction, are not thermally sound (Klunne, 2002; Walker, 2000). During winter the building will thus be subjected to excessive heat loss as materials are not able to retain heat and the opposite will occur during summer due to rapid heating and retention of heat. This may lead to discomfort and physical stress on the body of the inhabitants.

Unlike the informal areas, the low-cost formal house *is* 'fully serviced' with provision of water, electricity, sanitation and refuse removal (Gilbert, 2004). The free basic water policy came into effect on 1 July 2001 (although some municipalities had commenced the roll-out before this date as per the Water Services Act, act no. 108 of 1997) to ensure that all households have access to a basic supply of potable water, i.e. a basic supply of 6000 litres (L) per household per month. This was essentially to ensure that especially the poor has access to water, and the amount provided is based on a supply of at least 25L of water per person per day based on an average household size of 8 persons (Department of Water Affairs and Forestry (DWAF), 2002).

The free basic electricity policy was implemented in July 2003 (Western Cape Government, 2004) supplying households with an amount of 50kWh per household per month for a grid-based system, with the intention that it be used for lighting, media access and boiling drinking water. This amount is clearly not enough for cooking or space heating, or for heating water for washing purposes. All water and electricity used beyond the free basic water and electricity amounts would thus be for the user's account. Fiil-Flynn and Soweto Electricity Crisis Committee (SECC) (2001, cited in McDonald and Pape, 2002) documented that the average amount of electricity required by poor households to meet their energy requirements may be up to 600kW/h per month, depending on the season and indoor heating needs.

Families, in order to qualify for core/basic housing, had to have a monthly income not exceeding R3 500. The subsidy amount is based on a joint spouse monthly income, before any deductions, for households assumed to be unemployed or having low-income jobs (SA Government Info., 1994). The dilemma is that after moving into the housing unit, expenses associated with maintenance of the home and services needs to be covered by the new homeowner. Typically the social and financial obligation to pay for services beyond the free services, in the form of a basic water and electricity supply, rests upon the home owner. New home owners may not be able to maintain the house and afford costs relating to rates, water, electricity for spatial heating and cooking, and other domestic expenses. When services essential for hygiene, health and household well-being cannot be met, the subsequent health and environmental exposures and outcomes may be negative. Thus the concern is that household- and environmental health may be affected negatively due both to the exposures resulting from residing in the basic core/ structure

and the resultant limited basic services they are expected to cope with in the absence of disposable finances.

The implication may be that users would not want to use the 'free commodities' of water and/or electricity beyond the *gratis* quantity and could make sacrifices which may impact negatively on health. These sacrifices may pertain to hygiene, whereby the use of free water is limited or used sparingly, and limiting electricity usage leading to exposure to harmful heating and cooking fuels, which may consequently translate into negative health impacts and increased exposures to harmful pollutants. Gilbert (2004) refers to the low-cost housing settlements as the "creation of slum neighbourhoods" and reports that beneficiaries of the houses cannot afford charges of water and electricity, or dwelling maintenance, therefore they may revert back to habits of the informal dwelling as it pertains to water, sanitation and energy, which are not necessarily health promoting or maintaining.

The tension now explored lays in owning a fully serviced house and having to pay for services beyond the free amounts in the formal house, and presumably having increased expenses translating into less/limited disposable finance to attain and satisfy other needs, after having lived in an informal settlement, with communal inadequate services but no expenses, as it pertains to water, electricity and minimal home maintenance.

Phumlani informal settlement came about in 1991 when approximately twenty persons, inclusive of children illegally occupied land in Lotus River (Manuel, L., Interview, 24 May 2000). At the

time the land fell within the jurisdiction of the then 'Cape Metropolitan Council', currently South Peninsula District, which is one of the eight sub-districts of the City of Cape Town Municipality.

Phumlani is a Xhosa word meaning 'Place of Rest', so named as no evictions occurred from this site. In the meantime an informal settlement was developing in the Zeekoevlei bushes approximately 1km away from Phumlani. The environmental health conditions were similar to those that existed in Phumlani. The two areas grew steadily. As from 1995, community leaders from both Phumlani and Pelikan Park-Zeekoevlei informal settlements began campaigning for the provision of low-cost housing to its residents (Mgutyana, P., Interview, 30 May 2000). This came to reality in 1999**,** with the commencement of construction of the first of the low-cost housing units. Housing was allocated on the basis of 'first come, first served', i.e. those having the longest length of stay in the informal settlement would be allowed to move into the core housing unit as soon as the first phase was completed. This occurred during 2000.

The two groups (residents of Phumlani and Pelikan Park-Zeekoevlei informal settlements) are homogenous and were both earmarked for resettlement to a new low-cost housing settlement. The new houses were $27m^2$ in size and constructed from hollow cement blocks (wall construction) which is regarded to have 'reasonable thermal capacities' (Klunne, 2002), but cause houses to be cold and damp (Walker *et al.*, 2000) as they are single leaf, i.e. not constructed with a cavity which could improve thermal ability. Roofing is constructed of fibre cement (which contains white asbestos) and the house is not supplied with a ceiling further impeding thermal ability, indoor air pollution (dust), inhabitant exposure to pollutants and exposure to drafts and cold. The houses typically consist of one room, with a wash trough/basin

and a separate space, to be used as the bathroom with a water-borne toilet and a shower. The inner walls of the house are not plastered and outer walls are plastered by a method referred to as 'bagging' and painted. Plastering walls assist with insulation, moisture resistance and cracking (Klunne, 2002).

Residents from Phumlani and Pelikan Park-Zeekoevlei informal settlements often have little or no expenses relating to payments for essential services, e.g. water supply, refuse removal or sanitation. Moving into low-cost housing required the household to maintain the dwelling, pay for services i.e. water, sewerage, refuse collection and removal which are provided by the local authority, and maintain an electricity supply to the dwelling. Families are commonly unable to afford the costs of these services. Concerns resulting from the above are that despite the improved housing, the associated increased expenses may impact negatively on the household and environmental health of the residents. This study seeks to establish the household and environmental health changes that might result from the move from the informal settlement to a formal low-cost housing area, where beneficiaries obtain an allotment of free basic services pertaining to water and electricity, and have to pay for that which they use beyond the free amounts.

1.2 PROBLEM STATEMENT:

Factors such as South Africa's political past, increasing urbanization, unemployment and poverty all contributed to the development of informal settlements in urban settings. The inability to afford a formal house means that the poor, in order to realise their right to housing in terms of the SA Constitution (1996) are placed on a housing waiting list, until such time that homes are

constructed, which process can vary in time. When houses are eventually obtained, these are in the form of starter-units upon which the beneficiary has to build in order to make it adequate in size so that family and belongings can be accommodated. The house comes fully serviced with access to free basic water and electricity and water-borne flush toilets. However, increases in household expenditure may occur as everything that is used by the household beyond the free basic services is for the account of the beneficiary, which they may not be able to afford. They may make compromises in terms of what the free services may be used for, at the cost of their health and that of household members. Thus, uncertainty exists in how the combined effect of relocating from inadequate informal housing with very limited, but free basic services, to low-cost housing with adequate infrastructure for basic services, but which now, except for a bare minimum quantum, have to be paid for, affects personal and environmental health.

1.3 PURPOSE OF THE STUDY:

The purpose of this study is to make available and disseminate the main results of the study to Provincial and Local departments of human settlements and departments of health, especially the environmental health section. The envisaged intention is that they may use the information when deciding on a housing *package* for future recipients of formal low-cost housing, particularly with regard to household and environmental health concerns within the City of Cape Town, and even the Western Cape. The information may also be useful in the development of Integrated Development Plans (IDP's) for the two entities respectively.

CHAPTER 2: LITERATURE REVIEW

2.1 OVERVIEW OF THIS CHAPTER:

The chapter will provide a brief global overview of contributions made towards the promotion and protection of public health since the 18th century. This is followed by a section presenting the South African urban housing scenario, with a general focus on health in informal and subsidised formal low-cost housing.

The chapter continues with a presentation of factors in respect of housing in informal and formal low-cost housing settlements, which may influence the health of inhabitants and the environment. This includes presentation of factors relating to:

a) Levels of household crowding: whereby a brief overview is provided in terms of what constitutes overcrowding within a residential dwelling. This is followed by a presentation of consequences for health due to overcrowding in informal and formal low-cost housing settlements.

b) Water provision in informal and formal low-cost housing settlements: commencing with brief overview of the importance of access to, and availability of, water from a public health perspective. It then presents the *water status quo* in informal settlements and its consequences for health, followed by the same information for formal low-cost housing settlements. A brief overview is given of the cost implication where water is not provided as an unpaid communal source.

c) Electricity as a household energy source: this section is introduced with an overview of its provision to subsidised formal low-cost housing. This is followed by the use of different energy sources, including electricity, in informal households, and its consequences for health. The same is presented for formal low-cost households and health. Basic electricity supplies are also reviewed in relation to poverty in both the settlements.

d) Sanitation is introduced with an overview of the importance of adequate sanitation and a description of the sanitation scenario in informal settlements. This is followed by a review of health consequences of inadequate sanitation in informal settlements. It continues with a review of the supply, use and consequences for health, of water-borne flush sanitation systems in formal low-cost housing.

e) Household refuse/waste management and pest presence and control, and its consequences for health, are presented in terms of the informal- and formal low-cost housing settlements respectively.

f) A review of self-reported health status of individuals and households in relation to housing and neighbourhoods is presented.

2.2 HOUSING AND HEALTH:

2.2.1 Public Health Overview:

The World Health Organisation's (WHO, 1948 in WHO 1998) definition of health, i.e. that "health is a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity" has its roots in the 1920 definition of Charles-Edward Winslow (Gostin, *undated*) who defines public health as:

'The science and art of preventing disease, prolonging life and promoting physical health and efficiency through organised community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organisation of medical and nursing service for the early diagnosis and preventative treatment of disease, and the development of the social machinery which will ensure to every individual in the community, a standard of living adequate for the maintenance of health.'

Public health intervention has its background in the presence of human waste and the need for its proper disposal in an attempt to curb the spread of diseases such as cholera and smallpox (Ohio Department of Health (ODH), 2008). One of the main interventions was making available access to clean water and safer food (*ibid*).

During the period 1779-1816, major contributions to public health by Johann Peter Franck, came with the proposal for the inclusion in policies to 'protect the population against disease and to promote health' in Germany (Last, 2011). In England, Jeremy Bentham, during the period 1748-1832, promoted similar policies, calling for reforms in prison health, and proposing the establishment of a 'ministry of health, birth control and a variety of sanitary measures' (Tallis,

2011; Peacock, 2007). Edwin Chadwick, after realising the interaction of disease and poverty and the positive health benefits of preventative measures, documented the following in relation to health of communities: the status of housing of the working population; lack of sewerage; lack of adequate water supplies; unsanitary work environments; social class and life expectancy and the economic impacts of unsanitary conditions, i.e. the impact of the residential and occupational environment on health (*ibid)*. He was thus tasked with the implementation of Bentham's proposals. These largely formed the organisational framework in the public health field during the late 19th and early 20th century in England.

The discovery of pathogenic bacteria by Pasteur and Koch lead to a better understanding of the 'epidemic phenomena' and contributed to the prevention of much of the infectious diseases, thereby revolutionising sanitation into a science (Winkelstein, 2011).

In society today, poverty is regarded as the key reason for the 'presence and persistence' of household environmental problems in low-income cities (Mcgranahan, 1993).

2.2.2 Urban *Informal* Housing and Health:

In South Africa, the link between substandard urban housing and poor health has been recognized for almost a century, with one of the first documented associations being reported as early as 1934, by Britten (Sharfstein, *et al.*, 2001). Westaway (2006) further notes that quality of life, as perceived by families, as not merely being based on the personal domain, but also being affected by the environmental quality of life experienced by the individual, which includes housing.

In order to satisfy one of the most basic needs, i.e. the need for shelter, newly urbanised individuals erect houses with any materials deemed suitable for this purpose, and recently urbanised households and individuals usually cluster together to form informal settlements. In most cases, basic – but not adequate- communal infrastructure and services in the form of standpipes for water, bucket toilets and points-of-entry waste collection services are provided to most urban dwellers in the informal settlement by local municipalities (Mitlin, 2001), but not access to adequate housing, infrastructure and services. Quite often though, the delivery of associated services does not accompany the sprawling informal settlement. The informal dwelling invariably lacks adequate ventilation, water, sanitation, and amongst others, inadequate food preparation and food storage areas (Richards *et al.*, 2006), subjecting those residing in them to a host of harmful exposures. These may all negatively impact on the health of those who find themselves subjected to living in informal settlements (Wang'ombe, 1995).

Residents of informal settlements report crime and unemployment to be the 'key' problems they face (Richards *et al.*, 2006). Being unemployed may subject the household to a variety of problems ranging from family stress, food insecurity, family violence, inability to maintain the dwelling and inability to afford education (*ibid*; Wekesa *et al.*, 2011). This was certainly found by Gilbert and Soskolne (2003) in that the health of those unemployed were found to be worse than that of the employed in a range of households across a spectrum of social differentials. Inhabitants of informal houses are furthermore 'at higher risk' for infections such as HIV/AIDS, TB, and vector borne diseases and are more likely to have barriers preventing access to treatment due to no proof of address (David *et al.*, 2007).

Often the location and structure of the dwelling means that it is unable to provide protection to its inhabitants during foul weather, such as torrential rains during winters in Cape Town, whereby flooding and temporary displacement is experienced due to high water tables (Goldberg, 2009). Health and safety of households in informal settlements are thus under threat of the elements.

2.2.3 Urban *Formal* Low-Cost Housing and Health

Shortt and Rugkasa (2007) have found that interventions aimed at improving health through housing improvements can have positive benefits. Thus, as noted by Breysse *et al.* (2004), the built environment, including residential dwelling, can be an 'agent of health or illness' for children. The provision of low-cost housing in South Africa is not necessarily supplied with the aim of benefitting health, but rather to reduce the housing backlog and fulfill constitutional obligations relating to the right to shelter. Donaldson (2002) reports that respondents reporting on key aspects within their province they would want government to improve on in order to make their lives better, list housing as the number one priority.

The advantage of owning a home and living in it, especially in the context of its health benefits, are given account of in much of the scientific literature. Benefits ranges from having access to amenities and services (Macintyre *et al.*, 2000 cited in Macintyre *et al.*, 2003), to reductions in exposure to home hazards such as indoor mould, stress, anxiety and depression (Macintyre *et al.*, 2003; *Black*man *et al.*, 2003 cited in Sandel and Wright, 2006). However, if the home occupants are unable to maintain the house with regards to the physical structure and hygiene, its inhabitants may suffer a variety of disease conditions, impacting especially on childhood health

which manifests in the form of allergies such as asthma (Sandel and Wright, 2006). Singh, *et al.*, (1996) cautions of a close relationship between poverty and diseases noting that the poor suffer due to their household environmental conditions, and thus regards poverty as the 'main polluter'. As reported by Govender *et al.* (2010) owning a subsidised home does not translate into an improvement in income, as employment status remains unchanged once they take occupancy of the low-cost dwelling. Socio-economic conditions, such as unemployment, are important as these may indirectly influence access to services, i.e. adequate sanitation, refuse collection and removal and may therefore influence conditions of urban environmental quality (Fobil *et al.*, 2010). For the poor, these may include amongst others, increases in diarrhoeal disease, skin diseases, pneumonia and worm infestations (*ibid*).

Core low-cost housing in South Africa can be regarded as physically inadequate housing. Aboutorabi and Abdelhalim (2003) describes low-cost housing in South Africa as being worse than the shacks they are supposed to replace, being neither structurally suitable for living, having high maintenance requirements due to poor construction and having no control or contribution (in design and construction) from the owners. Niemann, *et al.* (2003) estimates that thousands of people living in low-cost housing are left homeless, injured or deceased each year as a result of devastating weather conditions which could be directly linked to the quality of the structure. Deregulations and mass supply of housing with limited finances has, in South Africa, resulted in the use of sub-standard building materials. Huchzermeyer and Karam (2006) warns that the use of poor building materials can bring about similar conditions to those existing in slum areas, such as ill-health resulting from dampness which eventually leads to respiratory illnesses, caused by resultant mould and dust in the dwelling.

Many studies document the health consequences of low-cost substandard housing on the health of children. Sharfstein *et al.* (2001) describes that often the link between sub-standard housing and child health goes unrecognised by physicians. Krieger and Higgins (2002) confirms that living in sub-standard housing subjects the dwellers to many health risks, such as increased risk of chronic conditions, injury, poor nutrition and poor mental health. Children of poorer families also suffer more episodes of ill-health, especially infections of the respiratory tract, such as asthma and other allergies, and injuries (Victorino and Gauthier 2009).The focus on the child-health-housing link is far reaching and impacts not only on physical health but also on social, emotional and mental well-being. Marsh *et al.* (1999) refer to 'housing history matters' and illustrates how this impacts on the poverty cycle in the form of a sickly child often missing school, and ending up in a low-income job due to his/her low-level of education.

Sharing concern about the housing-and-health relationship, Sandel and Wright (2006) emphasizes communication between those responsible for housing delivery, i.e. housing departments, and recipients of housing. He continues to say that by merely involving the community, it is possible to establish real understanding of people's domestic settings. This would then include issues relating to household size and financial characteristics of recipients. The opportunity to factor in housing needs and priorities, based on the characteristics of recipients then could guide in the provision of adequate and appropriate infrastructure, improved basic services, and sustained positive impacts for the households and the household environment.

2.3 SOUTH AFRICAN HOUSING INFLUENCES ON HEALTH:

2.3.1 OVERCROWDING, HOUSING AND HEALTH

Crowding is defined as the number of persons per room (Habib *et al.*, 2009). Hall (2010) regards a home to be overcrowded when it houses more than two persons per room. Levels of crowdedness is however subjective, i.e. in relation to the size of the room, taking into account the age of the household members, meaning that children under the age of 10 years are regarded as '½ person' (Batson,1943 cited in Thomas, *et al.*, 2001). Some regard a room to be crowded when more than two persons share a room, or where more than four persons reside in a two bed-roomed dwelling whereas others prefers to view it as the measure of a household's 'fit' into the housing unit, measured as the number of persons per room (PPR) (Goux, 2005). These however, do not take into account size of the rooms or dwelling as does the Batson Scale.

2.3.1.1 Consequences of Overcrowding for Health in *Informal* Housing:

Few *et al.* (2004) reports that the average number of persons per room in an informal dwelling is 2.6 in Brazil (highest number 5-6), whereas, in Johannesburg, South Africa, the mean number is 3, (highest number up to 12). Govender, *et al.* (2010) reports household occupancy levels being significantly higher in low-cost housing, than that of the informal dwelling, but due to its size, the informal dwelling has a higher occupancy density than that of the formal dwelling. The impacts of overcrowding are the same in both formal and informal settings, and are elaborated on in the section that follows.

2.3.1.2 Consequences of Overcrowding for Health in *Formal* Low-Cost Housing:

The size of the homes may lend itself to becoming overcrowded, as it is not expected that the family size will be reduced once the families relocate to the new homes. Low-Cost housing however, is only to be extended by using pre-approved building plans and materials. Typically, the size of the core house erven varies in size from 100-200m^2. This has been cited as a concern to informal citizens being relocated, as they felt the erven size may not correspond with future changes in their socio-economic status (Dixon and Ramutsindela, 2006), i.e. in the event that their financial status allows, they will not have much space to extend the home to their desired size due to the small erf. The limited size of core low-cost housing does not suitably satisfy human social requirements as it may lead to overcrowding in terms of the South African National Building Regulations and Building Standards Act (SANBR), act no. 103 of 1997 (RSA, 1997) which stipulates an area of 2,5m^2 per person for sleeping purposes.

Consequences will include increase in spread of communicable diseases, lack of privacy between household members, lacks of space for storage of furniture, appliances and belongings and an increase in household accidents. Due to the crowded condition household hygiene may be neglected, allowing for the presence of pests, in and around the dwelling. Pest presence may itself be the cause of disease, e.g. development of allergies to their droppings such as cockroach allergies, easy spread of pathogenic micro-organisms due to the faeces and presence of rodents such as rats and mice, flea infestation due to the presence of pets, such as dogs and cats. Families previously unaccustomed to spending money on household- running and maintenance now have to do so.

Sharfstein and Sandel (eds.) (1998) associate a physically inadequate house and overcrowding with rodent infestation and emphasize its asthma enhancing ability and potential to increase the incidence and spread of zoonotic diseases. If accompanied by overcrowding communicable disease may spread easily. Quite often crowdedness is associated with pressure on limited facilities, especially those improving quality of life for inhabitants such as water, sanitation and personal space. These also increases the environmental hazards to health and well-being as a crowded environment poses various limitations to the household and can be more difficult to manage (Few, *et al.*, 2004).

Levels of crowding in a dwelling can be regarded as an indication of an existing need for affordable housing. A possible trend to cope with demand for shelter is the erection of backyard shacks, which serves the purpose of housing all household members, or which may serve as an income resource (Govender, *et al.*, 2010; Landman and Napier, 2010; Gilbert, 1999; Singh *et al.*, 1996), thus reverting back to living in shacks with all its negative health consequences and stifling government's plan to eradicate all informal settlements by 2014 (Dept. of Housing (DOH), 2004).

2.3.2 WATER, HOUSING AND HEALTH:

2.3.2.1 Overview:

Access to, and use of, advanced methods to treat water, and pipe it to users, has had a positive impact on the reduction of water-borne diseases during the last century (Fricker, 2003). The poor have the most to benefit from a health and socio-economic perspective, from having a constant supply of piped water to their avail (Kayaga and Franceys, 2007). In South Africa, this would

include those residing in informal settlements. However, water is a service that has running and maintenance costs attached to it and for many poor households, becomes a service that is unaffordable and they may run the risk of suffering from the consequences of water insecurity. Wutich and Ragsdale (2008) note that water insecurity can be regarded as insufficient supply or lack of access to water. For this reason, access to water has been promoted in the form of the 'Free Basic Water Supply' (DWAF, 1997).

2.3.2.2 Water Supply, Use and Consequences for Health in *Informal* Housing:

In informal settlements, water is typically supplied to households in the form of street located communal standpipes. This means that users have to collect water, transfer it to homes, store it in homes and use it as the need arises. Once home stored water is used, the process of fetch, cart, store, use, restarts. Quite often the task of ensuring the household is supplied with water rests upon children and, more often than not, women. Concerns about women's health due to water collection includes, amongst others, injuries to the back, neck and other joints, death due to road accidents, increased assault risks, and opportunity costs relating to lost economic and educational opportunities (Kirchner, 2007). The activity of having to collect water may bear other negative health consequences such as increased incidence of parasitic worm infestations due to humans and animals around the water sources (Fenwick, 2006). Gender has furthermore been found to be associated with the presence of emotional distress - similar to that experienced during food insecurity- whereby women suffer more distress than men where water insecurity is present (Wutich, *et al.*, 2008). Improper water storage in the home may favor the growth and multiplication of pathogens which could lead to infections (Luby, *et al.*, 2001).

2.3.2.3 Tapped Water in *Formal* Low-Cost Housing:

Once the free basic water supply of 6000L per month is depleted, the family is expected to pay for the use of additional quantities of water. The consequences of these limited basic supplies, together with low-incomes and other household priorities, may result in negative impacts on health of the household members of formal (albeit low-cost) houses. Families previously unaccustomed to spending money on household running and maintenance costs now have to do so. For households who are already in a dire financial situation, as the poorest of the poor are, this may cause considerable juggling of disposable finances between day to day domestic spending. Inocencio *et al.* (1999) suggests that a more reasonable figure, for satisfying basic health requirements of drinking water, hygiene, laundry, sanitation and cooking, would be 1300L of water per family per month.

2.3.2.4 Cost Of Water If Not from a Communal Source:

Not all municipalities are able to provide even the 6000L of water. Some are offering only a portion of the basic amount of water via communal standpipe and in some communities no access to piped water is provided at all (Our Water Commons, 2010). Access to the free basic supply of water is therefore not enjoyed by all SA citizens.

2.3.2.5 Moving From *Informal* House with a Standpipe to a *Formal* Low-Cost House with Water via a Tap:

Households using more than the free basic water (the 'first block') are charged on a 'rising block tariff' basis, i.e. the more water used, the higher the price becomes. For many families entering

the second or third block is financially not an option and they have their water capped at 6000L, or the water pressure is reduced, thereby making it impossible to exceed the free basic amount.

Since families in informal settlements have not paid for the use of basic services including water and electricity, this may prove challenging once they relocate to formal houses and are being billed for this. Families may then resort to the old practice of collection and storage of water to supplement the free supply. The inadequate storage of water, i.e. for prolonged periods in unclosed, unclean containers may result in a number of negative impacts for health.

Limited supplied of water results in increases in incidence of diarrhoeal diseases in children and the immuno-compromised individual, i.e. those with a pre-existing illness such as HIV/AIDS. A study done in Port Elizabeth (Thomas, *et al.*, 1999) reflects that even after a move to basic core low-cost housing, diarrhoea rates, relating to poor sanitation and a shared water supply, of as high as 10% were still recorded in low-income groups as opposed to 4,5% in families in high income groups**.** When supplies are limited, or interrupted, households inevitably resort to obtaining water from a raw source, such as directly from e.g. lakes, rivers and streams. They may also, become a burden to neighbors should their water supply be suspended due to e.g. non-payment for that which they have used beyond the free basic supply. Given unemployment rates and/or low levels of income in the low-cost housing settlements, few households will be able to pay for water beyond the free basic litres supplied per month.

2.3.3 ELECTRICITY, HOUSING AND HEALTH

2.3.3.1 Overview

Once relocated to formal low-cost housing, all households will be supplied with free basic electricity (FBE) amounting to 50KWh per month. This amount is deemed sufficient to be used for basic heating, i.e. of water via a kettle, lighting, communication, i.e. media access and ironing cooking (DME, 2003). As this is implemented at local government level, the FBE supply varies between different local government areas of jurisdiction, in Cape Town for example, the supply is for households using below a certain level of consumption, whilst for those in Tshwane, the electricity is available to all households (Sustainable Energy Africa (SEA), 2006). Anything utilized beyond the free amount users would have to pay for. Access to electricity carries with it certain health benefits (Markandya and Wilkinson, 2007) in that clean energy sources are used and appliances that enhances cleaning such as washing machines and refrigerators, which prolongs the shelf-life of food, i.e. limiting exposure to consuming food poisoning agents, becomes available.

2.3.3.2 Fuel Used and Consequences for Health in *Informal* Houses

Having resided in an informal settlement, meant that households were not formally supplied with free basic electricity. However, large numbers of 'illegal' electricity connections are present, in most instances running connections from RDP homes located close-by to informal settlements and via street lights (Damba, 2011). The presence of illegal electricity connections poses the risk of injury, or even death due to electrocution. The impact of the illegal connections means that the illegal users, if connected to the supply of an existing home, may impact on that household's free basic electricity supply and result in the supply being consumed at a fast rate. In return, they, i.e.

the additional user, could be charged large fees by the formal home-owner which is reported to be as high as R200 p/month (Damba, 2011; Mgwebi, 2011) for the use of electricity via the grid supply.

The benefits to those residing in informal housing are that they have access to electricity and all the benefits which accompany it, such as refrigeration of foods, thermal comfort brought about by space heating appliances during cold weather, and this comfort in itself has certain benefits for the health of household members (Adam, 2010; Spalding-Fletcher, *et al.*, 2002). The incidence of fires due to the use of candles and paraffin is reduced, and partaking in small scale economic activity is possible (Malzbender, *et al*. 2005; Spalding-Fletcher, *et al.*, 2002) Residents in informal houses typically use 'traditional' fuels for energy, such as wood, animal dung (mostly in rural areas) and paraffin for purposes of lighting, heating and cooking (Sagar, 2005), meaning that they have higher exposures to air pollutants, especially indoors. For women, this risk is higher than for any other household members, as they are the ones cooking and making fires for heating (Lodhi and Zain-al-Abdin, 1999). This means that their exposure to suspended particulate matter and carbon monoxide is quite high. In the pregnant female the foetus may die due to continued exposure to carbon monoxide (*ibid).* The incidence of lung cancers amongst women is largely driven by the use of paraffin and coal for cooking (Ramlogan, 1997). The health impact further varies from increased incidences of respiratory infections, including pneumonia, TB and chronic obstructive pulmonary disease (COPD) to low-birth weight and eye infections (Fullerton, *et al.*, 2008). For children in households where wood is used as fuel, a higher incidence of pneumonia is present (*ibid*).

2.3.3.3 Electricity Supply, Use and Consequences for Health in *Formal* Low-Cost Housing

The granting of illegal connections to the electricity network may place households of low-cost homes acting as the conduit for the electricity supply in the category of 'high-consumption' users. They could thus forfeit their free basic supply. They would then depend on natural energy sources in the form of wood for heating and cooking and in some instance purchase paraffin for this purpose, subsequently increasing exposure to harmful emissions due to combustion of these fuels during cooking and heating.

The amount of money that households fork out for electricity beyond the free supply was reported to be R200 per/month in 2001 (Fiil-Flynn *et al.*, 2001 in McDonald and Pape, 2002). Electricity costs have more than doubled in the meantime, meaning that poor households could easily be spending up to R400 in 2011 for electricity. It is envisaged that households may not be able to afford this and may suffer from fuel poverty. The reduction of electricity consumption is indeed reported as a coping strategy (Smit, 2003) when households fall upon hard times. Being unable to afford energy for heating may subject household members to poor health as the association between poorly heated homes and ill health, especially upper respiratory tract infections, are well documented (Shortt *et. al.*, 2007). This may also place a burden on the public health service as the poor, when ill, most often seeks health care at public health facilities (Evans *et al.*, 2000). Materials used in the construction of low-cost homes do not necessarily benefit health, especially since the homes are not fitted with under-floor or under-ceiling thermal insulating materials. In fact, many of the formal low-cost homes are not fitted with a ceiling at all. For this reason, low-cost houses in South Africa are not thermally or energy efficient (Mathews and Weggelaar, 2006). This simply means that thermal insulating ability of the home

is limited, or not present at all and comfort levels during hot and cold seasons will be affected. Having adequate thermal insulation such as a ceiling fitted to the low-cost house may considerably reduce energy consumption during winter, thereby saving money for the households, and decrease indoor temperature during summer (Mathews *et al.*, 2006; Spalding-Fletcher *et al.*, 2002).

Increasing fuel costs creates hardship and suffering for families, as fuel is almost as much a need as food is and having little money may lead to a *toss-up* when faced with having to decide between the two, especially during cold weather. Sandel (2000) speaks of the occurrence of iron-deficiency anemia resulting from nutritional deficiencies in winter when the choice between 'heating and eating' are difficult, and how it also contributes to a decreased growth rate of children between the ages of 6 months and two years.

2.3.4 SANITATION, HOUSING AND HEALTH

2.3.4.1 Overview

It is widely accepted that safe and adequate sanitation is an important factor in reducing people's exposure to disease (Loetscher and Keller, 2002). This holds especially true for poor communities, due to an increasing number of persons being immune-compromised- due to factors such as HIV/AIDS infections and malnutrition- in South Africa (Ganyaza-Twalo and Seager, 2005).

In Cape Town, about 94% percent of the population has access to water-borne sewerage (Njoh and Akiwumi, 2011). However, informal settlements lack adequate sanitation, i.e. flushing toilets (Richards, *et al.*, 2006). In most instances, informal settlements are supplied with communal-

often bucket- toilets shared by a minimum of 5 households per toilet facility (City of Cape Town, 2008). Shared sanitation facilities are, in terms of the MDG's, not considered adequate (Isunju *et al.*, 2011).

2.3.4.2 Sanitation Facility Used and Consequences for Health in *Informal* Housing

The absence of adequate sanitation poses huge disease-related hazards and increased pollution (*ibid*). The bucket toilet may contaminate soil, due to being overfull and spillages and may expose the community to direct and/or indirect contact with faecal contaminants (de Wet *et al.*, 2001). Bucket toilets are demeaning to the dignity of people in that there is no privacy for households using the facility, especially not for women and girls as their feminine hygiene needs are not met. Keeping the toilet facility clean can become the root of many arguments between households using the facility. Quite often the facility is then locked and access can become difficult especially for children. They may thus end up using any available open space for defecating thereby fouling the environment and exposing those in the neighbourhood to, amongst others, pathogens transferred by insect vectors such as flies. Inadequate and unsafe sanitation causes 90% of the diarrhoeal disease burden (Lopez *et al.*, 2006 cited in Isunju *et al.*, 2011) and is furthermore associated with increased malnutrition, hunger, subsequent death of children under the age of 5 years and low life expectancy.

In informal settlements where communal water-borne flush toilets do exist, these are often in a poor state due to children throwing large physical objects such as stones and bottles down the system, or due to the cleaning materials used for personal cleansing. However, in the informal settlement the responsibility for clearing the blockages rests with the municipality as it is

essentially public property. The informal households thus do not have to fork out any money for the repair and/or maintenance of the system.

2.3.4.3 Sanitation Facility Used in *Formal* Low-Cost Housing and Consequences for Health

Formal low-cost housing is serviced, i.e. with water, electricity and sanitation, and is thus expected to make the life of its inhabitants easier. Benefits of adequate sanitation include health improvements, but could also hold non-health benefits. These include amongst others, comfort, privacy, safety, convenience, dignity and reductions in conflict with neighbors, reductions in embarrassment and stress (Insunju *et al.*, 2011).

However, Govender *et al.* (2011) reports that families in low-cost housing have found to have low-level sanitation behavior and quite often that their toilets were either blocked or broken. Due to the private tenure status of the low-cost dwelling, the responsibility for repairs now rests with the owner and often they have no finances to repair these. This means that during this time they would utilize the neighboring household's facilities, placing strain on their water resources, or use open spaces.

Unfortunately, the improvement in tenure and physical living environment is not accompanied by improvements in income status. Thus the poor use the 'space' resource as a means of income whereby they rent their backyard space to poorly housed families, facilitating the development of slums in their back-yards (Govender *et al.*, 2011). The un-housed would then construct informal shack houses in the backyard without sanitation, water or electricity. Backyard dwellers commonly use any receptacle that could serve the purpose of a *chamber pot* which is then

disposed of in storm water drains (*ibid*). This increases the possibility of disease transmission, in particular those transmitted via the oral-faecal-route and leads to poor environmental quality, which inevitably influences quality of life (Westaway, 2006).

Govender *et al.* (2011) found that households sometimes use the flush mechanism on the toilet to dispose of grey water, thereby wasting water and increasing utilization of the free basic water.

2.3.5 HOUSEHOLD WASTE MANAGEMENT AND HEALTH

2.3.5.1 Overview

Waste management in informal settlements has proven to be a huge task due to the layout of the settlement and because the shack houses are located fairly close to one another. Often access, for collection of waste, to individual shack houses is impossible as no vehicular access is possible due to pathways mainly being intended for pedestrian use. Subsequently communal waste collection points are created, whereby each household has to ensure that their household waste reaches the collection point on collection days, usually once per week. However, this task is not always performed, i.e. placing waste at collection points, or collection of waste by local authorities. Poor households, especially those in informal settlements, and low-cost formal neighbourhoods, usually lack, amongst other services, adequate refuse collection (Mathee and Swart, 2001; Mathee and Mthembu, 2004). The municipality for the City of Cape Town therefore has a system whereby hourly paid labour is employed to disseminate refuse bags, and collect these when they are full, after which they transfer the bags to a central collection point, from where private waste collecting companies will collect and transfer the waste to a disposal site (Couth and Trois, 2010).

However, as waste is collected once per week, dogs would then often scavenge in the waste, and/or children would have access to it, putting their health at risk due to exposure to pathogens and chemicals in household waste and incurring physical injuries (UNEP, 2005). Household solid waste which is not collected will rot causing foul odours, create a fire hazard, provide a habitat for parasites – e.g. intestinal parasites due to the presence of organic waste -, attract pests such as rodents and flies and provide a breeding ground for pathogenic micro-organisms. Pests are reported to be associated with greater risk for the presence of chronic conditions, such as allergies (Krieger and Higgins, 2002). Hasan (1998) reports resident attitude as: 'not understanding their responsibility in maintaining a clean neighbourhood' and 'lack of opportunity to be involved in waste management' as reasons for indiscriminate dumping in informal settlements. The untimely removal of waste may furthermore result in seepage from bins, or refuse bags, and cause pollution of the environment (Govender *et al.*, 2011).

Households to which the municipality provides a black refuse bag for storage of household waste, usually store the refuse bag, containing waste, open and indoors out of fear that the refuse bag will be stolen or damaged by dogs in the area. Storage of refuse in open containers, inside the dwelling, has been associated with an increase in fly breeding and fly presence inside the home (Mmom and Mmom, 2011; Boadi, 2003; McGranahan, 1993), which is in turn associated with diarrhoea and food poisoning.

2.3.5.2 Household Waste Management in, and Consequences for Health in *Informal* Housing

Refuse generated in informal settlements are often collected infrequently, resulting in waste dumps, which increases health hazards as listed above. Waste may also be washed off with run-off from rainstorms and may pollute the settlement (Hasan, 1998). In developing nations, only about 50%-80% of waste generated is formally collected making dumping the only other alternative, subsequently followed by scavenging for recyclable material as an income generating activity for poor families, as they may be dependent thereon for their livelihoods (Wilson *et al.*, 2006). The presence of waste dumps poses a threat to those collecting the waste, those practicing re-use and/or recycling, children who play in the vicinity of, or directly on, the waste dumps and the entire informal community. Informal waste recycling and re-use is regarded as an 'adaptive response' by marginalized communities (*ibid*). They thus partake in this activity to generate an income (Couth and Trois, 2010). Quite often vulnerable groups, such as women and children partake in this activity, subjecting them to increased health risks due to the nature of waste in open dumps (Contreau, 2006 cited in Wilson *et al.*, 2006) as well as increased incidence of bites from dogs and rats (Eerd, 1996). Butchart *et al.* (2000) reports that community suggestions for prevention of injuries to children in informal settlements includes conducting 'clean-up campaigns' to rid the area where children play of injurious matter such as zinc, broken glass and materials capable of causing injury.

Westaway and Viljoen (2000) reported that respondents partaking in a study to test health and hygiene knowledge, attitude and behaviour, related that diarrhoea was transmitted by rubbish and stools and that it was prevented by e.g. keeping the 'house and yard' clean. This means that it

might create the assumption that a clean yard equates with healthy behaviour so dumping outside the immediate vicinity of the yard, while not ideal, is 'acceptable', with a preference for dumping waste as far from the yard as possible. In fact, the location of the waste dump in relation to the living space, as reported by Wilson *et al.* (2006) is often associated with 'low-sanitation' and 'poor personal hygiene', with these being worse amongst those households with waste around, or close to their houses. If and when waste piles up, the household might then bury the waste on-site or incinerate the waste on-site, or they may simply dump the waste in any available space in the neighbourhood. The incineration of waste is associated with inhalation of bio-aerosols, smoke and fumes and these may cause respiratory infections, dermatological infections and low-life expectancy (*ibid*), especially of vulnerable groups such as women and children. Other risk causing factors include exposure to dust, toxins, allergens, increased risk of accidents and infections. Increased risk of food poisoning is also present especially if food waste, dumped within the neighbourhood, is consumed.

2.3.5.3 Household Waste Management in, and Consequences for Health in *Formal* Low-Cost Housing

Waste collection and disposal forms part of the basic services provided to low-income households living in low-income settlements. This means that all refuse inside refuse receptacles provided by the local authority is collected and disposed of without any additional charge to the household. Contrary to difficulty in access for waste collection in the informal settlement, this activity is made easier in the formal low-cost housing settlement due to the presence of roads which provides vehicular access and therefore weekly door-to-door kerb-side collection of household waste (Smit, 2003). Each household in the low-cost formal settlement is provided

with a closeable refuse receptacle, as opposed to the non-sealable black bag provided in the informal settlement, for storing of waste on-site (outside the dwelling) until waste collection day. This means unwanted access to the waste in the formal settlement, by children, pests and stray animals such as dogs and cats, should be reduced. The bigger refuse storage receptacle owned by households residing in formal houses is presumably better able to securely store a week's worth of domestic waste, than the single, smaller, fragile black bag of the informal settlement.

The ownership of a refuse receptacle is associated with the control of diarrhea (Westaway, 1993; von Schirding *et al.*, 1991 cited in Westaway and Viljoen, 2000). However, formal low-cost households commonly store refuse indoors in smaller open containers, such as plastic shopping bags, and then transfer these outdoors once full, or they store the larger refuse receptacle indoors out of fear that it might be stolen. The indoor storage of waste in an open container can be viewed as a reversion back to behaviours adopted in the informal settlement, whereby waste is stored in open containers indoors, thereby creating increased opportunity for pest infestation and pest-breeding. This in turn presents an opportunity for health compromising consequences as a result of the pest presence, as is the case in the informal settlements.

Low-cost housing settlements produce less waste compared to those in middle-and high income areas, but a smaller amount of their waste is collected (McGranahan, 1993). This means that even if formal waste collection services are provided, some forms of dumping will still take place manifesting as heaps of waste dumps within the community. Should a refuse receptacle be stolen, waste generated by the household will not be collected and disposal thereof becomes the responsibility of the generator. Should they require the private waste collecting company to take

away and dispose of the waste, this activity will be for the account of the household requesting the service and they will be billed accordingly.

2.3.6 PEST PRESENCE, PEST CONTROL AND HEALTH

2.3.6.1 Overview

As noted before, the presence of inadequate and improper waste management is associated with the presence of a host of household pests. These include rats, mice, cockroaches, fleas, flies, mosquitoes and ticks.

2.3.6.2 Pest Presence and Health Consequences in *Informal* Housing

Pests in informal settlements are attracted by factors such as the lack of adequate sanitation, lack of adequate waste water disposal, in particular grey water, and infrequent collection and improper disposal of refuse. de Wet *et al.* (2001) reports that *Black* bags supplied for refuse collection is frequently dumped on streets where stray dogs open these, exposing all persons in the environment to the waste and causing it to attract other pests, such as flies, and stray animals, such as live stock (e.g. goats and sheep) used in urban agriculture. The combination of rats and fleas have been found to create the largest pest problem in informal settlements (Tolosana *et al.*, 2009; Battersby *et al.*, 2002).

Thomas *et al.* (2001 cited in Tolosana *et al.*, 2009) reports rats and mice to be such a common household pest in informal housing, that they are simply ignored by at least half of the households in that study. In addition to the consequences for health presented by rats and mice (see the previous section), both rats and mice have the ability to gnaw, and if foodstuff are not adequately stored, they may gnaw through its packaging and not only spoil food, but also

contaminate it. These pests have the ability to foul houses with smear marks from their fur, and through their droppings and urine. Rats and mice are not only a nuisance, but also present health risks.Rats can contaminate food with their fur, urine and faeces, they transmit fleas and ticks to humans and pets, and they can transmit diseases such as typhus fever and leptospirosis (Feldman, 2010). Rats furthermore bite people and, in addition to exposure to pathogens in their saliva, open up a portal of entry for a host of other infectious diseases via their bites. Fleas cause discomfort, irritability due to itching and scratching, and this scratching opens the skin to other infections. In heavy infestation fleas may cause dermatitis and allergic reactions amongst humans (WHO, undated).

2.3.6.3 Pest Presence and Health Consequences in *Formal* Low-Cost Housing

In urban formal houses cockroaches manifest as the most common pest, due to the presence of sewers (linked to water-borne sanitation) and their habit of feeding on sewage and their need for dampness and water for survival (Wang and Bennet, 2010). The use of electrical appliances that generate and maintain heat, serves as further encouragement for them to take up residence. Cockroaches are reported to spread amongst others the following dangerous pathogens: Klebsiella species (spp.), E. coli, Candida spp., Staphylococcus aureus, Shigella spp. and Campylobacter spp., due to the presence of these micro-organisms in its digestive tract and on its body surface (Salehzadeh *et al.*, 2007). The fact that they shed their skin as they grow, may lead to the development of allergies such as asthma, due to prolonged exposure to their faeces and skin (Wang and Bennet, 2010). Rats and mice are a common problem in formal low-cost housing and although infestation rates are lower than in informal houses, their presence holds similar consequences for health.

2.3.6.4 General Consequences for Health of Pest Presence in *ALL* Types of Dwellings:

Families usually use a combination of pesticides, such as baits and aerosols, to rid dwelling of the pests. Children, because of their physiology, are more vulnerable to the negative effects brought on by exposure to the pesticides residues, either through inhalation or, in most cases via skin absorption (Mathee and Mthembu, 2004). They furthermore have higher rates of respiration, ingestion and metabolism and therefore have a higher risk of exposure to environmental pollutants (*ibid*). Tolosana (2009) reports that these aerosol pesticides may also be ingested, i.e. via foodstuffs exposed to spraying in the home, and may lead to long term effects such as childhood leukemia, brain tumours and cognitive impairment.

Improperly discarded household organic waste may contribute to fly presence within a neighbourhood. The impact of flies in a household holds negative health consequences in that they are able to transmit micro-organisms to food, which may result in food poisoning and subsequently diarrhea, nausea and vomiting, with or without fever (Heller *et al.*, 2003). In young children under the age of 5 years, diarrhoea is particularly associated with the risk of dehydration.

2.4 SELF-REPORTED HOUSEHOLD- AND PERSONAL HEALTH

2.4.1 Overview

The environment in which people live, and the lack of choices with regards to *where* they live, may affect health (Desmond and Boyce, 2006). In addition to the environment in which they live, social factors and cultural factors may further impact on exposures and subsequent health outcomes (Monden, 2010). Self-reported health may be confused with the respondent's 'general

perception of quality of life' (Malström, *et al.*, 1999) and it varies with age, gender and socio-economic status, and due to subjectivity, it may therefore not be a good measure of health (McCallum, *et al.*, 1994 in Malström, *et al.*, 1999). However, self-reported health status, due to its stability over time, has proven to be a valid indicator of the health of populations due to their 'test-and-re-test-reliability' (Miilunpalo, *et al.*, 1997 cited in Malström, 1999; Lundberg, 1996 cited in Malström, 1999).

Access to facilities, services and social resources are recognized as an influence on self-reported health status, in that areas (neighbourhoods) with access to these resources and facilities, report better health across the age-gender spectrum, than those without (Gilbert and Soskolne, 2003). Neighbourhoods within which people live undeniably affect their health and poor deprived neighbourhoods may cause people living there to 'feel bad' and in 'poor health' regardless of their physical health status (Malström, 1999; Grafova, 2011).

Positive health improvements are an expected outcome for household health once families relocate from informal settlements to formal housing. Reasons for this is that a new clean environment with new, clean homes are assumed, and amidst the *newness* of the situation, may initially influence the perceived health-status. This positive expected outcome is further enhanced by the supply of infrastructure and access to services, some of which are free, which households did not have access to whilst residing in the informal settlement. The relocation activity brings about an anticipation of better houses and better facilities and better services for the poor, and may therefore positively impact on self-reported health status. Some studies reports 'declines in distress' once relocation occurs from areas with rudimentary facilities and services,

to areas with adequate facilities and services (Leventhal and Brookes-Gunn, 2003 cited in Ruel *et al.,* 2010).

However, Ruel *et al.* (2010) reports that those having lived in poor housing- and therefore informal settlements- will unavoidably suffer poor health and this poor health is likely to persist, but would not be due to relocating to low-cost housing, but rather due to a convergence of factors relating to a 'life-time of living in disadvantaged circumstances'. This then means that households experiencing factors such as existing poverty and pre-existing disease conditions will experience poor health even in an improved living environment, due to their mental, physical and socio-economic history/background. Those relocating from informal- to low-cost formal housing are presumed to be better off due to the security of tenure, permanency of the structure and access to basic services due to them, and it is therefore expected that they would report higher levels of self-perceived health (Leventhal *et al.* 2003 cited in Ruel *et al.*, 2010).

Researchers however argue that 'social capital' or 'social cohesion', which includes factors of 'social life, networks, norms and trust' and factors which enables people to 'jointly pursue shared objectives' (Putnam, 2004; Ellaway *et al.*, 2001), should be taken into account as factors that may influence the *poverty-ill-health-relationship* (Gilbert and Soskolne, 2003). The layout and make-up of the informal settlement allows communities to have a greater sense of social cohesion, as narrow paths between houses, as reported by Smit (2003), makes social interaction between households easy and provides a safe (from a traffic point of view) place for children in which to play. It is common practice to rely on neighbors for support, in the form of food, childcare and even money when times are tough (Manie, 2004). However, in the South African

context, amongst the poor, it is not uncommon for adult children to remain living in the 'family home', or on the same property (as back-yard dwellers) or even within the same neighbourhood, as their parents, due to factors such as accessing social support (social capital) and inability to afford formal housing.

It is somewhat difficult, if not impossible, to differentiate the effect of poverty on self-reported health between the two areas, i.e. informal settlement *versus* low-income housing, as both groups *are* fundamentally poor. Essentially it is *exactly* this poor household from the informal settlement (or backyard shack) who qualifies for the housing subsidy and eventually relocates to the low-cost dwelling, without a change (for the better) in economic status once occupation of the low-cost dwelling is taken (SA Government Information, 1994). Poverty is nonetheless regarded as a strong influencing factor for self-reported bad health (Gilbert *and* Soskolne, 2003; Ruel *et al.*, 2010; Wasylishyn and Johnson, 1998).

Children have little control over the environment in which they live and seldom are able to communicate how they feel, and the stress they experience may therefore go unnoticed (Advameg, 2011). Factors such as overcrowding, lack of privacy and noisy environments may contribute to stress and increased child ill-health (Evans *et al.*, 1991 cited in Evans *et al.*, 2003). Socio-economic status in childhood may impact on health and disease risk in adulthood, due to limited access (during childhood) to social and economic resources, such as education and 'other learning experiences' (Cameron and Williams, 2009; Mckenzie *et al.*, 2011). Monden (2010) further suggests that family factors, such as the level of education of parents, may also be an important factor influencing educational attainment of their children. Educational attainment in

turn influences self-reported health status of siblings, more than shared family factors, as adult health is more affected by environmental influences other than a 'shared family home' (*ibid*).

2.4.2 Self-Reported Health and *Informal* Housing

Levels of poor health have been found to be higher in informal settlements compared to that of low-income formal neighbourhoods. Self-reported health in informal settlements was reported by respondents as being positively influenced by employment and income (Desmond and Boyce, 2006). Factors such as limited life opportunities, due to unemployment, ill-health, poverty and low levels of education further influences health in informal settlements and therefore may create distress and subsequent poor health and poor self-perceived health. This link between poverty and limited choices or 'having no options' is echoed by Wasylishyn and Johnson (1998) and Gilbert and Soskolne (2003), who report that low income is associated with having to find 'coping strategies' in order to manage and/or cope with the 'psycho-social stressors' of their circumstances. This may lead to feelings of insecurity, powerlessness and frustration which may result in increased stress (*ibid*).

Age is found to be a strong influencing factor for self-perceived health, regardless of socially different levels of housing. Young people report good health even in the absence of separate bathing areas, cooking areas and flush toilets in their homes, whereas this is not the case for adults (Gilbert and Soskolne, 2003). However, socio-economic status of adults influence child health in the sense that children from lower socio-economic status report poorer health and higher psychological stress than their higher socio-economic counterparts (Mckenzie *et al.*, 2011)

2.4.3 Self-Reported Health and *Formal* Housing (General)

Access to water, sanitation and clean energy has the potential to positively influence health of dwellers in low-cost formal housing (Macintyre, 2000 cited in Macintyre 2003), if they can maintain the availability thereof. Access to water and adequate sanitation is associated with reductions in diarrhea, especially in children under the age of five years (Kayaga, 2007). Clean energy sources used for spatial heating and cooking reduces exposures to pollutants of the indoor environment, and therefore also reduces respiratory illnesses and days lost from school and/or work (Markandya and Wilkinson, 2007). Adequate sanitation restores and maintains human dignity and convenience (Loetscher and Keller, 2002). Regular refuse removal, control of dumping and the ability to store waste adequately in the home brings about a clean environment and may reduce the presence of a variety of pests in residential areas (Westaway, 1993; von Schirding *et al.*, 1991 cited in Westaway and Viljoen, 2000). Security of tenure has positive impacts on mental and social well-being (Shortt *et al.*, 2007).

2.4.4 Self-Reported Health and *Formal* Low-Cost Housing

However, in South Africa, low-cost formal housing is typically located in 'poor areas' which inhibits the long-term health or social benefits of the formal housing. Those residing in poorer neighbourhoods, and who are 'socially and economically deprived', frequently experience poor health irrespective of their housing type (Poortinga, *et al.*, 2008). Residents of these low-cost areas will therefore experience stigmatization, decreased self-esteem and subsequent negative health outcomes (Wasylishyn and Johnson, 1998; Ruel *et al.*, 2010). The neighbourhood itself, because of this 'cluster of poverty' may then present the 'development of poor health' (Poortinga *et al.*, 2008) and dwellers may experience poor health similar to those present in informal

settlements. Women were reported as experiencing more stress and were generally found to report lower levels of 'good health', and higher levels of 'poor health' than male counterparts, in a study assessing self-reported health and socially different neighbourhoods (Gilbert and Soskolne, 2003). Neighbourhood 'economic disadvantage' is associated with lower 'excellent'- or 'good' health in males (Grafova, 2011).

Beneficiaries of low-cost formal housing are typically those families at the lower-socio-economic scale. This low socio-economic status, in combination with the formal, yet still deprived, housing environment, leads to their children repeating this cycle of low-socio-economic-status and deprived-living-environments. Mckenzie *et al.* (2011) reports that in adulthood, they are likely to smoke, live in the 'most deprived areas', not have any qualifications and earn a low-income, being either unemployed or looking for work. They may also report poor self-rated health and higher psychological distress (*ibid)* due to lower incomes which are directly associated with levels of education, i.e. the higher the level of education attained, the better the chances of being employed, having higher income, better housing and living in a better neighbourhood and having better working circumstances (Monden, 2010; Mckenzie *et al.*, 2011).

If the formal house is physically inadequate and presents problems, such as damp and mould, it is significantly related to poor self-rated health, i.e. the more housing problems, the poorer the self-rated health (Poortinga, *et al.*, 2008).

New formal housing seems to bring about a reduction in the levels of the community's 'social cohesion' and would result in increased 'social differentiation' (Smith, 2003) e.g. due to the smaller dwelling, not all members of the extended family can be accommodated in the new

house, and these often end up in back-yard shacks or the original, or different informal settlements. Relocating to formal housing often brings about certain changes in what constitutes 'acceptable behavior' (*ibid,* Yose, 1999 cited in Smit, 2003), e.g. the keeping, slaughter and sale of live stock, including heads and internal edible organs of those animals, which increased economic well-being-, and which was freely performed in the informal settlements, becomes somewhat unacceptable in the formal area after relocation. This loss in economic activity will further exacerbate household poverty, which results in low self-perceived well-being and health. Smit (2003) further reports that informal settlements are regarded as 'rural' and in contrast, formal, albeit low-cost settlements are regarded as 'urban' by beneficiaries. For this reasons households are naturally 'expected' to adopt 'urban' behavior.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 THE AIM OF THE STUDY

The aim of this study was to assess the combined effects of moving from an informal dwelling to a core low-cost formal housing unit and receiving basic services, on environmental health and household health.

3.2 THE STUDY OBJECTIVES

The objectives of the study were the following:

a) To describe the socio-demographic characteristics of people living in informal settlements prior to, and 2 years after, relocating to low-cost housing
b) To describe the environmental and health conditions of families residing in informal settlements
c) To describe the environmental and health conditions of families residing in low-cost formal housing
d) To establish the effect of receiving low-cost formal housing, free basic water- and electricity, sanitation and waste removal services on household health and environmental health

3.3 STUDY DESIGN:

An ecological study design was used. Ecological studies are appropriate and useful for studying the effects of interventions, or exposures, and outcomes on populations rather than on individuals (Rothman and Greenland, 1997; Sheppard, 2006). An ecological study design is also useful where information that has been established at individual level can be used at the group level to

assess its public health impact (Schoenbach, 1999). It is acknowledged that the most valid study design although also the most expensive and logistically difficult would have been a prospective cohort, as it would have allowed for individual household exposure changes and outcomes to be measured and confounders of the change in housing exposure could also be adjusted for. However, it was thought to be too difficult to follow-up individual families as a result of presumed rapid shifting relating to the fast pace at which relocation was likely to occur in this setting, and too expensive for a mini-thesis.

In this study data was collected at household level to understand what the impact is at the group level. However, since the level of analysis is actually the 'group' as opposed to the individual, an ecological study design was appropriate, as the aim is to actually assess effects of the housing change on the group, which Rothman and Greenland (1997) regards as an appropriate rationale for using ecological study designs. Anticipated follow-up tracking constraints was a further motivation for using the ecological study design. The aim of this study was not to make inferences at the individual level and it is conceded that individual exposures and outcomes may be different within the study population, however of greater interest was the effect on the group as a whole.

3.4 STUDY POPULATION:

The study population was all households residing in the Phumlani and Pelikan Park- Zeekoevlei Informal area in the year 2000, who were on the waiting list to receive low-cost core housing units in Phumlani Village and were due to be relocated there.

3.5 SAMPLE:

The intention was to include the entire population of the two Informal settlements, i.e. Phumlani- and Pelikan-Park-Zeekoevlei informal settlement, consisting of 124 households (SPM Housing Administration Section: 2000) in the study, both at "baseline" and 2 years later. The rate of completing construction of new low-cost housing, as well as the rapid rate of relocation (residents from Phumlani Informal settlement relocating first having lived in this informal settlement for the longest period) made it impossible to do a baseline assessment of the entire group. The entire population remaining in the informal settlement at the time of "baseline" data collection, consisted of 53 households of whom all were included in the study at "baseline".

All 124 households were included in the sample during the data collection of the 2 years post-relocation survey.

3.6 MEASUREMENT INSTRUMENT:

Data was collected at household level. The measuring instrument used was a questionnaire administered via a structured, face-to-face interview . Respondents included any person over the age of 16 years. Only one person per household was interviewed. Data was collected in the form of open- and closed ended questions.

The following presents a brief overview of the questionnaire content:

Socio-demographic data, relating to household background was collected. This included collecting data on previous dwelling type and area of stay, number of household members,

age/gender profile of household, size of dwelling and number of family members employed in formal and/or informal employment.

Household crowding levels were determined by taking into account number of household members, and size of the dwelling. The age of persons in the dwelling was not taken into account when determining crowding levels, rather, total numbers of persons in relation to space used for sleeping purposes was used. The space was calculated by pacing out the dwelling, i.e. one pace = 1 meter, and the formula used for determining total space for sleeping was length x width. The cut-off for determining crowding levels was thus as advised by Batson (Batson,1943, cited in Thomas, *et al.*, 2001) whereby less than $2.5m^2$ of sleeping space was regarded as inadequate.

Data used to determine exposure to air pollution depended on the energy sources used for heating and cooking, i.e. fuel sources other than electricity and/or gas were regarded as polluting sources. The location of fuel burning, i.e. whether used indoors or outdoors was also taken into account as this influenced exposure.

Adequacy of water was based on water usage over a monthly period and the cut-off was access to a minimum of 3000L per/household per month. At "baseline" this was determined by taking into account the size of the water collection vessel and the number of times the household collected water per day. For the formal households, uninterrupted access of 6,000L was available to all households per month.

Access to adequate sanitation was defined as access to water-borne flush toilets.

Levels of household waste management was determined by collecting data on the location where households stored their refuse, e.g. either indoors or outdoors and whether refuse was stored in open or closed containers. Data was also collected on household satisfaction with frequency of refuse removal.

Pest prevalence was established by collecting data on the types of pests present per household, indoors and outdoors.

General environmental conditions were observed and recorded by the interviewer.

Data on household and personal health was only collected at 2 years post-relocation amongst the formal low-cost dwelling households. The respondent provided data on his/her current health status based on a 'Lickert'-type scale, rated excellent, good, average or poor. Respondents were also asked to rate whether they experienced a change in their own health status, and in that of the household as a whole, since relocating to the formal housing.

3.7 DATA COLLECTION/LOGISTICS:

Data was collected for the household rather than on individuals. A reliable respondent, for purposes of this study, was defined as a person over the age of 16 years who was at home at the time of the interview. Where no reliable respondent was present during the initial visit to a house, a return visit was made. After the two visits, if no respondent was present the household was regarded as a non-response.

3.8 PILOT STUDY:

A pilot study was conducted using the "baseline" questionnaire with trained fieldworkers, who were also meant to collect data in the main study, in the Phumlani Informal settlement. Interviews were conducted with 15 households who had relocated, in order to refine and modify the questionnaire.

In order to investigate the wording and clarity of the questionnaire translated from English into Xhosa and Afrikaans, it was administered to Xhosa and Afrikaans speaking level 4 Environmental Health students in order to establish whether, after translation, the same question is being asked.

3.9 ANALYSES:

Data was analysed by using the Statistical Package for the Social Sciences, version 17 (SPSS 17) and the data is described in graphical and tabular form. For categorical variables, associations were assessed by the use of 2x2 tables and the chi-square test was used to assess differences between the two groups. Significance levels were set with p-values, i.e. $p<0.05$, and 95% confidence intervals. For continuous variables, such as crowding levels and usage of water, the means and standard deviations (SD) were provided.

Additional descriptive data was interpreted in order to obtain a clear picture of the study population.

3.10 VALIDITY

The validity of results may have been affected by factors, which did not form part of the study and which were not measured, but which could have affected the household-, personal- and/or

environmental health other than relocating to a low-cost dwelling. This includes, amongst others the following:

a) Confounding measures: extraneous risk factors such as occupation and income status, i.e. the type of work and an increase, or decrease, in income; pre-existing disease (acute or chronic) and disease risk, meaning whether certain individuals or households had a pre-existing disease condition, or were unwell due to an exposure/s which was not measured for; seasonal influencing factors such as the influence of warm weather on the prevalence rates of diarrhoea.

b) Selection bias: this was due to selecting only a proportion of the group at "baseline" as the whole group could not be captured whilst in the informal settlement, but it would only have impacted on the results if the group who moved first and hence missed "baseline" assessment, was systematically different to the group who relocated, and hence constituted the "baseline" sample;

c) Measurement bias: this could have impacted in that respondents may have provided answers which they assume the interviewers wanted to hear and this may thus have impacted on the results of the study; however, fieldworkers were trained to use similar probes where respondents were reluctant or unsure of questions asked

d) Data Collection bias: errors possible due to chance is minimized as virtually the entire study population was assessed at "2 years relocated" , but a much smaller sample was used for the "baseline" assessment, therefore it's precision would have been lower

3.11 ETHICAL CONSIDERATIONS:

Permission to conduct the fieldwork and gain entry to the study area was jointly obtained by the then South Peninsula Administration Environmental Health and Housing Division. The Phumlani Village Health Committee arranged for entry into the community via its then chairperson. The Environmental Health Practitioner at the time of conducting the fieldwork, arranged meetings between fieldworkers and the relevant Health Committee members to facilitate community entry. The community was informed about the data collection by the health committee.

Reliable respondents were briefed, verbally, about the contents of the questionnaire, and oral permission had to be obtained prior to administering each questionnaire. Participants in the study were also assured of confidentiality, and no names of respondents were recorded. Respondents had the right to refuse to be interviewed and could refuse to answer any question they felt uncomfortable with. They could also withdraw from the interview at any stage without providing a reason.

CHAPTER 4: RESULTS and FINDINGS

4.1 INTRODUCTION

In this chapter the results and findings of the study is presented under the following headings:

a) **Response Rate**: This section provides information regarding the numbers of households in the sample and the proportions of responses obtained.

b) **Socio-Demographic Characteristics**: These sections describe characteristics of the two communities at "baseline" and at "2 years relocated" pertaining to the following:

   i. Gender age Composition per area: Here a description of the gender by age distribution is provided for both communities

   ii. Respondent Background: In this section a description of the respondent/household background, regarding where they came from prior to settling in either of the two areas, and the type of housing accommodation they resided in before settling in this area, is presented

   iii. Household Head: A description of the dominant head of the household, per area respectively, is presented

   iv. Household Size: In this section a comparison on the average numbers of persons occupying the dwelling per area for individual households are presented.

   v. Employment Status: This section provides a description of the number of persons in formal employment, for both "baseline" and "2 years relocated". It also describes numbers of households with no person employed at all in the two areas.

c) **Environmental and Household Health Conditions**: This section presents comparisons and descriptions of environmental health conditions between the two areas. It also provides descriptive information regarding the prevailing environmental health problems as identified by both respondents and interviewers. This is presented under the following headings:

i. Interviewer Observations: This section provides a description of the prevailing environmental health conditions as observed by the interviewer.

ii. Household Crowding: this section describes overcrowding per area as well as number of persons per household. It furthermore presents the average space allocated for sleeping purposes in the two areas, and describes extension status in the area at "2 years relocated".

iii. Household Water Usage: In this section water collection points, water collection practices, water storage practices and water (grey) disposal practices in the "baseline" area is described. It also presents comparisons between the amounts of water used between the two areas.

iv. Household Indoor Air Pollution: This section describes the fuel types used for cooking and heating purposes within the two areas. This section also provides comparisons in terms of exposure to indoor air pollution, due to cooking and/or heating, within the two areas respectively.

v. Sanitation: This section describes the types of toilet facilities used in the two areas and provides a comparison of exposure to inadequate toilet facilities between the two areas.

vi. Household Solid Waste Management: This section describes refuse storage practices as it occurs in the two areas. It furthermore provides a comparison between exposures to inadequate refuse storage between the two areas. It also describes refuse collection frequency and compares exposure to inadequate refuse collection frequency between the two areas.

vii. Household Pest Control: In this section the types of pests identified by respondents and the reasons for experiencing the pest problems, as related by respondents, are described.

viii. Household Health: This section describes the changes experienced in the health of the respondent, i.e. personal health, and that of the household "2 years relocated" .

4.2 RESPONSE RATE:

The following table provides a breakdown of the study population and response rate:

TABLE 1: RESPONSE RATE AT "BASELINE" AND "2 YEARS RELOCATED"

Area	*Total number of Households*	*Total number of Households in sample*	*Response rate and % responses*
"baseline"	124	53	53(100%)
"2 years relocated"	124	124	100(81%)

The number of households that were ultimately included in the study sample consisted of 53 households at "baseline" and 100 households "2 years relocated".

Due to the rapid rate of relocation from the informal settlement to low-cost housing, not all households, i.e. 124 households, could be captured at "baseline" as some of them had already

relocated by the time that data collection commenced. This may have impacted on the representivity of the sample at "baseline" if those who relocated earlier are systematically different from those who relocated later. 53 Households had not relocated by the time data collection had commenced thus all of these 53 households were included in the sample at "baseline".

The intention was to include all households (N=124) in the study at "2 years relocated" , but a 100% response rate could not be achieved as daytime, weekday attempts to reach 20 of the households proved unsuccessful and 4 houses were empty having been abandoned.

4.3 SOCIO-DEMOGRAPHIC CHARACTERISTICS

4.3.1 Gender-Age Composition per Area

The breakdown per age grouping for the different areas reflected that in both areas most households were occupied by persons older than 16 years, i.e. 70% at "baseline" and 77% at "2 years relocated".

The following table illustrates the gender by age composition of the two areas:

TABLE 2: GENDER/AGE DISTRIBUTION AT "BASELINE" and "2YRS RELOCATED"

Age	*Gender*	*"Baseline"*	*"2 Years Relocated"*
<16Yrs	**Male**	32 *(14.7%)*	45 (*12.1%)*
	Female	34*(15.7%)*	42*(11.3%)*
>16 Yrs	**Male**	81 *(37.3%)*	133*(35.7%)*
	Female	70 *(32.3%)*	153*(41%)*
Total		**217(100%)**	**373(100%)**

4.3.2 Respondent Background

At "baseline" the majority of respondents (79%), were more likely to be from elsewhere in Cape Town, before settling in the informal settlement. This was the scenario for 50% of respondents at "2 years relocated" (prevalence ratio (PR) = 1.577, 95% CI = 1.230-2.021). The likelihood of having resided in informal housing prior to relocating to the formal housing in either group, i.e. "baseline" and "2 years relocated", were the same (PR = 0.920 , 95% CI= 0.723-1.169). Thus, 67% of residents at "baseline", and 73% of residents at "2 years relocated" have lived in informal housing prior to moving to the formal housing respectively.

4.3.3 Household Headship

Males dominated as household heads both at "baseline" (81%) and at "2 years relocated" (73%), (PR= 1.103, 95% CI= 0.922-1.320).

4.3.4 Household Size

The average number of persons per household was 4.3 (median = 4.00) at "baseline" and 3.7 (median = 4.00) at "2 years relocated".

4.3.5 Household Employment Status

The proportion of households with at least one adult in formal employment was 58% at "baseline" and 55% at 2years after relocated, (PR=1.058, 95% CI=0.788-1.149). The proportion of households with no person in either formal or informal employment was 2% at "baseline" and 16% at "2 years relocated", with a PR= 0.120 (95% CI=0.016-0.881). Unemployment of males was significantly higher at "baseline" that at "2 years relocated" with a PR=0.173 (95%CI=0.56 – 0.536), and for females this remained more or less the same (PR=1.120, 95%CI=0.829 – 1.513)

4.4 ENVIRONMENTAL HEALTH CONDITIONS:

4.4.1 Interviewer Observations Relating to Environmental Health Conditions

Observations recorded by the interviewer were in regards to outdoor environmental health conditions in both areas. These observations pertain to the general environmental health conditions as observed during the time of conducting the interviews and are shown in table 3. Evidence of indiscriminate littering and dumping of refuse around the houses was twice as likely at "baseline" (60%) than at "2 years relocated" (PR=2.082, 95%CI=1.429-3.033).
Interviewers were not expected to record observations regarding the indoor household environment at "baseline", but they reported a damp, dark and mouldy indoor environment for 12% of households as well as dusty conditions for 6% of households at "2 years relocated".

Interviewers were invited inside the homes at "2 years relocated" and were thus able to make this observation. This was not the case at "baseline".

TABLE 3: GENERAL ENVIRONMENTAL HEALTH CONDITIONS AT "BASELINE" AND "2YRS RELOCATED"

Description*	"Baseline" n=53		"2 Yrs Relocated" n=100		Prevalence ratio (PR)	95% CI
	Number of Households	% of total	No. Of Households	% of total		
Evidence of indiscriminate littering *and* refuse dumps around dwelling and general environment	32	60%	29	29%	2.082	1.429-3.033
Poor pest control evident by presence of flies	18	34%	9	9%	3.774	1.823-7.811
Stagnant pools of waste water	4	7.5%	2	2%	3.774	.714-19.934
Bad odours due to inadequate toilet facility *and*/or improper waste	4	7.5%	10	10%	.755	.294-2.292
Dust	____	____	6	6%	____	____
Dark, damp, mouldy indoor environment	____	____	12	12%	____	____
Unacceptable environmental health conditions, i.e. one or more of the adverse conditions afore-mentioned observed	38	72%	50	50%	1.434	1.107-10858

*Interviewer may have identified more than one condition

4.4.2 Household Crowding

4.4.2.1 Overcrowding at "Baseline" and "2 Years Relocated"

Households at "baseline" were twice as likely to be overcrowded, (PR= 1.959, 95% CI = 1.153-3.328) than households at "2 years relocated". Thus, 53% of households at "baseline" and 27% of households at "2 years relocated" were overcrowded.

4.4.2.2 Number of Persons per Household

For the majority of households the number of occupants ranged between 2 and 4 people. This was the case for 64% of households at "baseline" and for 74% of households at "2 years relocated". The range of household occupancy is illustrated in the following histograms:

FIGURE 1: AVERAGE NUMBER OF PERSONS PER HOUSEHOLD AT "BASELINE"

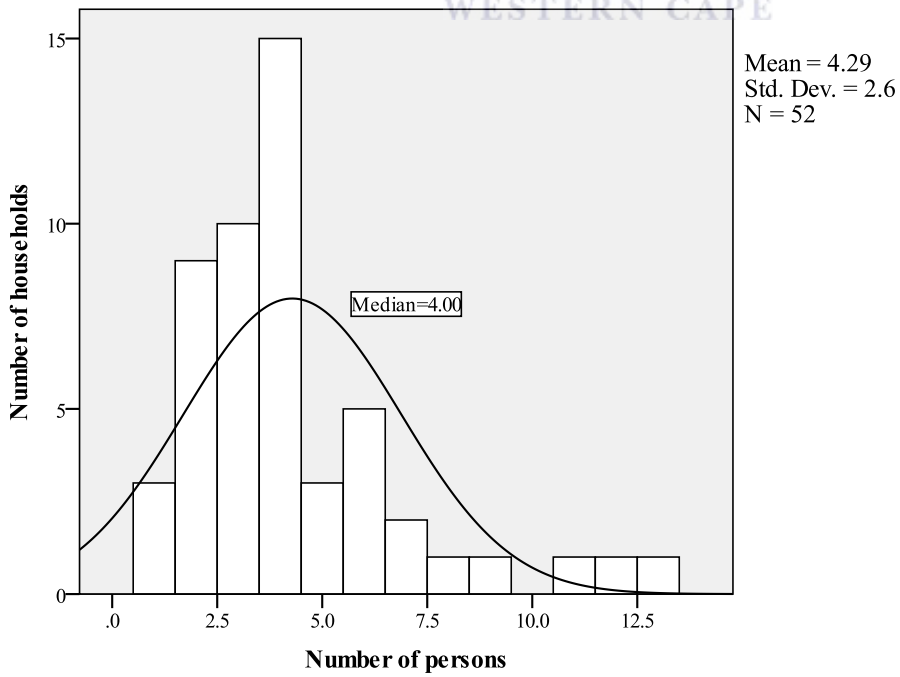
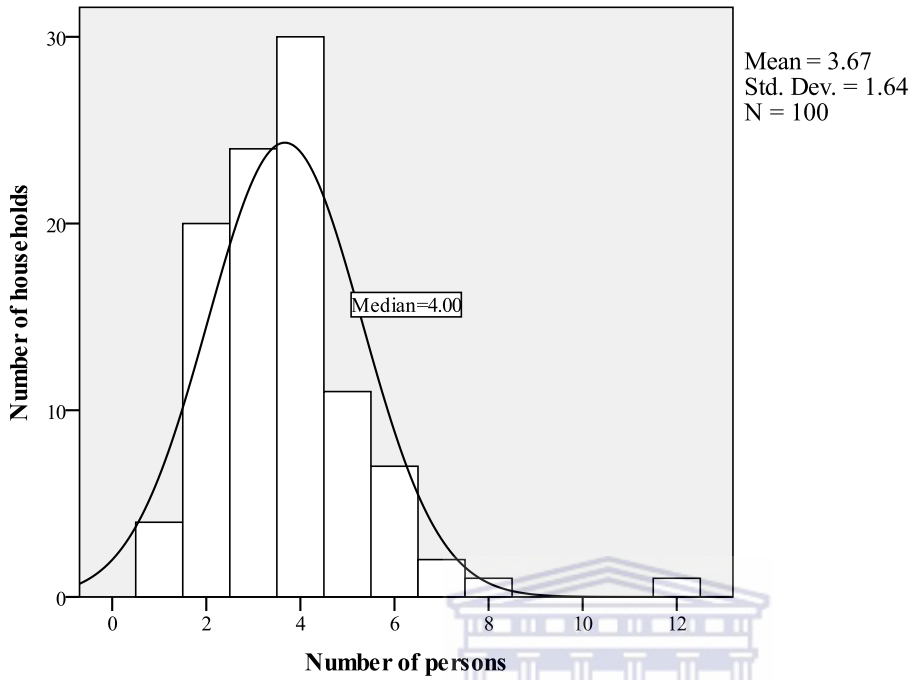


FIGURE 2: AVERAGE NUMBER OF PERSONS PER HOUSEHOLD AT "2 YEARS RELOCATED"



4.4.2.3 Space Used for Sleeping per Household

Space used for sleeping purposes varied with the number of household members in both "baseline" and at "2 years relocated" , the latter using more space for sleeping purposes. At "baseline" the average sleeping space was 2.93m^2, (SD ±1.203). At "2 years relocated" this was 3.56m^2, (SD ±.756).

4.4.2.4 Extension to the Formal Low-Cost House

At "baseline", houses could be extended to any size- as available space would allow- accommodating household belongings or extended family and household members. At "2 years relocated" extensions would only be allowed if it followed pre-approved building plans and used building materials as approved by the local municipality. Any extension contrary to these

specifications would be demolished on the instruction of the building inspector - either by the local municipality or the owner. Table 4 shows the status of the formal dwellings with regards to extensions.

TABLE 4: STATUS OF THE HOUSE AT "2 YEARS RELOCATED"

Extension Status	*Number of Households*	*N*	*%*
Houses extended	38	100	38
Extensions demolished	14	38	37
Extension used as sleeping space	18	38	47
Intend to extend or extend further	27	100	27
Intend to use future extension as sleeping space	16	27	59

4.4.3 Household Water Usage

4.4.3.1 Water Collection Point

A communal standpipe was provided for the community at "baseline" while water was piped into houses for those at "2 years relocated".

At "baseline" the water sources used varied with 74% of households using the communal standpipe in the informal settlement as a source of water, 13% obtained their water from friends or relatives who had relocated to the low-cost housing, 7,5% from the lake which was situated at a greater distance from the settlement.

4.4.3.2 Water Collection and Storage Practices

Since those assessed at "baseline" did not have piped water connected to their houses they had to regularly collect water and store it. On average, water was collected twice per day, with a mean collection frequency of 2,63 and SD±1.048 for households at "baseline". Water was stored indoors in closed containers (62%), open containers (31%) and the rest did not store water, but rather collected and used as was required.

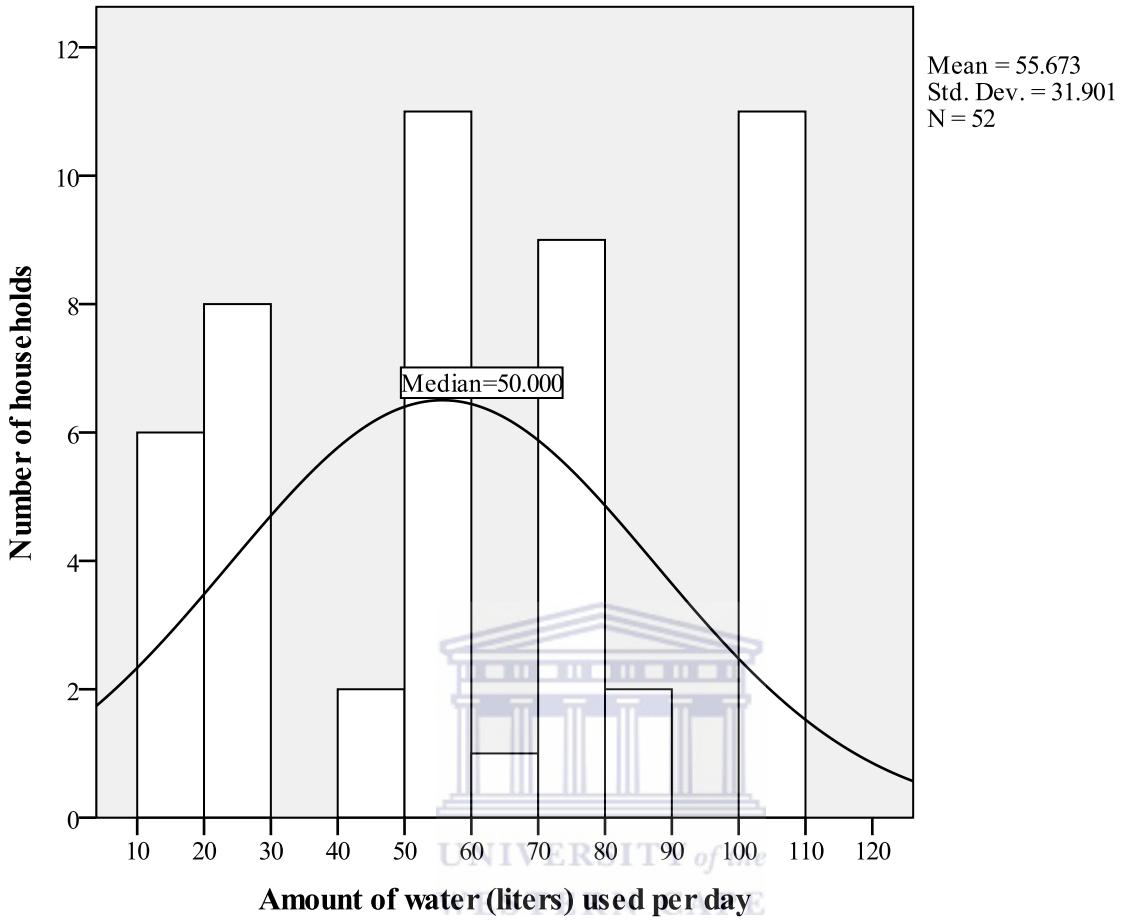
4.4.3.3 Amount of Water Used

i) Quantity of Water Used per Day

At "baseline" communities could relate how much water they used ***per day***. The amount of water used per month was determined by taking into account the size of the collection container and the number of times water was collected per day. On average, households used 55,7L (SD±31.901) of water per day.

The following diagram depicts the amounts of water used **per day** at "baseline":

FIGURE 3: AVERAGE QUANTITY OF WATER USED PER DAY AT "BASELINE"



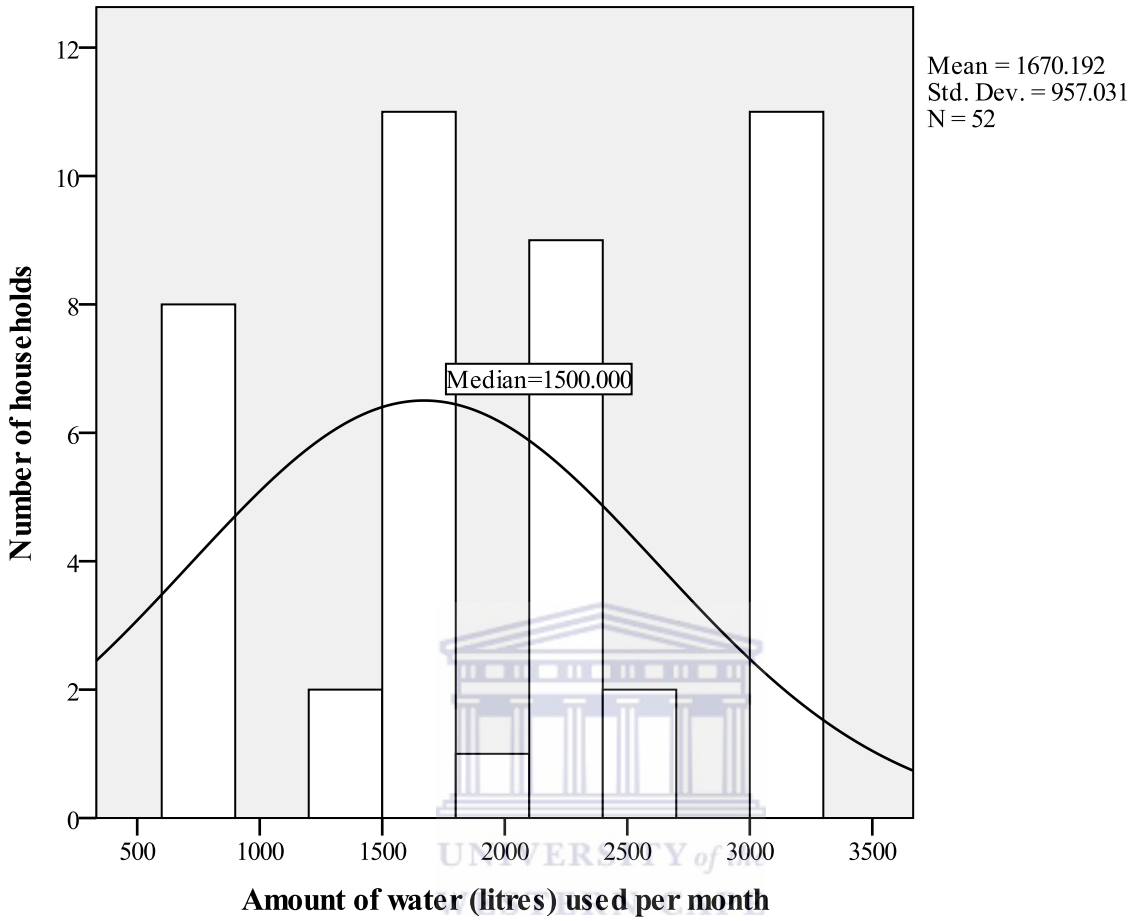
ii) Quantity of Water Used per Month

At “baseline” an average of 1 670L (median = 1500, SD ±957.031) per month of water was used.

Most households (79%) use <3,000L of water per month.

The following graph illustrates the quantities of water used by households **per month**:

FIGURE 4: AVERAGE QUANTITY OF WATER USED PER MONTH AT "BASELINE"



Quantities of water used at "2 years relocated" were not measured as communities had access to in-house taps and therefore did not monitor amounts of water used per day.

All households at "2 years relocated " are assumed to have used ≥3,000L of water per month. As all had access to the 6,000L supply of free basic water per household, it was reasonable to assume that all had used at least 3000L of water per month, although most would have used much more than that. Furthermore, at "2 years relocated" none of the households were paying for water as they had not received any water accounts, nor had any water cut-offs occurred, at this time. A total of 7% of households' water supply had been transferred to the 'dripped supply

system'. It is assumed that these households may have exceeded the free basic water supply amount of 6,000L per month by a large margin.

The following tables compare the amounts of water used at "baseline" and at "2 years relocated":

TABLE 5: COMPARISON OF WATER USAGE AT "BASELINE" AND "2 YEARS RELOCATED":

Area	*No. of Households (N)*	***Water Usage Per Month:***		*Total*
		< 3000L	≥3000L	
"Baseline"	52	21.2%	78.8%	100%
"2Years Relocated"	100	0%	100%	100%

Households at "baseline" were less likely to have access to ≥3000L of water per month (PR=0.212, 95% CI=0.125-0.358), than households at "2 years relocated".

4.4.3.4 Waste Water Disposal Practices

Most households at "baseline" disposed of their waste water by simply discarding it in their outside yard area (85%).

The following table depicts the disposal practices of waste water at "baseline":

TABLE 6: WATER DISPOSAL PRACTICES AT "BASELINE":

*Disposal Practice**	*n=52*	*%*
Throw in own yard (no garden)	44	**85**
Throw in bushes(not on property)	7	**13.5**
Re-use in garden	1	**2**

At "2 years relocated" waste water is simply piped away via the sewer mains.

4.4.4 Household Indoor Air Pollution:

4.4.4.1 Fuel Types Used at "Baseline" and "2 Years Relocated:

The main fuel type used for cooking and heating at "baseline" was wood as opposed to electricity at "2 years relocated".

Table 7 depicts the types of fuel used for heating and cooking purposes in the two areas respectively:

TABLE 7: FUEL TYPES USED AT "BASELINE" AND "2YRS RELOCATED"

*Fuel Type**	*"Baseline"*				*2Years Relocated*			
	Cooking(n=51)		**Heating(n=50)**		**Cooking(n=100)**		**Heating(n=64)**	
	No. of H/holds	**%**	**No of H/holds**	**%**	**No. of H/holds**	**%**	**No of H/holds**	**%**
Wood	22	43	39	78	2	2	16	25
Paraffin	19	37	8	16	18	18	5	8
Gas	16	31	1	2	2	2	1	2
Electricity	------	------	------	------	82	82	33	52
None	------	------	6	12	------	------	10	16

* *Respondent may have used more than one option*

4.4.4.2 Indoor Air Pollution due to Cooking and Heating:

The use of gas and/or electricity as a fuel source for household cooking and heating is considered as non-air pollution fuels. All other fuels used for this purpose is considered as fuels causing indoor air pollution.

Sixty four percent of households at "baseline" cook their main meal indoors, while this is the case for 100% of households at "2 years relocated".

The proportion of households exposed to indoor air pollution due to cooking is 6 times more likely (PR=6.239, 95%CI=3.467-11.228) at "baseline" (69%) than at "2 years relocated" (11%). Proportion exposed to indoor air pollution due to heating is 2.5 times more likely (PR=2.514, 95%CI=1.795–3.523) at "baseline" (98% of households exposed) compared to "2 years relocated" (39% of households exposed). Thirty two percent of households at "baseline" intended to use gas and/or electricity as a heating fuel once they have relocated to the low-cost housing.

Exposure to indoor air pollution due to both cooking and heating is 2 times more likely (PR=2.185, 95% CI=1.655–2.885) at "baseline" than at "2 years relocated".

4.4.5 Household Sanitation

4.4.5.1 Types of Toilet Facilities:

At "baseline" the toilet facility provided by the local municipality was one communal bucket toilet for the entire community. In terms of this study the 'bucket toilet system' or no toilet is regarded as inadequate. However, respondents indicated that residents are using alternative types

of toilet facilities, for example, some had their own private household bucket. These are listed in the following table:

TABLE 8: ALTERNATIVE TOILET FACILITIES USED DUE TO INADEQUATE TOILET FACILITIES AT "BASELINE"

*Alternative**	*No of households (n=51)*	*%*
Bush	**19**	**37.3**
Neighbour's in-house toilet (recently relocated)	**7**	**13.7**
Bucket (in own dwelling or own yard)	**12**	**23.5**
Not disclosed	**15**	**29**

*** respondent may have used more than one option**

Respondents related the following reasons for using alternative toilet facilities:

TABLE 9: REASONS FOR NOT USING THE SINGLE, COMMUNAL, BUCKET TOILET AS IDENTIFIED BY RESPONDENTS AT "BASELINE":

*Reasons for not using communal toilet**	*No. of respondents (n=53)*	*%*
Facility is not well maintained (always blocked, full or dirty)	18	34
Facility is not sufficient in number	16	30
No communal toilet is provided	10	19
Unsafe due to distance from dwelling to toilet too far	8	15
Not answered	15	28

*** respondent may have provided more than one reason**

All households at "2 years relocated" were provided with in-house, water-borne/flush type toilets. Households make use of these as their only toilet facility.

4.4.5.2 Access to Adequate Toilet Facilities:

At “baseline” 100% of households are exposed to inadequate toilet facilities.

4.4.6 Household Solid Waste/Refuse Management

4.4.6.1 Household Refuse Storage

Waste storage practices at “baseline” consist of a combination of storing household refuse in opened and/or closed containers indoors or outdoors. For the purpose of this study, inadequate refuse storage is defined as waste stored in an open container, indoors or outdoors. At “baseline” inadequate refuse storage was 90%.

Households at “baseline” were 7.381 times ($p<0.05$, 95% CI=4.131-12.633) more likely to be exposed to inadequate refuse storage, than households at “2 years relocated”. Ninety percent of households at “baseline”, compared to 12% of those at “2 years relocated” store their household waste inadequately.

At “2 years relocated”, all households were supplied with a 240L “Otto-Bin” with closable lid, upon occupation of the low-cost house. All residents were still using these bins 2 years later. The bins were used for storage of household refuse outside (76%) and inappropriately inside (22%) the dwelling, the latter fearing the bin would be stolen.

4.4.6.2 Household Refuse Collection Frequency

Both areas had formal collection of refuse once per week, but at "baseline" the households used small refuse receptacles as they were not supplied with Otto-Bins. Households at "2 years relocated" were generally happier with the refuse collection frequency as they could store their refuse in a closed receptacle, namely the Otto-Bins.

Inadequate frequency of refuse collection was 4.412 times higher at "baseline" that at "2 years relocated" ($p<0.05$, 95% CI = 2.060-9.448). At "2 years relocated" refuse was collected once per week which was adequate for the majority of households (92%). Thirty five percent of respondents at "baseline" felt that refuse collection frequency was inadequate.

A few respondents at "baseline" (2%) were uncertain regarding number of times refuse is collected from the area per week. However, they (35%) felt that refuse collection once per week is inadequate as storing it for this period of time would attract pests, such as stray cats, dogs and rodents. For this reason 7.6% of respondents related that they simply dump their refuse in the nearby bushes, incinerate it, or store it indoors once their collection containers become full.

4.4.7 Household Pest Presence and Pest Control

4.4.7.1 Types of Pests Present

Pest problems were experienced at "baseline" (81%) as well as at "2 years relocated" (74%). Rodents posed the biggest pest problem for 46% of households at "baseline". At "2 years relocated", the major pest problems experienced were that of crawling insects (54%) - which

included ants, cockroaches *and* fleas- and flying insects (69%)- including flies, gnats *and* mosquitoes.

The following table summarises the pest problems as experienced by households:

TABLE 10: PEST TYPES IDENTIFIED AS PROBLEMS BY RESPONDENTS AT "BASELINE" AND "2YRS RELOCATED"

Types of pest	***"baseline"***		***2 Yrs Relocated***	
	No. Of Households (n=52)	**% of total**	**No. Of Households (n=100)**	**% of total**
Crawling (ants, cockroaches)	18	34.6	54	54
Flying(gnats, flies, mosquitoes)	32	61.5	69	69
Rodents (rats and mice)	24	24	40	40

Households at "baseline" were as likely as households at "2 years relocated" to experience pest problems. There is no significant difference in the prevalence of pest between the two areas (PR=1.091, 95% CI=0.915-1.302).

4.4.7.2 Reasons for Pest Problems

Respondents were asked to identify reasons why they thought they were experiencing pest problems.

The reasons provided differed between the two areas and is illustrated in the following tables respectively:

TABLE 11: REASONS FOR PEST PROBLEMS AS IDENTIFIED BY RESPONDENTS AT "BASELINE":

*Reason for Pest Problem**	*No. of Respondents (n=40)*	*%*
Unclean surrounding environment *and* uncontrolled dumping	15	37.5
Natural Vegetation in surrounding environment attracts pests	9	22.5
Inadequate refuse collection and lack of storage space	8	20
Inadequate toilet facility	6	15
Nearby composting plant	5	12.5
Stagnant grey water	4	10
Stray pets(cats and dogs) attract pests	4	10
Food in house attracts pests	3	7.5

* Respondent may have used more than one option

Most respondents attributed the existence of the pest problems to an unclean surrounding environment (38%) and the natural vegetation (23%) which acts as harbourage to the pests.

TABLE 12: REASONS FOR PEST PROBLEMS AS IDENTIFIED BY RESPONDENTS AT "2 years relocated" *:*

*Reason for Pest Problem**	*No. of Respondents (n=60)*	*%*
Unclean surrounding environment	21	60
Inadequate refuse collection and lack of storage space	12	20
Related to summer season	10	16.7
Unclean homes	10	16.7
Natural Vegetation in surrounding environment	5	8.3
Stagnant grey water	4	6.7
Stray pets(cats and dogs)	4	6.7
Food in house attracts	2	3.3
Nearby composting plant	1	1.7
Nearby Sewerage Purification Plant	1	1.7
Construction of the house (poor ventilation)	1	1.7
Houses too densely spaced	1	1.7
Back-yard shacks	1	1.7

* Respondent may have used more than one option

The majority of respondents (60%) at "2 years relocated" felt that the unclean surrounding environment was the biggest cause of the pest problems they are experiencing. In addition, 20% of respondents also felt that the poor management of households waste, coupled with dumping also attracted pests.

4.5 GENERAL SELF-REPORTED HEALTH CONDITIONS

4.5.1 Health of Children ≤6 Years Old

Questions relating to diarrhoea incidence were based on a 2 week recall period. Children under 6 years at "baseline" were about 6 times more likely than those at "2 years relocated" to experience diarrhoea (PR=5.588, 95% CI = 1.284-24.315). No significant difference was found in the prevalence of respiratory infections (PR=1.277, 95% CI=.498-3.274), skin infections (PR=3.288, 95% CI=.353-30.636) or eye infections (PR=.941, 95% CI=.879-1.008) between the two areas.

4.5.2 Self-Reported Respondent and Household Health

Questions relating to general household health were only posed at 2 Yrs Relocated. Respondents were asked questions about ***changes*** in their own, and current household, health status. This is depicted in the following table:

TABLE 13: HEALTH STATUS OF RESPONDENT AND HOUSEHOLDS AT "2YRS RELOCATED"

RATING	*Change experienced in respondent's health since relocating* *(n= 100)* *%*	*Change experienced in household health since relocating* *(n=100)* *%*
Better	76	77
Worse	14	13
No Change	10	10
TOTAL	100	100

Respondents felt that their own health (75%) and that of the household members (77%) was better since relocating.

Respondents were also asked to rate their ***current*** health status, at the time of being interviewed. Their responses are depicted in the following table:

TABLE 14: CURRENT HEALTH STATUS OF RESPONDENT AT "2YRS RELOCATED"

RATING	Respondent's health status (n= 100) %
Excellent	14
Good	49
Average	26
Poor	11
TOTAL	100%

Most respondents (63%) indicated that their health was either excellent or good.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION:

This study sought to determine the effect of relocating from informal housing to formal low-cost housing on households' health and environmental and health living conditions in Phumlani Village. The main findings suggest that environmental health conditions improved post-relocation. At household level, residents related an improvement in: environmental health conditions; conditions relating to general household health and individual/personal health.

5.2 IMPLICATIONS OF SOCIO-DEMOGRAPHIC CHARACTERISTICS:

At "baseline" most households had previously (meaning before settling in the "baseline" area) lived in other parts of Cape Town. Reasons for this could be that families had been evicted from elsewhere, either by landlords, or from unlawful occupation of land, or that they have settled in this area because the risk of being evicted is reduced (Manuel, L., Interview, 24 May 2000). This, together with the fact that respondents resided in informal housing before settling in the area at "baseline", could mean that families move from one informal settlement to the next in the absence of security of tenure of formal housing (Mgutyana, P., Interview, 30 May 2000). It further suggests that the establishment of informal settlements will be perpetuated if formal affordable housing is not provided/available (Huchzermeyer *et al.*, 2006). In addition, the desperation for owning formal housing and the fact that the housing waiting list is an ever-growing phenomenon, forces people to settle in informal housing settlements to escape 'overcrowded and unaffordable' accommodation (Smit, 2003). Quite often this accommodation takes the form of a shack in an informal settlement or a shack in the backyard of formal housing.

Living conditions in both backyard- and informal settlement shack have been well documented to affect health and the environment adversely.

The numbers of households with no persons employed at all i.e. in either formal or informal employment, is relatively higher at "2 years relocated" than at "baseline", especially with regards to *no males* employed in the household. This could translate into an inability to support the basic needs of the household such as food and clothing, as well as an inability to maintain the home and essential services of water, sanitation and electricity (Pareira *et al.*, 2011), all of which would adversely affect household health. This is a concern as employment levels of males have significantly decreased post relocation leaving a section of the community worse off, as female levels of employment also remained unchanged. The implications of having to pay for services have not been felt yet, as those relocated had not yet been charged, or received a bill for payment of services, therefore they live in better environmental health conditions. A concern is that the benefits of these services may not be sustained once services are charged for by the municipality, due to an inability to pay.

Security of tenure brings with it a certain degree of self-assurance, as the risk of eviction and having to seek other accommodation, where payment might be required, is reduced. This may affect the need for employment. This follows the findings by Govender *et al.* (2010) whereby backyard shack dwellers have higher levels of employment than those in low-cost permanent houses as they had to pay rental fees or face eviction if they cannot, whereas, conversely, those in the low-cost housing might become dependent on rental fees as a source of income as opposed to having employment (Lemanksi, 2011). Having the owner of the main formal dwelling being

unemployed may however result in an inability to pay for services such as water, electricity and general maintenance and upkeep of the dwelling. If services cannot be afforded, these will be suspended and the family will find themselves in the situation whereby they end up having inadequate water and sanitation and all its associated ill effects (Govender *et al.*, 2010; Lemanski, 2006). This, in turn, may lead to deterioration in personal, household and domestic hygiene, and a resulting increase in diseases related to above, such as diarrhoea (Govender *et al.*, 2010; Goebel *et al.*, 2010). Social implications might be that the household becomes dependant on neighbours for water, placing a burden on households in their surrounding environment, which may lead to conflicts and possibly violence. On the other hand, being of a similar socio-economic background, the neighbours may serve as valuable 'social capital' (de Castro *et al.*, 2008) as they are now able to temporarily support households finding themselves in this predicament, on the assumption that they in turn would be supported should the need arise.

5.3 CROWDING LEVELS:

Crowding levels within homes are significantly lower post-relocation. This is due to larger living space i.e. the low-cost dwelling is larger than most of the houses in the informal settlement at "baseline". In terms of household health, it will decrease the spread of communicable diseases, since living in crowded conditions increases the transmission of, amongst others, respiratory illness and tuberculosis (Krieger *et al.*, 2010). Larger living space impacts positively on childhood health in that the contraction of infectious diseases, and numbers of household injuries and accidents, decreases (Sharfstein *et al.*, 2001; Evans and English, 2002; Leventhal, 2010). Additional improvements in health are a reduction in childhood asthma (Dixon *et al.*, 2009) and improvements in housing provide protection

against non-asthma respiratory conditions in children and adults (Barton *et al.*, 2007). Increased space impacts positively on children's progress in schools as study space may now be available (Bullen *et al.*, 2008; Lien *et al.*, 2008; Goux and Maurin, 2005) which may impact on economic attainment/self-sufficiency in the long run (Leventhal and Newman, 2010). However, this particular positive effect will not be experienced, if the additional space does not result in 'private space' for the child (Lien *et al.*, 2008).

Occupancy levels are lower post-relocation due to the decrease in numbers of persons occupying the dwelling. The reasons for this lower occupancy levels are unclear but it could be because extended families, who had previously lived with families in the informal dwelling obtained their own low-cost house elsewhere or they may have moved to an informal settlement elsewhere.

Lower occupancy levels coupled with increase in dwelling size is associated with self-reported improved indoor comfort and an improvement in house-keeping and domestic hygiene, since residents feel that it is easier to keep the home clean if it is not densely crowded with people and belongings (Bullen *et al.*, 2008, Molnar, 2010). Personal hygiene may also be improved due to the addition of closable ablution facilities where private and personal cleansing can take place (Lauster and Tester 2010; Molnar 2010). Psycho-social benefits and well being is also documented as social networks within neighbourhoods are improved (Egan *et al.*, 2010) due to inhabitants feeling more free to invite people to their homes as it has more space, is not overcrowded and is more clean than before (Wells and Harris, 2007; Oseland and Raw, 1991). Butala *et al.* (2010) also relates improvements in

mental health conditions as being closely associated with improvements in living conditions. Crowding is regarded as the 'most potent' aspect of housing affecting mental health (Wells *et al.*, 2007). Decreases in crowding levels in the home impacts on violence in the home and in the general neighbourhood, and can thus foster better harmony at domestic and at neighbourhood level (Egan *et al.*, 2010; Wallace and Wallace, 1998; Barton *et al.*, 2007; Wells *et al.*, 2007). Although difficult to predict, this may possibly impact positively on reductions of crime within the neighbourhood.

5.4 EXPOSURE TO INDOOR AIR POLLUTION:

Post relocation households had access to cleaner fuels, in the form of electricity, for, amongst others, basic heating of water and in some instances spatial heating, lighting, communication and cooking purposes. Pereira *et al.*, (2011) suggests that electricity, in the South African context, is viewed by users, as merely 'one more energy option' and that the use thereof is greatly influenced by its cost. This simply means that just because it's available, does not mean it will be used for the purpose intended, i.e. among others for basic cooking and lighting, neither that it will be used sparingly by recipients.

Lower levels of exposure to indoor air pollution post-relocation can be attributed to improved access to electricity connections as well as to subsidized free basic electricity (FBE) to poor households (DME, 2004). Access to free basic electricity at "2 years relocated" lead to significantly reduced exposures to indoor air pollution (IAP) due to the decreased use of dangerous fuels, such as coal, paraffin and wood (Spalding-Fletcher *et al.*, 2002). At "2 years relocated", households, even though connected to the main energy grid, were not billed for

electricity use. This means that they had access to unlimited use of electricity. In future, households, whilst still having access to free basic electricity, would be fitted with pre-paid electricity meters, and would have to pay for that which is used in excess of the free basic amount of electricity. This may subsequently reduce their daily electricity consumption and increase especially indoor air pollution (IAP), due to the use of biomass fuels such as wood and paraffin, and increase exposure to its emissions.

Howells (2006) argues that the impact of free basic electricity could be much greater and more cost effective if other clean alternatives are supplied to the poor for cooking, such as liquid petroleum gas (LPG) stoves. He further argues that its efficiency is much better than that of electricity and its use could then free up more electricity for other applications in the home. The cost of electricity also greatly influences whether FBE electricity will actually be used for the purpose intended, amongst which are cooking and lighting, as access does not equate to actual use, and ever increasing tariffs may outweigh the intentions of this 'lifeline' to the poor (Winkler *et al.*, 2011). The transition to, and adoption of electricity as a fuel source, is affected by its pricing, and this factor does not support the continued preferential use of electricity in these households, especially once the full cost of electricity is charged to them (de Fatima *et al.*, 2010). The implication is that these households will rather use a combination of energy sources, amongst which would be unsafe fuels, thereby minimising the reduction in IAP in future.

Decreased air pollution may result in positive health benefits (Wilkinson *et al.*, 2009), such as reduction in respiratory tract infections and asthma (Preval *et al.*, 2010), increases in positive

health (Goldemberg$_a$ *et al.*, 2004; Winkler *et al.*, 2011) and the reduced risk of premature mortality due to pneumonia, tuberculosis (Goldemberg$_b$ and Johanson (eds.), 2004). Additional conditions such as chronic obstructive pulmonary disease (COPD) in males and females and lung cancer especially in females due to them being overly exposed during cooking and preparing fires for heating may also be reduced (Torres-Dosal, *et al.*, 2008). However, in this study, although a minor decrease in respiratory infection is present, it is not statistically significant. This could be due to a lack of actual reductions, or due to imprecise measuring of respiratory infections, or due to a small sample size. In addition to actual health improvements at house-hold level, illness related expenditure as a result of decreased IAP exposure is often reduced (Bruce *et al.*, 2000; Habermehl, 1999 cited in Hutton *et al.*, 2007; Larson and Rosen, 2002; Grieshop *et al.*, 2011).

More illness-free days translates into improved productivity, i.e. those employed can actually go to work which could result in improved household income and associated benefits (Hutton, 2007). For children of school-going-age there is a reduction in school absenteeism due to air pollution related illnesses, as well as an improvement in growth and physical development of infants and children under the age of 3 yrs (Liddel and Morris, 2010).

Other benefits of access to, and use of, electricity includes decreased risk of burns and poisonings (Larson *et al.*, 2002; Mehlwana 1999 cited in Spalding-Fletcher 2005) as a result of using biomass fuels such as using candles for lighting, paraffin stoves for cooking and wood for heating. Access to, and use of electricity for lighting may improve education attainment as it allows the opportunity for study at night and less time is spent on collecting

wood as a fuel source (Kanagawa *et al.*, 2008). The use of electricity may result in a decrease in incidence of accidental fires destroying the home and neighbourhood (Adam, 2010).

Studies suggest a 'hierarchy of energy saving methods', with the first step being installing and improving thermal insulation to the dwelling to bring about reductions in energy consumption (Verebeek and Hens, 2005 cited in Lloyd, 2008). This may bring about significant changes in using other fuels use for space heating, as thermal comfort levels are improved (Hong *et al.*, 2006). However, subsidy amounts currently determine the sizes of houses as well as the materials used in its construction. Poor quality construction materials and -methods translates into poor structures, with poor insulating ability. Solar water heaters can effectively reduce the household energy costs by as much as 30% (SEI, 2010), freeing up electricity for other household uses, and thereby further limiting potential exposure to harmful emissions due to the combustion of polluting fuels. Solar water heating panels may be able to supply up to 90% of household hot water needs per year (Manganye and Dintchev, *undated*). Households, if made aware of, and taught how to effectively utilise free basic electricity without resorting to air-polluting fuels, e.g. how to use hot-boxes for cooking, could limit exposure to air polluting fuels and save money.

Although this was not directly measured, new, albeit low-cost-homes, are built with more thermally sound building materials and is thus expected to be better insulated against heat exchange. However, the lack of under-roof insulating materials such as a ceiling (Mathews and Weggelaar, 2006), as is the case for formal low-cost housing in this study, influences the

use of often dangerous bio-fuels for space heating, especially during winter months, thereby increasing exposure to harmful emissions.

5.5 WATER ACCESS, AVAILABILITY AND USAGE

Due to water being piped to individual homes, and having access to free basic water per month (DWAF, 2002) all households had an improved water supply post relocation. At "2 years relocated" households had unlimited access to water supplies, due to them not having been billed for consumption yet. Closer proximity to the dwelling, such as an in-house, or *in-own-yard* water point translates into increases in domestic water usage (Cairncross *et al.*, 2003 cited in Peter, 2010) and positive improvements in child health (Mangyo, 2008). Children now do not have to collect water as part of their daily chores, allowing for more time to focus on school work and contributing to their social development. For the girl child, not having to fetch water provides the opportunity to actually attend school (*ibid*). Aiga and Umenai (2002) found that where water supply and access are improved, the time usually spent by adults on water collecting activities was reallocated to income-generating activities and consequently improved household income. Women will especially have more time to take care of family members and to attend to their own welfare (Fong *et al.*, 1996)

Given the low levels of employment, and subsequent irregular incomes of households as discussed in an earlier section, there are concerns as to whether families would be able to cope with payment for water used beyond the FBW amount, once billing commences. An implication of this may be that water supplies may be interrupted as a first step by the municipality to reclaim payments, and eventually be suspended as a last resort. Hunter$_b$ *et al.* (2009) suggests that the benefits of clean water supply can be eliminated by even a few days

of interrupted supply. Households might then resort to becoming dependent on neighbours for water and revert back to the practice of collecting and storing water, which may reverse all the initial positive effects as stored water often becomes contaminated in the home and impacts on disease incidence (Moyo *et al.*, 2004). In more severe cases, residents may resort to collecting water from unsafe sources, such as the nearby lake.

The theoretical consequence of improved access to clean water, are positive impacts on health, especially as it relates to the prevalence of infectious disease such as diarrhoea which was in fact what was found for this study with a 5.6 reduction in diarrhoeal incidence. As water is piped directly into homes, there is no need to store water which may result in less incidence of diarrhoeal disease due to poor water storage practices in the home (Checkley *et al.*, 2004; Fewtrell *et al.*, 2005).

Access to adequate quantities and quality of water supply does not automatically translate into a decrease in childhood diarrhoeal disease as other factors amongst which poor sanitation, overcrowding and inadequate waste disposal, impact on the transmission and extent of the disease (Gasana *et al.*, 2001). Fewtrell *et al.* (2005) in a systematic review of water, sanitation and hygiene interventions to reduce diarrhoea, suggests that even though all the above interventions result in reductions of diarrhoea, water quality interventions, i.e. water treatment either centrally or at point-of-use, are more effective than assumed and that interventions with a single focus, e.g. one which aims solely to improve quality, or access, are not less successful than its multi-focus counterparts, i.e. where measures of sanitation, water and hygiene measures are combined.

Mara (2003) and Majuru *et al.*, (2011) both found similar reductions in other infectious disease conditions following improvements in water provision of which conditions may include , amongst others, shigella infections, trachoma and skin infections as reported by Aiello (2002). In this study, reductions in skin infections were similarly found, although the reduction was not as marked as the diarrhoea reduction and there was a large confidence interval as a result of a small sample size.

Better access to water could also translate into improvements in household hygiene and personal hygiene (Kjellstrom *et al.*, 2007), the latter due to increased frequency of bathing and hand washing (Peter, 2010). However improved access to water does not necessarily lead to improvements in basic household hygiene – and therefore not necessarily to improved health either (Govender et al, 2010), especially if the supply is interrupted as this may have a significant impact on health, as it may contribute to the incidence of diarrhoea (Hunter$_a$ *et al.* 2009).

5.6 SANITATION

All households in this study had increased access to adequate sanitation at "2 years relocated". Sanitation was present in the form of homes being supplied with in-house water-borne-flush toilets which were connected to the sewer mains, meaning waste is piped away. Improvements in sewerage facilities play a major role in reducing illness and deaths due to infections transmitted by the faecal-oral-route and due to direct contact with waste matter (Aiello *et al.*, 2008).

There was a marked decrease in incidence of childhood diarrhoeal diseases at“2 years relocated” as compared to that at “baseline”. It is likely that this is directly linked to the improved sanitation as well as the greater access to clean water. This link of sanitation and water to diarrhoeal illnesses was confirmed by several other authors (Hall, 2009; Mara *et al.*, 2010). Decreases in severe childhood diarrhoeal episodes may further result in decreases in hospitalization (Andrade *et al.*, 2009). As in-house toilets are available, exposure of children and crawling babies to faecal matter in the surrounding environment is also reduced (Palamuleni, 2002). A direct spin-off is that where sanitation is improved and adequate, the incidence of childhood intestinal parasitic worm infestation is reduced (Asaolu, 2002; Barreto *et al.*, 2010; Bleakley, 2002 cited in Watson, 2006). This holds benefits for improving child development due to reducing the impediment on learning resulting from worm infestations (Cumming, 2009) and fewer days absent from school due to ill-health.

Availability of adequate sanitation is regarded as an overall cost-effective intervention in relieving the burden of infectious diseases in developing countries (Laxminarayan, 2006). Reducing household expenditure on sanitation related diseases could avail money for other essentials (Cumming, 2009) and thereby improve general household well-being.

The neighbourhood improves in terms of the ‘disease environment’ as the spread of infectious disease , especially water-borne gastro-intestinal diseases, to neighbouring surroundings are reduced (Watson, 2006). An additional benefit for the

community/neighbourhood is that bad odours due to defecating - especially by young children in the outside environment- is eliminated. A reduction in odours was indeed observed by fieldworkers, as overfull buckets (bucket toilets) which at "baseline" was the main cause of theses odours, were no longer present. Having no visible faeces in the environment and no foul odours, can generate a sense of a hygienic environment in community members (Sohel-Rana, 2009) and could therefore encourage members to maintain this hygienic environment.

In-house toilets provides for increased privacy of use, accompanied improvements in personal hygiene and safety especially for women and girls (Kjellstrom *et al.,* 2007; Mahon and Fernandes, 2010 cited in Mara, 2010; WHO, 2008) and eliminates the fear of being harmed and harassed due to having to use common facilities (Drangert, 1998). Having the toilet situated indoors eliminates arguments, and therefore reduces social disruptions in communities, regarding responsibility for cleaning a communal facility. An in-house facility is more likely to be cleaned regularly (Avvannavar and Mani, 2008) thus facilitating hygiene control of the facility. Generally improvements in environment, amongst which sanitation and associated infrastructure of sewers and tarred roads, and the supply of water, leads to a perceived reported improvement in satisfaction with environmental quality, health and personal satisfaction, i.e. perceived improved quality of life (Westaway, 2006). These satisfaction levels with hygiene and the surrounding environment can then be further enhanced by health promotion activities which enables household to manage and maintain hygiene in the home.

As households are connected to the sewer mains, albeit not measured post relocation, an improvement in grey water disposal, such as that resulting from discarding waste water used for personal cleansing and household cleaning practices, is expected.

5.7 WASTE MANAGEMENT & PEST PRESENCE

Significantly higher numbers of households practiced adequate storage of refuse post relocation than at "baseline". This practice is encouraged by the provision of refuse receptacles, large enough to satisfy the refuse storage needs of households, by the local municipality. Due to larger refuse receptacle size and the fact that it is fitted with a closable lid, households are able to store most of their domestic waste. This means that the presence of refuse heaps as a result of indiscriminate dumping of household refuse in the general environment and around the dwelling is expected to be reduced, which was indeed observed by fieldworkers during data collection at "2 years relocated" and this contributed to an aesthetically pleasing environment.

Households were significantly more pleased with the frequency of refuse removal at "2 years relocated" due to the fact that the municipality is indeed delivering the services of scheduled refuse collection to this area. Furthermore, due to the presence of roads, refuse removal vehicles can now access all collection points (kerbside collection). Improvements were also reported in refuse collection frequency. This scheduled reliable collection service also impacts on the reduction of dumping of especially household waste in the area as households have assurance that refuse will be collected at least once per week.

Improvements in household waste management are expected to bring about significant reductions in pest presence and pest activity. However, no significant change was found in numbers of households experiencing pest problems post relocation. This is surprising as visible pest presence is not expected in formal housing. A major draw card for pests is indiscriminate dumping of especially organic food waste resulting from household activities. This activity was reduced, but not ceased as observed by fieldworkers post-relocation and could therefore be a contributing factor to the presence of pests. Other reasons for their presence are unclear but could be due to the close proximity of the location to the lakes, Zeekoevlei and Rondevlei and the ground level routes of ingress of houses, which facilitates easy spread from surrounding farm areas.

The consequence of pest presence and their disease carrying ability could impact on rates of infectious diseases and increased allergic diseases (Molnar *et al.*, 2010; Boadi, *et al.*, 2005; Castorina *et al*., 2010). This may lead to an increased use of, and accidental exposure to, household pesticides (Mansour, 2004). Castorina *et al.* (2010) have found that households are more likely to use pesticide aerosol sprays than other types, including gel or baiting which could be safely placed out of the reach of children and which do not have a residual pesticide load large enough to cause harm. Indoor residual pesticides resulting from aerosol pesticide sprays are especially of concern to child health and that of pregnant females (Majekodunmi *et al.*, 2002). In children, especially up to the age of 11 years, long-term developmental effects are experienced as residual pesticides are inhaled or enter through the skin (Tolosana, *et al.*, 2009). Diseases includes, amongst others: childhood leukaemia (Ma *et al.*, 2002), damage to the reproductive system of pubescent

girls (Guilette *et al.* 1998)- especially due to its ability to act as an endocrine disruptor - and cognitive impairments (Garry, 2004).

5.8 HOUSEHOLD HEALTH

Post relocation, respondents related a self-perceived improvement in their own health and in the health of household members since relocating. Reasons for this improved health could be that the households are overwhelmed by the 'newness' of the homes and the demolition and removal of all that was the informal settlement at "baseline". Stronegger *et al.* (2010) found that self-rated health improvement is strongly associated with perceived satisfaction with the quality of the living environment. As households now own the home, it is possible that some of the stress of living in an informal settlement and anxiety of being evicted from the site is now erased making lives a little easier. Further research reports indicate that inhabitants of owner-occupied homes, i.e. where tenure is secure, has significantly better health than those in non-owner occupied (rental) homes for a variety of disease variables, ranging from chronic illness to anxiety and depression (Ellaway and Macintyre, 1998; Macintyre, *et al.*, 2003; Pollack, *et al*, 2010). This could well be the case for the community post-relocation as the overall environment could be perceived as 'better' than the informal housing settlement and neighbourhood- that they had lived in at "baseline"- as it upgraded with new low-cost housing; rubble and litter heaps are reduced; water and sanitation is supplied and other municipal services such as refuse removal is provided.

The improvement in health is manifested by the decreased incidence of diarrhoea in children under the age of 6 years, which could be accounted for by the improved access to water which is piped directly into the home, as well as provision of water-borne flush toilets.

Respiratory infections could have remained unchanged due to a variety of factors amongst which is the inability to afford clean fuels such as electricity and/or gas (Lloyd, 2008) as fuel cost is a major consideration to the poor (Pareira *et al.* 2011).

The implication of this so-called 'fuel-poverty' could mean that the initial benefits of relocating to low-cost housing may not be sustained, as available finances would rather be utilised for more basic needs such as food, with electricity thus being a relative luxury rather that a necessity. Low-cost housing is typically not supplied with ceiling or under-floor insulation which may cause conditions to be cold and damp within the dwelling, and which may negatively influence health, especially respiratory health of children and infants. Failure to sustain clean cooking fuels may negatively impact on the health of women (Haines *et al.*, 2009) who are normally responsible for cooking meals and therefore more exposed to the harmful emissions of biomass fuels. As said before, the latest low-cost RDP houses are constructed with better insulating building materials, however they are still not good enough to allow for fuel savings.

The presence of skin diseases could be as a result of the lack in change in pest presence, such as the presence of fleas, as observed by the interviewers. Eye infection could be unchanged as a result of persistent poor personal- and environmental hygiene, albeit reduced, which were also observed by the interviewers.

Health of the disadvantaged cannot be 'sustainably improved by housing alone'. This ties in with the views of Molnar *et al.* (2010) who concludes that other factors impacting on health, such as education, employment and social support structures are as important as housing.

5.9 LIMITATIONS:

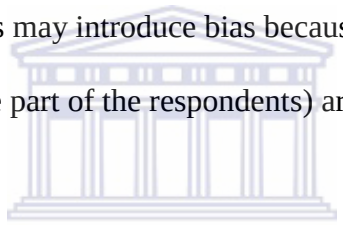
This study has a number of limitations, including factors which may have compromised the validity of the results. These include confounding measures, selection bias, measurement bias and data collection bias.

Although some of these limitations and "validity compromising" issues were mentioned in earlier sections, they will be presented as a composite group here.

Logistical flaws presented in the form of time constraints as the rate of relocation to newly built homes was not anticipated and several households relocated before they could be interviewed. This meant that not all households could be captured at "baseline" as new homes were occupied as soon as they were completed. This would have had an effect on the representivity of the sample at "baseline" if those who relocated first are systematically different from those who remained and were therefore the ones interviewed at "baseline". However the two groups were homogenous for a number of factors, including age *and* gender distribution, household headship and previous accommodation type prior to moving into the new houses. For this reason it is reasonable to assume that minimal bias was introduced and its effect would not be significant.

Measurement bias was minimised by using only trained fieldworkers for conducting the interviews.

The design of the questionnaire may have introduced some shortcomings as not all questions were posed to respondents during the two phases of the study e.g. questions relating to respondent general health and general health of household members were only posed during interviews at "2 years relocated" with the questions focussing on changes in health status since "baseline". Comparing the perceived health status at "baseline" to "2 years relocated" is thus not possible, i.e. the self-reported improved health cannot be statistically compared. This may introduce bias because of positive outcomes associated with a new dwelling (on the part of the respondents) are expected.



General questions relating to environmental conditions were ill-defined and were broadly subject to the observation (and opinion) of the interviewer; no tangible measurement techniques were used to support or validate interviewer observations and this may influence the validity of the observation. However, this measurement bias was also limited as trained field workers were used to collect and record data.

In addition, missed opportunities were presented in that valuable indoor environmental influences relating to the dwelling –and household -such as presence of indoor mould growth, dampness, cold, humidity were not directly explored. This could have provided valuable data regarding the indoor environmental conditions of the dwelling and

supported further explanation and description of possible environmental health conditions relating to changes in the indoor home environment.

6. CONCLUSION:

The findings of this study suggests that at 2 years after relocating from informal houses beneficiaries of formal low-cost housing are experiencing improved living conditions. These included benefits to health stemming from the: a) reduced crowding levels, b) the supply of clean water to houses, c) the presence of adequate sanitation, d) regular refuse removal, and e) reduced exposure to air polluting energy sources due to the provision of free basic electricity.

A health outcome which improved significantly post relocation was the reduction in incidences of diarrhoea in children under the age of 6 years.

The combination of the lack of employment, and factors such as hygiene education, health promotion and behaviour change, which were not part of the housing 'package', probably mitigated against health benefits. This is evident by the improved, but not eliminated unsatisfactory environmental conditions prevailing in the formal settlement. Concerns do exist as to the sustainability of the positive health outcomes, especially those associated with the provision of free basic water and sanitation. Households in the formal settlements have unlimited access to basic services, but as these are provided free for only a limited supply, the additional amounts required are for the account of the user. At the time of data collection

families had not yet been billed, or paid, for water usage therefore the volume of water utilised would have been higher than if payment were required. It is therefore uncertain how long the positive benefits, associated with free basic services, resulting from relocating from the informal settlement to formal low-cost housing can be sustained and what the factors are that contributes to the sustainability of these benefits.

7. RECOMMENDATONS:

Apart from realising the constitutional right to a house, and the fulfilment of the social obligation on the side of government, subsidised housing poses positive benefits for health. It is therefore clear that the provision of subsidised housing to indigent households is highly beneficial. The positive health benefits could be further enhanced if the public health outcomes could be considered as it relates to materials used in the building of low-cost housing, especially as it relates to its thermal exchange. It is acknowledged that this would inevitably be at a greater cost to the state, but this cost can be outweighed and returned via potential long-term benefits of less ill health; increased educational attainment; and improved self-employment opportunities, therefore less dependent on state funding and more self-reliant.

As additional energy requirements comes at a cost to the consumer, which they may not be able to afford, it is recommended that retro-fitting of existing homes with e.g. ceilings, and associated under-roof insulating materials be installed and that government aid, in the form of subsidies be made available for this purpose. This could even be done by

trained members of the community, thereby imparting skills and knowledge to those involved and potentially creating future employment opportunities. It is also recommended that these be installed in the construction of future formal low-cost homes so that beneficiaries can enjoy the comfort and health benefits thereof from the onset. The possibility of increases in free basic amounts, especially to indigent households, must be considered by the local municipality, as has been done by local authorities elsewhere in the country.

It is further recommended that retro-fitting *all* low-cost formal homes with solar heating panels by the City of Cape Town be fast-tracked, as this holds benefits to the household in that spending on electricity is reduced and more electricity is available for other household activities.

Environmental health improvements are hampered by the return to learnt behaviours which neither benefit the community nor the environment in the formal low-cost housing settlement. It is thus recommended, that hygiene promoting activities be included as part of the total "beneficiary package". This activity should ideally take place prior to relocating from the informal settlement and be continued after relocation.

REFERENCES:

Aboutorabi, M. and Abdelhalim, (2000) A study of housing affordability for low-income households in Kayelitsha township, South Africa. *In: Strategies for a sustainable built environment: proceedings of a conference, Pretoria, 23-25 August* [Online]. Available from: http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/Aboutorabi.pdf [Accessed 15th October 2011]

Advameg (2011) Stress. *Encyclopedia Of Mental Disorders* [Online]. Available from: http://www.minddisorders.com/Py-Z/Stress.html [Accessed 10th October 2011]

Adam, F. (2010) Free basic electricity, a better life for all. Johannesburg: Earth Life Africa [Online]. Available from: http://www.earthlife.org.za/wordpress/wp-content/uploads/2010/03/Free-Basic-Electricity-Final-Low-res.pdf [Accessed 10th August 2011]

Aidala, A.A. and Sumartojo, E. (2007) Why Housing? *AIDS Behavior* [Online], **11**:S1-S6. Available from: doi 10.1007/s10461-007-9302-z [Accessed 24th August 2011]

Aiello, A., Larson, E.L., and Sedlak R. (2008). Hidden heroes of the health revolution: Sanitation and personal hygiene. *American Journal of Infection Control*, **36**, S129-S151

Aiello, A.E. and Larson, E.L., (2002) What is the Evidence for a Causal Link Between Hygiene and Infections? *The Lancet of Infectious Disease*, **2**, 103-110.

Aiga, H. And Umenai, T. (2002) Impact of improved water supply on household economy in a squatter area of Manila. *Science and Medicine* [Online], **55**, 627-641. Available from: PII: S 0 2 7 7 - 9 5 3 6 (0 1) 0 0 1 9 2 – 7 [Accessed 10th May 2011]

Aigbavboa, C.O. and Thwala, W.D. (2011) Housing Experience of South African low-income beneficiaries, *The Built and Human Environment Review* [Online], **4**,1-13. Available from: http://www.tbher.org/index.php/tbher/article/view/36 [Accessed 19th September 2011]

Akhmat, G. and Khan, M.M., (2011) Key interventions to solve the problems of informal abodes of the third world, due to poor infrastructure. *Procedia- Social and Behavioral Science* [Online], **19,** 56-60. Available from: doi:10.1016/j/sbspro.2011.05.107 [Accessed 24th September 2011]

ANC, (1994) White Paper on Reconstruction and Development, Notice no. 1954 of 1994. Pretoria: Government Printers

Andrade, I.G., Queiroz, J.W., Cabral, A., Lieberman, J.A. and Jeronimo, S.M.B. (2009). Improved sanitation and income are associated with decreased rates of hospitalization for diarrhoea in Brazilian infants. *Royal Society of Tropical Medicine and Hygiene* [Online], **103**, 506-511. Available from: doi:10.1016/j.trstmh.2008.12.017 [Accessed 29th June 2011]

Arthur, S.R.MdeF., Zahran, S. and Bucini, G. (2010) The adoption of electricity as a domestic source. *Energy Policy* [Online], **38**, 7235-7249. Available from: doi:10:1016/j/enpol.2010.07.054 [Accessed 12th May 2011]

Asaolu, S.O., Ofoexie, I.E., Odumuyiwa, P.A., Owemimo, O.A. and Ogunniyi, A.B. (2002). Effect of water supply and sanitation on the prevalence and intensity of Ascaris lumbricoides among pre-school-age children, cited in: Ajebandele and Ifewara, Osun. *Transactions of the Royal society of Tropical Medicine and Hygiene*, **96**, 600-604

Avvannavar, A. and Mani, M. (2008) A conceptual model of people's approach to sanitation. *Science of the Total Environment* [Online], **390**, 1-12. Available from: doi:10.1016/j.scitotenv.2007.09.018 [Accessed 2nd June 2011]

Barreto, M.L., Genser, B., Strina, A., Teixeira, M.G., Assis, A.M.O., Rego, R.F., Teles, C.A., Prado, M.S., Matos, S.M.A., Alcântara-Neves and Cairncross, S. (2010) Impact of a city-wide sanitation program in north-east Brazil on intestinal parasites infection in young children. *Environmental Health Perspectives* [Online], **118** (11), 1637-1642. Available from: doi:10.1289/ehp.1002058 [Accessed 2nd June 2011]

Barry, M., (2006) Formalising informal land rights: the case of Marconi Beam to Joe Slovo Park. *Habitat International* [Online], **30**, 628-644. Available from: doi:10.1016/j.habitatint.2005.03.002 [Accessed 24th September 2011]

Barton, A., Basham, M., Foy, C., Buckingham, K., Somerville, M. (2007) The Watcombe housing study: the short term effect of improving housing conditions on the health of residents. *Journal of Epidemiology and Community Health* [Online] **61**, 771-777. Available from: doi: 10.1136/jech.2006.048462 [Accessed 31st May 2011]

Batson, E. (1943) Interim report of the social survey in Cape Town, cited in: Thomas EP, Seager JR, Viljoen E, *et al.* (2001) Household Environment and Health in Port Elizabeth, South Africa: Executive Summary. Port Elizabeth: South African Medical Research Council, University of Port Elizabeth, and Stockholm: Environment Institute, Sweden

Bruce, N., Perez-Padilla, R. and Albalak, R. (2000) Indoor air pollution in developing countries: a major environmental and public health challenge for the new millennium. Bulletin of the World Health Org., **78**, 1078–1092.

Battersby, S.A. , Parsons, R. and Webster, J.P. (2002) Urban rat infestations and the risk to public health, *CIEH: Journal of Environmental Health Research* [Online], **1**(2), 4-12. Available from: http://www.cieh.org/jehr/jehr3.aspx?id=11422*and*LangType=2057 [Accessed 20th October 2011]

Birch, S. (2001) Commentary: social inequalities in health. *Social Epidemiology and Social Value. International Journal of Epidemiology* [Online], **30**, 294–296. Available from: doi:10.1093/ije/30.2.294 [Accessed 24th September]

*Black*man, T., Anderson, J. and Pye, P. (2003) Change in adult health following medical priority re-housing: a longitudinal study. *Journal of Public Health and Medicine*, 2522-2528. Cited in Sandel, M. and Wright, R.J. (2006). When home is where the stress is: expanding the dimensions of housing that influence asthma morbidity. *Archives of Disease in Childhood* [Online], **91**(11), 942-948. Available from: doi10.1136/adc.2006.098376 [Accessed 24th September 2011]

Bleakley, H. (2002) Disease and Development: Evidence from Hookworm Eradication in the American South. Cited in Watson, T. (2006) Public Health investment and the infant mortality gap: evidence from federal sanitation interventions on U.S. Indian reservations. *Journal of Public Economics* [Online], **90**, 1537-1560. Available from: Doi:10.1016/j.jpubeco.2005.10.002 [Accessed 12th May 2011]

Boadi, K., Kuitunen, M., Raheem, K., and Hanninen, K. (2005) Urbanisation without development: environmental and health implications in African cities. *Environmental Development and Sustainability* [Online], **7**, 465-500. Available from doi:10.1007/s10668-004-5410-3. [Accessed 15th August 2011]

Boadi, K.O. (2004) Environmental and health in the Accra Metropolitan Area, Ghana, *Theses (level unspecified), University of JŸvaskŸla* [Online]. Available from: https://jyx.jyu.fi/dspace/bitstream/handle/123456789/13155/9513919935.pdf?sequence=1 [Accessed 20th October 2011]

Bray, R. (2008) Apartheid shanty towns in Cape Town. Cape Town [Online]. Available from: www.capetown.at.co.za [Accessed 8th October 2011]

Breysse, P., Farr, N., Galke, W., Lanphear, B., Morley, R., and Bergofsky, L. (2004) The relationship between housing and health: children at risk. *Environmental Health Perspectives: Children's Health- Workgroup Report* [Online], **112**(15), 1583-1588. Available from: doi:10.1289/ehp.7157 [Accessed 19th August 2011]

Bruce N., Perez-Padilla, R. and Albalak, R. (2000) Indoor air pollution in developing countries: a major environmental and public health challenge. *Bulletin of the World Health Organization*, **78** (9), 1078-92.

Built Environment Support Group (BESG). (1999) Towards the right to adequate housing. *Built Environment Support Group and European Union Foundation for human rights in South Africa*, Natal Witness Printing and Publishing Company Ltd., South Africa. Cited in Bullen, C., Kearns, R.A., Clinton, J., Laing, P., Mahoney, F., and McDuff, I. (2008) Bringing health home: Housholder and provider perspectives on a healthy housing programme in Aukland, New Zealand. *Social Science and Medicine* [Online], **66**, 1185– 1196. Available from: doi:10.1016/j.socscimed.2007.11.038 [Accessed 10th May 2011]

Bullen, C., Kearns, R.A., Clinton, J., Laing, P., Mahoney, F. and McDuff, I. (2008) Bringing health home: householder and provider perspectives on the healthy housing programme in Aukland, New Zealand. *Social Science and Medicine* [Online], **66**, 1185-1196. Available from: doi: 10.1016/j.sosscimed.2007.11.038 [Accessed 10th May 2011]

Butala, N.M., Van Rooyen, M.J. and Patel, R.B. (2010) Improved health outcomes in urban slums through infrastructure upgrading. *Social Science and Medicine* [Online] **71**: 935-940. Available from: doi:10.1016/jsocscimed.2010.05.037 [Accessed 29th June 2011]

Butchart, A., Kruger, J. and Lekoba, R. (2000) Perceptions of injury causes and solutions in a Johannesburg township: implications for prevention, *Social Science and Medicine* [Online]. Available from: **50**, 331-344. Available from: PII: S0277-9536(99)00272-5. [Accessed 15th August 2011]

Cairncross, S., O'Neill. D., McCoy, A., Seth, D. (2003) Health, environment and the burden of disease: a guidance note. *Department for International Development, London*. Cited in: Peter, G. (2010) Impact of rural water projects on hygiene behaviour in Swaziland. *Physics and Chemistry of the Earth* [Online], **35**, 772-779. Available from: doi:10.1016/j.pce.2010.07.024 [Accessed 6th May 2011]

Cameron, L. and Williams, J. (2009) Is the relationship between socio-economic status and health stronger for older children in developing countries? *Demography* [Online], **46**(2), 303-324. Available from: DOI: 10.1353/dem.0.0054 [Accessed 13th October 2011]

Castorina, R., Bradman, A., Fenster, L., Barr, D.B., Bravo, R., Vedar, M.G., Harnly, M.E., McKone, T.E., Eisen, E.A. and Eskenazi, B. (2010) Comparison of current-use pesticide and other toxicant urinary metabolite levels among pregnant women in the CHAMACOS cohort and NHANES. *Environmental Health Perspectives*, **118** (6), 856-863

Checkley, W., Gilman, R.H., Black, R.E., Epstein, L.D., Cabrera, L. and Sterling, C.R. (2004) Effect of water and sanitation on childhood health in a poor Peruvian per-urban community. *The Lancet: Articles*, **363**, 112-118

CIEH. (2008) Mice 'public health risk not just a nuisance', *Chartered Institute of Environmental Health: Environmental Health News* [Online]. Available from: http://www.cieh.org/ehn/ehn3.aspx?id=6496 [Accessed 20th October 2011]

City of Cape Town (COCT). (2008) Water and sanitation service standard. *COCT*: Cape Town [Online]. Available from: http://www.capetown.gov.za/en/Water/Documents/Water%20and%20Sanitation%20Service%20Standards.pdf [Accessed 25th September 2010]

Contreau, S. (2006) Occupational and environmental health issues of solid waste management: special emphasis on developing countries. Cited in Wilson, D.C., Velis, C. and Cheeseman, C. (2006) Role of informal sector recycling in waste management in developing countries, *Habitat International* [Online], **30**, 797-808. Available from: doi:10.1016/j.habitatint.2005.09.005. [Accessed 15th September 2010]

Cortés Ballerino, C., (2002). *Building materials and engineering design: low-income housing projects, Port Elizabeth-South Africa*. Master of Science Thesis, Royal Institute of Technology, Sweden

Couth, R. and Trois, C. (2010) Carbon emissions reduction strategies in Africa from improved waste management: A review, *Waste Management* [Online], **30**, 2336-2346. Available from: doi:10.1016/j.wasman.2010.04.013 [Accessed 5th June 2011]

Cumming, O. (2009) The sanitation imperative: a strategic response to a development crisis. *Journal of Desalination* [Online], **248**, 8-13. Available from: doi10.1016/j.desal.2008.05.031 [Accessed 29th June 2011]

Damba, N. (2011) South Africa: Protest sparked by attempt to cut illegal electricity connections. *All Africa Global Media, West Cape News-Cape Town* [Online]. Available from: http://allafrica.com/stories/printable/201109161082.html [Accessed 3rd October 2011]

Daniels, P.W. (2004) Urban challenges: the formal and informal economies in mega-cities, *Cities*, **21**(6), 501-511. *Proceedings: International Federation on Health Promotion World Congress 2003, Vienna, 5-8 October* [Online]. Available from: doi:10.1016/j.cities.2004.08.002 [Accessed 12th June 2011]

Davenport, T.R.H. and Saunders, C. (2000) South Africa: A modern history. 5th Edition. London: MacMillan

David, A.M., Mercado, S.P., Becker, D., Edmundo, K. and Mugisha, F. (2007) The prevention and control of HIV/AIDS, TB and vector-borne diseases in informal settlements: challenges, opportunities and insights. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* [Online], **84**(1), i65-i74. Available from: doi:10.1007/s11524-007-9183-5 [Accessed 14th September 2011]

De Castro, A.B., Rue, T. and Takeuchi, D.T. (2008) Associations of employment frustration with self-rated physical and mental health among Asian American immigrants in the U.S. labor. *Public Health Nursing* [Online], **27**(6), 492-503. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21087302 [Accessed 10th October 2011]

de Fatima, M., Arthur, S.R., Zahran, S. and Bucini, G. (2010) On the adoption of electricity as a domestic source by Mozambican household. *Energy Policy* [Online], **18**, 7235-7249. Available from: doi:10.1016/j.enpol.2010.07.054 [Accessed 25th September 2011]

de Wet, T., Mathee, A. and Barnes, B. (2001) Anthropology and Epidemiology: a case study of health and environment in Alexandra, Johannesburg, *Medical Research Council, South Africa* [Online]. Available at: http://www.mrc.ac.za/healthdevelop/casestudy.pdf [Accessed 20th October 2011]

Department of Housing (DOH). (2004) 'Breaking New Ground': a comprehensive plan for the development of sustainable human settlements. (As approved by Cabinet and presented to MINMEC on 2 September 2004), Pretoria: DOH

Department of Minerals and Energy (DME). (2004) Free basic energy policy guidelines: low-income household energy support programme. *DME* [Online]. Available from: http://www.cederbergmunicipality.co.za/Documents/20101201102205_item_Beleid%20-%20Free%20Basic%20Energy%20Policy%20Guidelines.pdf [Accessed 31st May 2011]

DME. (2003) Electricity basic services support tariff (EBSST/Free Basic Electricity) policy for the Republic of South Africa. Department of Minerals and Energy, Pretoria

Department of Water Affairs and Forestry (DWAF). (2002) Free Basic Water Implementation Strategy, version 2. Cape Town: Government Printers

Desmond, C. and Boyce, G. (2006) A healthy attitude? *Health Behaviours, Human Science Research Council* South Africa: HSRC Press [Online]. Available from: http://www.google.co.za/url?q=http://www.hsrc.ac.za/Research_Publication-19110.phtml*and*sa=U*and*ei=29O8TtzsD4fPhAfojt3FBA*and*ved=0CBMQFjAA*and*usg=AFQjCNHEreIY0rS8TgKX1BxmDTxwcKVDiw [Accessed 12th October 2011]

Dixon, J. and Ramutsindela, M. (2006) Urban resettlement and environmental justice in Cape Town. *Cities* [Online], **23**(2), 129-139. Available from: Doi:10.1016/j.cities.2005.08.003 [Accessed 12th May 2011]

Dixon, S., Jacobs, D.E., Fowler, C., Martinez, Y., Harris, J., Moffat, S., Walton, H., and Ruiz, B. (2009) An examination of interventions to reduce respiratory health and injury hazards in homes of low-income families. *Environmental Research* [Online], **109**, 123-130. Available from: doi:10.1016/j.envres.2008.10.001 [Accessed 12th May 2011]

Donaldson, R. (2002) Provincial living preferences in South Africa, public attitudes in contemporary South Africa-insights from an HSRC survey. Kirstenhof, Cape Town: Compress. Available from: www.hsrcpress.ac.za/downloadpdf.php?...**Public_Attitudes_in_Contemporary**...**Public**%20**Attitudes**%20in%20**Contemporary**%20SA [Accessed 24th August 2011]

Drangert, J.O. (1998) Fighting the urine blindness to provide more sanitation options. *Water SA*, **24**(2), 157-164.

DWAF. (2002) Free basic water implementation guideline for local authorities, version 2.3. Cape Town [Online]. Available from: http://www.dwaf.gov.za/Documents/FBW/FBWLocalAuthGuidelinesAug2002.pdf [Accessed 24th April 2006]

DWAF. (1997) Water Services Act, act no. 107 of 1997, Government Printers, Pretoria [Online]. Available from: http://www.dwaf.gov.za/Documents/Legislature/a108-97.pdf [Accessed 20th April 2005]

Eerd, V. (1996) The occupational health aspects of waste collection and recycling. *WASTE Working Document 4, Part 1, Urban Waste Expertise Program (UWEP)* [Online]. Available from: http://www.waste.nl/page/558 [Accessed 6th October 2011]

Egan, M., Kearns, A., Mason, P., Bond, L., Coyle, J., Beck, S., Crawford, F., Hanlon, P., Lawson, L., McLean, J., Sautkina, E., Thomson, H. and Walsh, D. (2010) Protocol for a mixed methods study investigating the impact of investment in housing, regeneration and neighbourhood renewal on the health and wellbeing of residents: the GoWell programme. *Medical Research Methodology, BioMed Central* [Online], **10**(41). Available from: http://www.biomedcentral.com/1471-2288/10/41 [Accessed 10th May 2011]

Ellaway, A., and Macintyre, S., (1998) Does housing tenure predict health in the UK because it exposes people to different levels of housing related hazards in the home or its surroundings? *Health and Place* [Online], **4**(2), 141-150. Available fromPII: S1353-8292(98)00006-9 [Accessed 22th August 2011]

Ellaway, A., Macintyre, S. and Kearns, A. (2001) Perceptions of place and health in socially contrasting neighbourhoods. *Urban Studies Journal* [Online], **38**, 2299-2316. Available from: http://usj.sagepub.com/content/38/12/2299.full.pdf [Accessed 24th August 2011]

Evans, G.W., English, K. (2002) The environment of poverty, multiple stressor exposure, psychophysical stress, and socio-emotional adjustment, *Child Development*, **73**, 1238-1248.

Evans, G.W., Kliewer, W., and Martin, J. (1991) The role of the physical environment in the health and well-being of children, in: Evans, G.W., Wells, N.M. and Moch, A. (2003) Housing and mental health: a review of the evidence and a methodological and conceptual critique, *Journal of Social Science* [Online], **59**(3), 475-500. Available at: http://Onlinelibrary.wiley.com/doi/10.1111/1540-4560.00074/pdf [Accessed 14th September 2011]

Evans, J., Hyndman, S., Stewart-Brown, S., Smith, D. and Petersen, S. (2000) An epidemiological study of the relative importance of damp housing in relation to adult health. *Journal of Epidemiology and Community Health*, **54**, 677-686

Fadare, W. and Mills-Tettey, R. (1992) Squatter Settlements in Port Harcourt. *Habitat International* [Online], **16**(1), 71-81. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271760*and*_user=3956543*and*_pii=019739759290009N*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=1992-12-31*and*wchp=dGLbVlt-zSkzV*and*md5=5e6677cca1ac8aa2dca8aee96b43731e/1-s2.0-019739759290009N-main.pdf [Accessed 24th September 2011]

Feldman, K. (2010) *Urban rats: the public health perspective* Presentation: Center for Zoonotic and Vector-borne Disease, Maryland, USA, 19 May [Online]. Available from: http://www.jhsph.edu/bin/e/t/051920_Feldman_PPT.pdf [Accessed 20th October 2011]

Fenwick, A. (2006) Water-borne infectious diseases-could they be consigned to history? *Science Magazine*, **313**, 1077-1081

Few, R., Gouveia, N., Mathee, A., Harpham, T., Cohn, A., Swart, A., *et al.* (2004) Informal sub-division of residential and commercial buildings of Sao-Paulo and Johannesburg: living conditions and policy implications. *Habitat International*, **28,** 427-442.

Fewtrell, L., Kaufmann, R.B., Kay, D., Enanoria, W., Haller, L., and Colford, J.M. jnr., (2005) Water, sanitation and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *The Lancet of Infectious Disease*, 42-52.

Fiil-Flynn, M. and Soweto Electricity Crisis Committee (SECC). (2001) The Electricity Crisis in Soweto- Municipal Services Project Occasional Paper Series, Number 4. Cited in McDonald, D. and Pape, J. (2002) Cost recovery and the crisis of service delivery in South Africa. *Cape Town: HSRC Publishers* [Online]. Available from: www.hsrcpress.ac.za/downloadpdf.php?...Crisis...Service...Cost%20Recovery%20and%20the%20Crisis%20of%20Service%20Delivery... - [Accessed 25th September 2011]

Fobil, J., May, J. and Kraemer, A., (2010) Assessing the relationship between socio-economic conditions and urban environmental quality in Accra, Ghana. *International Journal of Environmental Research and Public Health* [Online], **7,** 125-145. Available from: doi:10.3390/ijerph7010125 [Accessed 24th September 2011]

Fong, M.S., Wakeman, W, and Bhusan, A. (1996) Toolkit on gender in water and sanitation. *Gender Toolkit Series* **No. 2**. Washington, DC: The World Bank.

Fricker, C. (2003) Microbiological analysis, water supplies- microbiological analysis. CRF Consulting, *Encyclopedia of Food Sciences and Nutrition (Second Edition)*, 6117-6120

Fullerton, D., Bruce, N. and Gordon, S.B. (2008) Indoor air pollution from biomass fuel smoke is a major health concern in the developing world. *PubMedCentral: Transactions of the Royal Society of Tropical Medicine and Hygiene* [Online], **102**(9), 843-851. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2568866/pdf/main.pdf [Accessed 29th August 2011]

Ganyaza-Twalo, T. and Seager, J. (2005) Literature review on poverty and HIV/AIDS: measuring the social and economic impacts on households. *SAHARA*, Pretoria [Online]. Available from: www.sahara.org.za/.../84-literature-review-on-poverty-and-**hivaids**-measuring-the-social-and-economic-impacts-on-households.html [Accessed 15th August 2010]

Garry, V. (2004) Pesticides and children. *Toxicology and Applied Pharmacology* [Online], **198**, 152-163. Available from: doi:10.1016/j.taap.2003.11.027 [Accessed 24th August 2011]

Gasana, J., Morin, J., Ndikuyeze, A. and Kamoso, P. (2002) Impact of water supply and sanitation of diarrheal morbidity among young children in the socioeconomic and cultural context of Rwanda (Africa). *Environmental Research, Section A* [Online]**, 90**, 76-88. Available from: doi:10.1006/enrs.2002.4394 [Accessed 4th April 2011]

Gilbert, A. (2004) Helping the poor through housing subsidies: lessons from Chile, Colombia and South Africa. *Habitat International* [Online], **28**, 13-40. Available from: PII: S197–3975(02)00070–X [Accessed 19th September 2011]

Gilbert, A., (1999) A home is forever? Residential mobility and home ownership in self-help settlements. *Environment and Planning*, **31**, 1073-1091.

Gilbert, L. and Soskolne, V. (2003) Self-Assessed Health- a case study of differentials in Soweto, South Africa. *Health and Place* [Online], **9**, 193-205. Available from: PII: S1353–8292(02)00039–4 [Accessed 25th September 2011]

Goebel, A. (2007) Sustainable urban development? Low-Cost housing challenges in South Africa. *Habitat International* [Online], **31,** 291-302. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271760*and*_user=3956543*and*_pii=S0197397507000185*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=2007-12-31*and*wchp=dGLzVlB-zSkzS*and*md5=9e88b6410ad6ced01b26191ab8fd3028/1-s2.0-S0197397507000185-main.pdf [Accessed 7th September 2011]

Goebel, A., Dodson, B., and Hill, T. (2010) Urban Advantage or urban penalty? A case study of female headed households in a South African city. *Health and Place* [Online], **16**, 573-580. Available from: doi:10.1016/j.healthplace.2010.01.002 [Accessed 12th May 2011]

Goldberg, K. (2009) The water dialogues: Cape Town case study. *Water Dialogues* [Online]. Available from: http://www.waterdialogues.org/south-africa/documents/CapeTownCaseStudy-FullReport.pdf [Accessed 24th August 2011]

Goldemberg$_a$, J., Johansson, T.B., Reddy, A.K.N. and Williams, R.H. (2004) A global clean cooking fuel initiative. *Energy for Sustainable Development*, **VIII**(3), 5-12

Goldemberg$_b$, J. and Johansson, T.B., (Eds.). (2004). World Energy Assessment: Overview, 2004 update, United Nations Development Program, United Nations Department of Economic and Social Affairs, and World Energy Council, New York

Gostin, L.O. (undated) Public health law and ethics: a reader. USA: California University Press [Online]. Available from: http://www.publichealthlaw.net/Reader/toc.htm [Accessed 5th September 2011]

Goux, D. and Maurin, E. (2005) The effect of overcrowded housing on children's performance at school. *Journal of Public Economics* [Online], **89**, 797-819. Available from: http://www.jourdan.ens.fr/~emaurin/wdocuments/publications/Journal-public-Economics-05.pdf [Accessed 10th August 2011]

Govender, T, Barnes, J.M. and Pieper, C.H. (2010) Living in low-cost housing settlements in Cape Town, South Africa-the epidemiological characteristics associated with increased health vulnerability. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* [Online], **87**(6), 899-911. Available from: http://www.springerlink.com/content/e873502512203073/fulltext.pdf [Accessed 5th April 2011]

Govender, T., Barnes, J. and Pieper, C. (2011) The impact of densification by means of informal shacks in the backyards of low-cost houses on the environment and service delivery in Cape Town, South Africa. *Environmental Health Insights* [Online], **5**, 23-52; Available from: doi:10.4137/EHI.S7112 [Accessed 14th September, 2011]

Grafova, I. (2011) Do neighbourhood matter: Self-assessed health and residential selection among older Americans. *Conference proceeding: International Health Economics Association, USA, 12 June 2011* [Online] Available from: http://ihea2011.abstractsubmit.org/presentations/1285/ [Accessed 13th October 2011]

Grieshop, A.P., Marshall, D.J. and Kandlikar, M.(2011) Health and climate benefits of cook-stove replacement options. *Energy Policy* [Online, in press]. Available from: doi:10.1016/j.enpol.2011.03.024 [Accessed 6th May 2011]

Guillette, E.A., Meza, M.M., Aquilar, M.G., Soto, A.D. and Enedina, I. (1998) An anthropological approach to the evaluation of preschool children exposed to pesticides in Mexico. *Environmental Health Perspectives*, **106**, 347– 353.

Habib, R.R., Mahfoud, Z., Fawaz, M., Basma, S.H., Yeretzian, J.S. (2009) Housing quality and ill-health in a disadvantaged urban community. *Public Health* [Online], **123,** 174-181. Available from: doi: 10:1016/j.puhe.2008.11.002 [Accessed 12th May 2011]

Haines A, McMichael AJ, Smith KR, Roberts I, Woodcock J, Markandya A, *et al.* (2009) Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers. *Lancet* [Online], **374**, 2104–2114. Available from: http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673609617591.pdf?id=4d037fefcb72946c:20f0f1f:133b580aaf4:42c51321606009512 [Accessed 12th May 2011]

Hall, K. (2009) Housing and services- Access to basic sanitation. *Children Count*, Children's Institute, University of Cape Town [Online]. Available from: www.childrencount.ci.org.za [Accessed 15th August 2011]

Hall, K. (2010) Statistics on children in South Africa: Housing and services-overcrowding. *Children Count*, Children's Institute, University of Cape Town [Online]. Available from: http://www.childrencount.ci.org.za/uploads/factsheet_12.pdf [Accessed 12th September 2011]

Habemehl, H., 1999. The economics of improved stoves: guide to micro- and macroeconomic analysis and data assessment. Cited in Hutton, G., Rehfuess, E. and Tediosi, F. (2007) Evaluation of the costs and benefits of interventions to reduce indoor air pollution. *Energy for Sustainable Development*, **XI**(4), 34-43

Hardoy, J., Cairncross, S. and Satterthwaite, D. (1990) The poor die young: housing and health in third world cities. London: Earthscan Publications

Harsch, E. (2001) South Africa tackles social inequities. *Africa Recovery* [Online], **14**(4), 12. Available from: http://www.un.org/ecosocdev/geninfo/afrec/subjindx/144soafr.htm [Accessed 15th February 2002]

Harvey, P.A. (2008) Environmental sanitation crisis: more than just a health issue. *Environmental Health Insights- Commentary-Special Issue*, **2**, 77-81

Hasan, S. (1998) Problems of municipal waste management in Bangladesh: AN inquiry into its nature. *Habitat International* [Online], **22**(2), 191-202. Available from: PII:S0197-3975(97)00039-8 [Accessed 17th August 2011]

Heller, L., Colosimo, E.A. and de Figueiredo, A. (2003) Environmental sanitation conditions and health impact: a case control study, *Revista de Sociedade Brasileira de Medicina Tropical* [Online], **36**(1), 41-50. Available from: www.scielo.br/pdf/rsbmt/v36n1/15306.pdf [Accessed 13th October 2011]

Hong, S.H., Oresczyn, T. And Ridley, I. (2006) The impact of energy efficient refurbishment on the space heating fuel consumption in English dwellings. *Energy and Buildings* **38** (10), 1171-1181

Howells, M., Victor, D.G., Gaunt, T., Elias, R.J. and Alfstad, T. (2006) Beyond free electricity: the cost of electric cooking in poor households and a market friendly alternative. *Energy Policy* [Online], **34**, 3351-3358. Available from; doi:10.1016/j.enpol.2005.07.006 [Accessed 6th June, 2011]

Huchzermeyer, M. (2001) Housing for the poor? Negotiated housing policy in South Africa. *Habitat International* [Online], **25**, 303-331. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271760*and*_user=3956543*and*_pii=S0197397500000370*and*_check=y*and*_origin=*and*_coverDate=30-Sep-2001*and*view=c*and*wchp=dGLbVlV-zSkzV*and*md5=fe9cbb59343ea6f02d2b8b4f9b7c999f/1-s2.0-S0197397500000370-main.pdf [Accessed 19th September 2011]

Huchzermeyer, M. and Karam, A. (eds.). (2006) Informal settlements: a perpetual challenge? Cape Town: UCT Press

Hunter$_a$, P.R., Zmirou-Navier, D. and Hartemann, P. (2009) Estimating the impact on health of poor reliability of drinking water interventions in developing countries. *Science of the Total Environment* [Online], **407**, 2621-2624. Available from: doi:10.1016/j.scitotenv.2009.01.018 [Accessed 4th April 2011]

Hunter$_b$, P.R., Pond, K., Jagals, P., and Cameron J. (2009) An assessment of the costs and benefits of interventions aimed at improving rural community water supplies in developed countries. *Science of the Total Environment* [Online], **407**, 3681-3685. Available from: doi:10.1016/j.scitotenv.2009.03.013 [Accessed 6th May 2011]

Hutton, G., Rehfuess, E. and Tediosi, F. (2007) Evaluation of the costs and benefits of interventions to reduce indoor air pollution. *Energy for Sustainable Development*, **XI**(4), 34-43.

IDASA. (2002) The Grootboom case and women's housing rights. *Budget Briefs: Budget information Services, Budget Brief No.111* [Online]. Available from: http://www.idasa.org.za/bis [Accessed 7 October 2011]

Inocencio, A.B., Padilla, J.E. and Javier, E.P. (1999) Determination of basic household water requirements. *Phillipine Institute for Development Studies- Discussion Paper Series* [Online], **99**(02), 1-59. Available from: http://dirp4.pids.gov.ph/ris/dps/pidsdps9902.pdf [Accessed 20th October 2010]

Isunju, J.B., Schwartz, K., Schouten, M.A., Johnson, W.P. and van Dijk, M.P. (2011) Socio-economic aspects of improved sanitation in slums: a review. *Journal of Public Health* [Online], **125**, 368-376. Available from: doi:10.1016/j.puhe.2011.03.008 [Accessed 29th June 2011]

Jongeling, R., Klunne, W., Maathuis, S. and Suurenbroek, Y. (2002) Low cost energy efficient housing by South African housing associations. *energy4Africa* [Online]. Available from: http://energy4africa.net/klunne/publications/SB02.pdf [Accessed 24th August 2011]

Kanagawa, M. and Nakata, T. (2008) Assessment of access to electricity and the socio-economic impacts in rural areas of developing countries. *Energy Policy* [Online], **36**, 2016-2029. Available from: doi:10.1016/j.enpol.2008.01.041 [Accessed 10th May 2011]

Kayaga, S. and Franceys, R. (2007) Cost of urban utility water connections: excessive burden to the poor. *Utilities Policy* [Online], **15**, 270-277. Available from: doi:10.1016/j.jup.2001.06.002 [Accessed 29th August 2011]

Kjellstrom, T., Friel, S., Dixon, J., Corvalan, C., Rehfuess, E., Campbell-Lendrum, D., Gore, F. and Bartram, J. (2007) Urban environmental health hazards and health equity. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* [Online], **84** (1), i86-i97. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1891648/pdf/11524_2007_Article_9171.pdf [Accessed 12th May 2011]

Kirchner, S. (2007) Hell on earth-systematic rape in Eastern Congo. *Journal of Humanitarian Assistance* [Online], Feinstein International Centre, Tuffs University. Cited in Sorenson, S.B., Morssink, C. and Campos, P.A., (2011) Safe access to safe water in low-income countries: water fetching in current times. *Social Science and Medicine* [Online], **72**, 1522-1526. Available from: http://www.womenforwater.org/docs/Paper_water_fetching.pdf [Accessed 10th September 2011]

Klunne, W. (2002) Energy efficient housing in South Africa - overview of current state of affairs- Final Draft November 2002. *South Africa* [Online]. Available from: http://microhydropower.net/klunne/rsa_eeh.html [Accessed 24th September 2011]

Krieger, J. and Higgins, D.L. (2002) Housing and health: time again for public health action, *American Journal of Public Health*, **92**, 758-768

Krieger, J., Jacobs, D.E., Ashley, P.J., Baeder, A., Chew, G.L., Dearborn, D., Hynes, H.P., Miller, J.D., Morley, R., Rabito, F. and Zeldin, D.C. (2010) Housing intervention and control of asthma-related indoor biologic agents: a review of the evidence. *Journal of Public Health Management Practice* [Online], **16** (5), S11-S20. Available from: http://journals.lww.com/jphmp/Fulltext/2010/09001/Housing_Interventions_and_Control_of.4.aspx [Accessed 15th September 2011]

Labour Research Service, (2010) Overview of South African labour history. *SA Labour History Project* [Online], South Africa. Available from: http://www.lrs.org.za/salhap/history.htm [Accessed 24th September 2011]

Landman, K. and Napier, M., (2010) Waiting for a house or building your own? reconsidering state provision aided and unaided self-help in South Africa. *Habitat International* [Online], **34**, 299-305. Available from: doi:10.1016/j.habitatint.2009.11.015 [Accessed 7th September 2011]

Larson, B.A. and Rosen, S. (2002) Understanding household demand for indoor air pollution control in developing countries. *Social Science and Medicine* [Online], **55**, 571-584. Available from: PII:S0277-9536(01)00188–5 [Accessed 12th May 2011]

Last, J.M. (2011) Encyclopedia of public health [Online]. Available from: http://www.enotes.com/public-health-encyclopedia/frank-johann-peter# [Accessed 8th October 2011]

Lauster, N. and Tester, F. (2010) Culture as a problem in linking material inequality to health: on residential crowding in the Arctic. *Health and Place* [Online], **16**, 523-530. Available from: doi:10.1016/j.healthplace.2009.12.010 [Accessed 12th May 2011]

Laxminarayan, R., Chow, J. and Shahid-Salles, S. (2006) Intervention cost-effectiveness: overview of main messages. (*In:* Jameson, D.T., Breman, J.G., Measham, A.R. *et al.* (eds.), *Disease control priorities in developing countries.* Washington: The World Bank and Oxford University Press. p.35-86)

Lemanski, C. (2009) Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies. *Habitat International* [Online], **33**, 472-484. Available from: doi:10.1016/j.habitatint.2009.03.002 [Accessed: 20th August 2011]

Lemanski, C. (2011) Moving up the ladder or stuck on the bottom rung? Homeownership as a solution to poverty in urban South Africa. *International Journal of Urban and Regional Research* [Online], **35** (1), 57-77. Available from: doi:10.1111/j.1468-2427.2010.00945.x [Accessed 23rd May 2011]

Leventhal, T. and Brooks-Gunn, J. (2003) Moving to opportunity: an experimental study of neighbourhood effects on mental health, *American Journal of Public Health*, **93**, 1576-1582. Cited in: Ruel, E., Oakley, D., Wilson, G.E. and Maddox, R. (2010) Is public housing the cause of poor health or a safety net for the unhealthy poor? *Journal of Urban Health* [Online], **87**(5), 827-838. Available from: doi:10.1007/s11524-010-9484-y [Accessed 12th October, 2011]

Leventhal, T. and Newman, S. (2010) Housing and child development. *Children and Youth Services Review* [Online], **32**, 1165-1174. Available from: doi.10.1016/j.childyouth.2010.03.08 [Accessed 6th April 2011]

Liddell, C. and Morris, C. (2010) Fuel poverty and human health: a review of recent evidence. *Energy Policy* [Online] **38**, 2987-2997. Available from: doi:10.1010/j.enpol.2010.01.037 [Accessed 10th May 2011]

Lien, H-M., Wu, W-C. and Lin, C-C. (2008) New evidence on the link between housing environment and children's educational attainments. *Journal of Urban Economics*, **64**, 408-421.

Lloyd, C.R., Callau, M.F., Bishop, T., and Smith, I.J. (2008) The efficacy of an energy efficient upgrade program in New Zealand. *Energy and Buildings* [Online], **40**, 1228-1239. Available from: doi:10.1016/j.enbuild.2007.11.006 [Accessed 10th May 2011]

Lodhi, M.A.K. and Zain-al-Abdin, A. (1999) Indoor air pollution produced from fossil fuel and biomass. *Energy Conversion and Management* [Online], **40**, 243-248. Available at: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271098*and*_user=3956543*and*_pii=S0196890498001186*and*_check=y*and*_origin=*and*_coverDate=28-Feb-1999*and*view=c*and*wchp=dGLbVlS-zSkWb*and*md5=44345ef83a00cc03cc796d70ba0f5ddd/1-s2.0-S0196890498001186-main.pdf [Accessed 10th August 2011]

Loetscher, T. and Keller, J. (2002) A decision support system for selecting sanitation systems in developing countries. *Socio-Economic Planning Sciences* [Online], **36**, 267-290. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271736*and*_user=3956543*and*_pii=S0038012102000071*and*_check=y*and*_origin=*and*_coverDate=31-Dec-2002*and*view=c*and*wchp=dGLzVlV-zSkzS*and*md5=30efcee7a783b5930f5dfe042bfd17fa/1-s2.0-S0038012102000071-main.pdf [Accessed 10th October 2011]

Lopez, A.D., Mathers, C.D., Ezzati, M. Jamison, D.T. and Murray CJL (2006) Global burden of disease and risk factors. New York: OxfordUniversity Press and the World Bank. Cited in Isunju, J.B., Schwartz, K., Schouten, M.A., Johnson, W.P. and van Dijk, M.P. (2011) Socio-economic aspects of improved sanitation in slums: a review. *Journal of Public Health* [Online], **125**, 368-376. Available from: doi:10.1016/j.puhe.2011.03.008 [Accessed 29th June 2011]

Luby, S., Agboatwalla,M., Raza, A, Sobel, J., Mintz, E., Baier, K., Rahbar, M., Qureshi, S., HassanP, R., Ghouri, T.F., Hoekstra, R.M., and Gangarosa, E. (2001) A low-cost intervention for cleaner drinking water in Karachi, Pakistan. *International Journal of Infectious Disease* [Online], **5**(3), 144-150. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=272991*and*_user=3956543*and*_pii=S120197120190089X*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=2001-12-31*and*wchp=dGLbVlV-zSkzV*and*md5=fc75ea47f163191658560500bf964bdc/1-s2.0-S120197120190089X-main.pdf [Accessed 24th August 2011]

Lundberg, O. and Manderbacka, K. (1996) Assessing reliability of a measure of self-rated health. *Scandinavian Journal of Social Medicine*, **24**,218-224. Cited in Malström, M., Sundquist, J. and Johansson, S-E. (1999) Neighbourhood environment and self-reported health status: a multilevel analysis. *American Journal of Public Health* [Online], **89**(8), 1181-1186. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1508675/pdf/amjph00008-0037.pdf [Accessed 10th September 2010]

Ma, X., Buffler, P.A., Gunier, R.B., Dahl, G., Smith, M.T., Reinier, K. and Reynolds, P. (2002) Critical windows of exposure to household pesticides and risk of childhood leukemia. *Environmental Health Perspectives,* **110**, 955– 960.

Macintyre, S., Ellaway, A., Der, G., McKay, L., Hiscock, R., and Kearns, A. (2003) What features of the home and the area might help to explain observed relationship between housing tenure and health? Evidence from the west of Scotland. *Health and Place* [Online], **9**, 207-218. Available from: PII: S1353-8292(02)00040-0 [Accessed 22nd August 2011]

Macintyre, S., Hiscock, R., Kearns, A., Ellaway, A. (2000) Housing tenure and health inequalities: a three-dimensional perspective on people, homes and neighbourhoods. Cited in Macintyre, S., Ellaway, A., Der, G., McKay, L., Hiscock, R., and Kearns, A. (2003) What features of the home and the area might help to explain observed relationship between housing tenure and health? Evidence from the west of Scotland. *Health and Place* [Online], **9**, 207-218. Available from: PII: S1353-8292(02)00040-0 [Accessed 22nd August 2011]

Mahon, T. and Fernandes, M. (2010) Menstrual hygiene in South Asia: a neglected issue for WASH (water, sanitation and hygiene) programmes. Cited in Mara, D., Lane, J., Trouba, D. and Scott, B. (2010) Sanitation and health. *Plos Med* [Online], **7**(11). Available from: doi.1371/journal.pmed.1000363 [Accessed 4th April 2011]

Majekodunmi, A., Howard, M.T. and Shah, V.(2002) The perceived importance of cockroach Blatta orientalis (L.) andBlattella germanica (L.) infestation to social housing residents. *Journal of Environmental Health Research,* **1:** 27–34

Majuru, B., Mokoena, M.M., Jagals, P., Hunter, P.R. (2011) Health impact of small-community water supply reliability. *International Journal of Hygiene and Environmental Health* [Online], **214**, 162-166. Available from: doi:10.1016/j.ijheh.2010.10.005 [Accessed 6th May 2011]

Malström, M., Sundquist, J. and Johansson, S-E. (1999) Neighbourhood environment and self-reported health status: a multilevel analysis. *American Journal of Public Health* [Online], **89**(8), 1181-1186. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1508675/pdf/amjph00008-0037.pdf [Accessed 10th September 2010]

Malzbender, D., Goldin, J. Turton, A. and Earle, A. (2005) Traditional water governance and South Africa's "National Water Act"- tension or cooperation? In: *International Workshop on: 'African Water Laws: Plural Legislative Frameworks for Rural water management in South Africa', 26-28 January 2005, Gauteng, South Africa.* South Africa [Online]. Available from: http://www.nri.org/projects/waterlaw/AWLworkshop/MALZBENDER-DB.pdf [Accessed 26th September 2011]

Manganye, M.F. and Dintchev, O.D. (*undated*) The impact of solar water heating technology in low cost housing environment as one of the renewal energy option to reduce the load on the national grid. Tswane, University of Tshwane [Online]. Available from: http://active.cput.ac.za/energy/web/DUE/DOCS/416/Paper%20-%20Manganye%20F.pdf [Accessed 24th October 2011]

Mangyo, E., (2008) The effect of water accessibility on child health in China. *Journal of Health Economics* [Online], **27**, 1343-1356. Available from: doi:10.1016/j.jhealeco.2008.04.004 [Accessed 5th May 2011]

Manie, S. (2004) The people's housing process: current practice and future trends. *Development Action Group (DAG)* [Online]. Available from: http://www.dag.org.za/docs/research/5.pdf [Accessed 15th August 2010]

Mansour, S.A. (2004) Pesticide exposure: Egyptian scene. *Toxicology* [Online], **198**, 91-115. Available from: doi:10.1016/j.tox.2004.01.036 [Accessed 12th May 2011]

Manual, L.G. Interview on 24th May 2000, Phumlani Informal Settlement

Mara, D.D. (2003) Water, sanitation and hygiene for the health of developing nations. *Public Health: Journal of the Royal Institute of Public Health*, **117**, 452-456

Mara, D., Lane, J., Trouba, D. and Scott, B. (2010) Sanitation and health. *Plos Med* [Online], **7**(11). Available from: doi.1371/journal.pmed.1000363 [Accessed 4th April 2011]

Markandya, A. and Wilkinson, P. (2007) Electricity generation and health. *The Lancet* [Online], **370**(9591), 979-990. Available from: doi:10.1016/S0140-6736(07)61253-7 [Accessed 15th August 2010]

Marsh, A., Gordon, D., Pantazis, C. and Heslop, P. (1999) Home sweet home: the impact of poor housing on health. Bristol: Policy Press

Mathee, A. and Mthembu, Z. (2004) The South African healthy environments for children alliance. *In: 8th World Congress on Environmental Health, Durban, South Africa, 22-27 February 2004;* Document Transformation Technologies, SB Conferences, Durban, South Africa

McDonald, D.A. and Pape, J. (eds) (2002) Cost recovery and the crisis of service delivery in South Africa, HSRC/Zed, Cape Town and London

Mathee, A. and Swart, A. (2001) A description of living condition and health status in indoor informal settlements in Johannesburg. *Urban Health and Development*, **4**, 15-18

Mathews, E.H. and Weggelaar, S (2006) Enhancing the efficiency of low-cost houses by the development of a low-cost ceiling system. *Journal of Energy in Southern Africa* [Online], **17**(1), 18-27. Available from: http://www.erc.uct.ac.za/jesa/volume17/17-1jesa-mathews.pdf [Accessed 17th May 2011]

Mbiba, B. and Huchzermeyer, M. (2002) Contentious development: peri-urban studies in sub-Saharan Africa. *Progress in Development* , **2**(2), 113-131

McCallum, J., Shadbolt, B. and Wang, D. (1994) Self-rated health and survival: a 7-year follow-up study of Australian elderly. *American Journal of Public Health*, **84**,1100-1105. Cited in Malström, M., Sundquist, J. and Johansson, S-E. (1999) Neighbourhood environment and self-reported health status: a multilevel analysis. *American Journal of Public Health* [Online], **89**(8), 1181-1186. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1508675/pdf/amjph00008-0037.pdf [Accessed 10th September 2010]

McGranahan, G. (1993) Household environmental problems in low-income cities. *Habitat International*, **17**(2): 105-121. *In: International Workshop on Planning for Sustainable Urban Development – Cities and Natural Resource Systems in Developing Countries: proceedings of a workshop* [Online], *Cardiff, 13-17 July, 1992*. Cardiff. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271760*and*_user=3956543*and*_pii=019739759390008Z*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=1993-12-31*and*wchp=dGLzVlB-zSkzV*and*md5=7beb4eadebba5d740b0b702c6f4c38c0/1-s2.0-019739759390008Z-main.pdf [Accessed 12th May 2011]

Mckenzie, S.K., Carter, K.N., Blakely, T. and Ivory, V. (2011) Effects of childhood socioeconomic position on subjective health and health behaviours in adulthood: how much is mediated by adult socioeconomic position? *BioMed Central, Ltd.: Public Health* [Online], **11**, 269. Available from: http://biomedcentral.com/1471-2458/11/269 [Accessed 12th October 2011]

Mehlwana, A.M., and Qase, N. (1999) *The Contours of domesticity, energy consumption and poverty: the social determinants of energy use in low-income urban households in Cape Town's townships (1995-1997)*. Cited in Spalding-Fletcher, R. (2005) Health Benefits of electrification in developing countries: a quantitative assessment in South Africa. *Energy for Sustainable Development*, **IX**(1): 53-62

Mgutyana, P. Interview on 30th May 2000, Phumlani Informal Settlement

Mgwebi, G. N. (2011) Grappling for solutions to illegal electricity connections. *Afesis-Corplan* [Online]. Available from: http://www.afesis.org.za/Sustainable-Settlements-Articles/grappling-for-solutions-to-illegal-electricity-connections.html [Accessed 3rd October 2011]

Miilunpalo, S., Vuori, I., Oja, P., Pasanen, M. and Urponen, H. (1997) Self-rated health status as a health measure: the predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *Journal of Clinical Epidemiology*, **50**, 517-528. Cited in Malström, M., Sundquist, J. and Johansson, S-E. (1999) Neighbourhood environment and self-reported health status: a multilevel analysis. *American Journal of Public Health* [Online], **89**(8), 1181-1186. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1508675/pdf/amjph00008-0037.pdf [Accessed 10th September 2010]

Mitlin, D. (2001) Housing and urban poverty: a consideration of the criteria of affordability, diversity and inclusion. *Housing Studies* [Online], **16**(4), 509-522. Available from: http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=8437e58c-91df-4890-b98b-cd8c881df1b9%40sessionmgr111*and*vid=2*and*hid=123 [Accessed 7th September 2011]

Mmom, P.C. and Mmom, C.F. (2011) Environmental sanitation and public health challenges in a rapidly growing city of the third world: the case of domestic waste and diarrhoea incidence in Greater Port Harcourt metropolis, Nigeria. *Asian Journal of Medical Sciences* [Online], **3** (3), 115-120. Available from: http://www.maxwellsci.com/print/ajms/v3-115-120.pdf [Accessed 24th August 2011]

Molnar, A., Adany, R., Adam, B., Gulis, G., Kosa, K. (2010) Health impact assessment and evaluation of a Roma housing project. *Health and Place* [Online], **16**, 1240-1247. Available from: doi:10:1016/jhealthplae.2010.08.011 [Accessed 12th May 2011]

Monden, C.W.S. (2010) Do measured and unmeasured family factors bias the association between education and self-assessed health? *Social Indicators Research* [Online], **98**, 321-336. Available from: doi:10.1007/s11205-009-9547-1 [Accessed 13th October 2011]

Moyo, S., Wright, J., Ndamba, J. and Gundry, S. (2004) Realising the maximum health benefits from water quality improvements in the home: a case from Zaka district, Zimbabwe. *Physics and Chemistry of the Earth* [Online], **29**, 1295-1299. Available from: doi:10.1016/j.pce.2004.09.012 [Accessed 10th May 2011]

Niemann, H.J., Knauf, I.M. and Goliger, A.M., (2003) Safety oriented design wind loads for low-rise buildings arranged in groups. *German Science Foundation and German Association for Technical Co-Operation, DFG* [Online]. Available from: http://www/aib.ruhr-uni-bochum.de/wwsi/germany/mp1.html [Accessed 15th August 2005]

Njoh, A.J. and Akiwumi, F.A. (2011) The impact of colonization on access to improved water and sanitation facilities in African cities. *Cities* [Online], **28**, 452-460. Available from: doi:10.1016/j.cities.2011.04.005 [Accessed 15th September 2011]

Ohio Department of health (ODH). (2008) History of public health. USA: Ohio Government [Online]. Available from: http://www.odh.ohio.gov/public_health/history/history1.aspx [Accessed 6th September 2011]

Oldewage-Theron, W., Dicks, E.G. and Napier, C.E., (2006) Poverty, household food insecurity and nutrition: coping strategies in an informal settlement in the Vaal Triangle, South Africa. *Journal of the Royal Institute of Public Health* [Online], **120**, 795-804. Available from: doi:10.1016/j.puhe.2006.02.009 [Accessed 15th September 2011]

Ooi, G.L. and Phua, K.H., (2007) Urbanisation and slum formation. *Journal of Urban Health: Bulleting of the New York Academy of Medicine* [Online], **84**(1), i27-i34. Available from: doi:10.1007/s11524-007-9167-5 [Accessed 24th September 2011]

Oseland, N.A. and Raw, G.J. (1991) Room size and adequacy of space in small homes. *Building and Environment* **26** (4), 341-347, Great Britain: Pergamon Press

Our Water Commins. (2010) Water Solutions- Case 4: Free Water in South Africa [Online]. Available from: http://ourwatercommons.org/water-solutions/case-4-free-water-south-africa [Accessed 03rd October 2011]

Palamuleni, L.G. (2002) Effects of sanitation facilities, domestic solid waste disposal and hygiene practices on water quality in Malawi's urban poor areas: a case study of South Lunzu township in the city of Blantyre. *Physics and Chemistry of the Earth* [Online], **27**, 845-850. Available from: PII:S1474-7065 (02) 00079-7 [Accessed 29th June 2011]

Pareira, G.M., Sena, A.J., Freitas, M.A.V. and da Silva, N.F. (2011) Evaluation of the impact of access to electricity: a comparative analysis of South Africa, China, India and Brazil. *Renewable and Sustainable Energy Reviews* [Online], **15**, 1427-1441. Available from: doi:10.1016/j.rser.2010.11.005 [Accessed 10th October 2011]

Peacock, D. (2007) Cotton times- understanding the industrial revolution: Edwin Chadwick- the sanitary man [Online]. Available from: http://www.cottontimes.co.uk/chadwicko.htm [Accessed 08th October 2011]

Peter, G. (2010) Impact of rural water projects on hygiene behaviour in Swaziland. *Physics and Chemistry of the Earth* [Online], **35**, 772-779. Available from: doi:10.1016/j.pce.2010.07.024 [Accessed 6th May 2011]

Pollack, C.E., Griffin, B.A. and Lynch, J. (2010) Housing affordability among homeowners and renters. *American Journal of Preventative Medicine* [Online], **39**(6), 515-521. Available from: Doi; 10.1016/j.amepre.2010.08.002 [Accessed 19th August 2011]

Poortinga, W., Dunstan, F.D and Fone, D.L. (2008) Neighbourhood deprivation and self-rated health: The role of perceptions of the neighbourhood and of housing problems. *Health and Place* [Online], **14**, 562-575. Available from: doi:10.1016/j.healthplace.2007.10.003 [Accessed 10th October 2011]

Preval, N., Chapman, R., Pierse, N., Howden-Chapman, P. and The Housing, Heating and Health Group. (2010) Evaluating energy, health and carbon co-benefits from improved domestic space heating: a randomized community trial. *Energy Policy* [Online], **38**, 3965-3972. Available from: doi.10.1016/j.enpol.2010.03.020 [Accessed 10th May 2011]

Pugh, C. (2000) Squatter Settlements: their sustainability, architectural contributions, and socio-economic roles. *Cities* [Online], **17**(5), 325-337, Available at: PII: S0264-2751(00)00029-9. [Accessed 19th September 2005]

Putnam, R. (1996) Who killed civic America? *Prospect* [Online] **6**, United Kingdom: Prospect2009. Available from: http://www.prospectmagazine.co.uk/1996/03/whokilledcivicamerica/ [Accessed 20th August 2010]

Putnam, R. (2004) Education, diversity, social cohesion and social capital. *In: Raising the quality of learning for all: Proceedings of a meeting of OECD Ministers, Dublin, 18-19 March 2004*, Dublin: OECD [Online]. Available at: www.oecd.org/dataoecd/2/30/2380806.pdf [Accessed 14th August 2011]

Ramin, B. (2009).Slums, climate change and human health in Sub-Saharan Africa, *Bulleting of the World Health Organisation* [Online], **87**, 886-886. Available from: doi:10.2471/BLT.09.073445 [Accessed 25th September 2011]

Ramgolan, R. (1997) Environment and human health: a threat to all. *Environmental Management*, **8** (2), 51-66

Republic of South Africa (1996). The Constitution of the Republic of South Africa. As adopted on 8 May 1996 and amended on 11 October 1996 by the Constitutional Assembly, Cape Town: RSA

Republic of South Africa (1997). Housing Act 1997, act no. 107 of 1997. *Government Gazette*, Cape Town: Government Printers

Republic of South Africa. (1988) Free Settlement Areas Act, act no. 102 of 1988. Pretoria: Government Printers

Republic of South Africa. (1977) South African National Building Regulations and Building Standards Act, act no. 103 of 1977 (as amended). Pretoria: Government Printers

Richards, R., O'Leary, B. and Mutsonziwa, K. (2006) Measuring quality of life in informal settlements in South Africa. *Social Indicators Research* [Online], **81**, 375-388. Available from: doi:10.1007/s11205-006-9014-1 [Accessed 30th August 2011]

Rothman, K.J. and Greenland, S. (1997) Modern Epidemiology, 2nd Edition, Lippincott-Raven Publishers, Philadelphia, USA

RSA (2008) A new housing policy and strategy for South Africa 1994, SA Government Information [Online]. Available from: http://www.info.gov.za/whitepapers/1994/housing.htm#5.3 [18th May 2009]

Ruel, E., Oakley, D., Wilson, G.E. and Maddox, R. (2010) Is public housing the cause of poor health or a safety net for the unhealthy poor? *Journal of Urban Health*, **87**(5),827-838. Available from: doi:10.1007/s11524-010-9484-y [Accessed 12th October, 2011]

Saff, G. (1990) The probable effects of the introduction of the free settlements areas in Johannesburg. *Urban Forum- Earth and Environmental Sciences* [Online], **1**(1), 5-27. Available from: DOI: 10.1007/BF03036524 [Accessed 24th September 2011]

Sagar, A.D. (2005) Alleviating energy poverty for the world's poor. *Energy Policy* [Online], **33**, 1367-1372. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271097*and*_user=3956543*and*_pii=S0301421504000096*and*_check=y*and*_origin=*and*_coverDate=31-Jul-2005*and*view=c*and*wchp=dGLzVlV-zSkzV*and*md5=7a45eef36a01f2dfbf1a8d0ddbb94569/1-s2.0-S0301421504000096-main.pdf [Accessed 29th August 2011]

Salehzadeh, A., Tavacol, P. and Mahjub, H. (2007) Bacterial, fungal and parasitic contamination of cockroaches in public hospitals of Hamadan, Iran. *Journal of Vector Borne Disease* [Online], **44**, 105-110. Available from: http://www.mrcindia.org/journal/issues/442105.pdf [Accessed 18th October 2011]

Sandel, M. and Wright, R.J. (2006). When home is where the stress is: expanding the dimensions of housing that influence asthma morbidity. *Archives of Disease in Childhood* [Online], **91**(11), 942-948. Available from: doi10.1136/adc.2006.098376 [Accessed 24th September 2011]

Sandel, M., Sharfstein, J., Kahn, R.S. and Bauchner, H. (2000) No place like home: child health status and housing-related health hazards in families about to receive federally funded housing subsidies. *NLM Gateway* [Online]. Available from: http://gateway.nlm.nih.gov/MeetingAbstracts/ma?f=102272439.html [Accessed 10th March 2011]

Schoenbach, V.J. (1999) Analytical study designs, *New Jersey, USA* [Online]. Available from: http://www.epidemiolog.net/evolving/AnalyticStudyDesigns.pdf [Accessed 19th February 2010]

Stockholm Environment Institute (SEI). (2010) How to implement renewable energy and energy efficient options [Online], 12-27. Available from : http://www.energycommunity.org/documents/SEA4.Solar%20water%20heater%20implementation.pdf [Accessed 24th June 2011]

Sexwale, T. (2011) Address by the Minister of Human Settlements, Tokyo Sexwale MP, on the occasion of the Human Settlements Budge Vote, National Assembly Cape Town [Online]. Available from: http://www.info.gov.za/speech/DynamicAction?pageid=461*and*sid=17894*and*tid=32315 [Accessed 24th June 2011]

Sharfstein, J. and Sandel. M. (eds.) (1998) Not safe at home; how America's housing crisis threatens the health of its children. Boston: Boston Medical Center [Online]. Available from: http://www.afhh.org/ifc/Not%20Safe%20At%20Home.pdf [Accessed 24th February 2004]

Sharfstein, J., Sandel M. and Kahn, R. (2001) Is child health at risk while families wait for housing vouchers? *America Journal of Public Health* (Online), **91**(8), 1191-1193. http://ajph.aphapublications.org/cgi/reprint/91/8/1191.pdf [23rd April 2002]

Shaw, R.A., Louw, M. and Brettel, S., (2001) Reducing crime in Durban, victim survey and safer city strategy. *Institute for Security Studies (ISS),* Pretoria, Monograph No 58. Cited in Richards *et al.*, (2006) Measuring quality of life in informal settlements in South Africa. *Social Indicators Research* [Online], **81**, 375-388. Available from: doi:10.1007/s11205-006-9014-1 [Accessed 25th September 2011]

Sheppard, L. (2006) Ecological Study Design. Encyclopedia of Environmetrics, University of Washington, WA, USA

Shortt, N. and Rugkasa, J., (2007) "The walls were so damp and cold": fuel poverty and ill-health in Northern Ireland from a housing intervention. *Health and Place* [Online], **13**, 99–110. Available from: Doi:10.1016/j.healthplace.2005.10.004 [Accessed 6th June 2011]

Singh, A.L., Fazal, S., Azam, F and Rahman, A. (1996) Income, environment and household- A household level study of Aligarh City, India. *Habitat International*, **20**(1), 77-91.

Smit, W. (2003) The impact of the transition from informal housing to formalized housing in low-income housing projects in South Africa. *Journal of the Development Action Group (DAG), Cape Town,*1-22. In: *Nordic Africa Institute Conference on the Formal and Informal City- What Happens at the Interface? Proceedings of a conference, Copenhagen, 15-18 June, 2000* [Online]. Available from: http://www.j:dagpubs\mariken3.rtf [Accessed 19th August 2011]

Sohel-Rana, M.D. (2009) Status of water use sanitation and hygiene condition of urban slums: a study on Rupsha Ferigat slum, Khulna. *Journal of Desalination* [Online], **246**, 322-328. Available from: Doi10.1016/j.desal.2008.04.052 [Accessed 16th May 2011]

Sorenson, S.B., Morssink, C. And Campos, P.A. (2011) Safe access to safe water in low-income countries: water fetching in current times. *Social Science and Medicine* [Online], **72**, 1522-1526. Available from: http://www.womenforwater.org/docs/Paper_water_fetching.pdf [Accessed 10th September 2011]

South African Government Information. (1994) A new housing policy and strategy for South Africa 1994 [Online]. Available from: http://www.info.gov.za/whitepapers/1994/housing.htm [Accessed 24th February 2010]

South Peninsula Municipality (SPM). (2000) Housing Administration Section Report: 1999-2000. Cape Town: SPM

Spalding-Fletcher, R. (2005). Health Benefits of electrification in developing countries: a quantitative assessment in South Africa. *Energy for Sustainable Development*, **IX**(1): 53-62.

Spalding-Fletcher, R., Clark, A., Davis, M., and Simmonds, G. (2002) The economics of energy efficiency for the poor- a South African case study. *Energy* [Online], **27**, 1099-1117. Available from: PII: S0360-5442(02)00081-6 [Accessed 10th May 2011]

Srinivas, H. (1994) Defining squatter settlements [Online]. Available from: http://www.gdrc.org/uem/define-squatter.html [Accessed 30th September 2004]

Stadler, A. W. (1979) Birds in the cornfield: squatter movements in Johannesburg, 1944-1947. *Journal of Southern African Studies - Special Issue on Urban Social History* [Online], **6**, (1), 93-123. Available from: http://links.jstor.org/sici?sici=0305-7070%28197910%296%3A1%3C93%3ABITCSM%3E2.0.CO%3B2-S [Accessed 24th September 2011]

Statistics South Africa (StatsSA). (2001) Census 2001/2001. Cited in Wekesa, B.W., Steyn, G.S. and Otieno, F.A.O. (2011) A review of physical and socio-economic characteristics and intervention approaches of informal settlements. *Habitat International* [Online], **35**, 238-245. Available from: doi:10.1016/j.habitatint.2010.09.006 [Accessed 20th September 2011]

Stronegger, W.J., Titze, S. and Pekka, O. (2010) Perceived characteristics of the neighbourhood and its association with physical activity behavior and self-rated health. *Health and Place* [Online] **16,** 736-743. Available from: doi.10.1016/j.healthplace.2010.03.005 [Accessed 19th August 2011]

Sustainable Energy Africa (SEA). (2006) State of energy in South African cities. Westlake: SEA [Online]. Available from: http://www.npcOnline.co.za/MediaLib/Downloads/Home/Tabs/Diagnostic/MaterialConditions2/State%20of%20Energy%20in%20South%20African%20Cities%202006.pdf [Accessed 10th October 2011]

Tallis, R. (2011) Jeremy Bentham (1748-1832) [Online]. Available from: http://www.humanism.org.uk/humanism/humanist-tradition/freethinkers/jeremy-bentham [Accessed 8th October 2011]

Thomas, E.P., Seager, J.R. and Viljoen, E. (1999) Household Environment and Health in Port Elizabeth, South Africa: Executive Summary. *Urban Health and Development Bulletin*. **2**, 41-54.

Thomas EP, Seager JR, Viljoen E, *et al.* (2001) Household Environment and Health in Port Elizabeth, South Africa. Executive Summary. Port Elizabeth: South African Medical Research Council, University of Port Elizabeth, and Stockholm: Environment Institute, Sweden. Cited in Tolosana, S., Rother, H-A. and London, L. (2009) Child's Play: exposure to household pesticide use among children in rural, urban and informal areas of South Africa. *South African Medical Journal*, **99**(3), 180-184

Thomas, E.P., Seager, J.R. and Mathee, A. (2002) Environmental health challenges in South Africa: policy lessons form case studies. *Health and Place* [Online], **8**, 251-261. Available from: PII:S 1 3 5 3 – 8 2 9 2 (0 2) 0 0 0 0 6 – 0 [Accessed 19th September 2011]

Thomas, E.P., Seager, J.R., Viljoen, E., Potgieter, F., Rossouw, B., Tokota, B., McGranahan, G. and Kjellèn, M. (1999) Household, Environment and Health in port Elizabeth. *South Africa. Medical Research Council of South Africa (MRC), Stockholm Environment Institute (SEI) and SIDA* [Online]. Available from: http://www.mrc.ac.za/healthdevelop/householdpart1.pdf [Accessed 5th November 2004]

Tolosana, S., Rother, H-A. and London, L. (2009) Child's Play: exposure to household pesticide use among children in rural, urban and informal areas of South Africa. *South African Medical Journal*, **99**(3), 180-184

Tomlinson, M., (1998) South Africa's new housing policy: An assessment of the first two years, 1994-1996. *International Journal of Urban and Regional Research*, **22**(1), 137-147

Torres-Dosal, A., Pérez-Maldonado, I.N., Jasso-Pineda, Y., Martínez Salinas, R.I., Alegría-Torres, J.A. and Díaz-Barriga, F. (2008) Indoor air pollution in a Mexican indigenous community: evaluation of risk reduction program using biomarkers of exposure and effect. *Science of the Total Environment*, **390**, 362–368

Transnet, (1998) South African railway development. *The Union Limited* [Online], South Africa. Available from: http://home.intekom.com/bluegrass/sites/steamsa/general1.html [Accessed 23rd September 2011)

United Nations (UN). (1997) Glossary of environment statistics: studies in methods. Series **F**, 67. New York, United Nations

UNEP. (2005) Solid waste management. *United Nations Environment Programme, Ca Incorporated, ISBN: 92-807-2676-5* [Online]. *Available from:* http://www.unep.or.jp/ietc/publications/spc/solid_waste_management/Vol_I/Binder1.pdf [Accessed 24th August 2011]

Union of South Africa (1951) The Prevention of Illegal Squatting Act, act no. 52 of 1952. *Government Printers, Pretoria, South Africa* [Online]. Available from: http://www.disa.ukzn.ac.za/index.php?option=com_displaydc*and*recordID=leg19510706.028.020.052 [Accessed 26th January 2010]

Union of South Africa (1913) Native's Land Act, act no. 27 of 1913. *Union of South Africa* [Online]. Available from: http://www.polity.org.za/polity/govdocs/legislation/misc/nla1913.html [Accessed 25th January 2010]

Union of South Africa (1950) The Group Areas Act, act no. 41 of 1950. *Government Printers, Pretoria, South Africa* [Online]. Available from: http://www.britannica.com/EBchecked/topic/247103/Group-Areas-Act [Accessed 24th September 2011]

Verebeek, G. and Hens, H. (2005) Energy savings in retrofitted dwellings: economically viable? Cited in Lloyd, C.R., Callau, M.F., Bishop, T., and Smith, I.J. (2008) The efficacy of an energy efficient upgrade program in New Zealand. *Energy and Buildings* [Online], **40**, 1228-1239. Available from: doi:10.1016/j.enbuild.2007.11.006 [Accessed 10th May 2011]

Victorino, C.V. and Gauthier, A.H. (2009) The social determinants of child health: variation across health outcomes-a population-based cross-sectional analysis. *BioMedCentral Paediatrics* [Online], **9**, 53. Available from: doi:10.1186/1471-2431-9-53 [Accessed 13th October 2011]

Von Schirding, Y.E.R., Yach, D., Blignaut, R. and Matthews, C. (1991) Environmental determinants of acute respiratory symptoms and diarrhea in young coloured children living in urban and peri-urban areas of South Africa. *South African Medical Journal,* **79,** 457-460. Cited in Westaway, M. and Viljoen, E. (2000). Health and hygiene knowledge, attitude and behavior. *Health and Place* [Online], **6**, 25-32; Available from: PII:S1353-8292(99)00027-1[Accessed 15th August 2010]

Walker, J., Hill, R.C. and Bowen, P.A. (2000) A sustainability assessment method for Greenfields, low-cost, cement block housing development on the Cape Flats, Cape Town. *Proceedings: Strategies for a Sustainable Built Environment, Pretoria, 23-25 August, 2000* [Online]. Available from: http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/bowen,hill,etc.pdf [Accessed 24th September 2011]

Wallace, D. and Wallace R. (1998) Scales of geography, time and population: The study of violence as a public health problem. *American Journal of Public Health* **88**(12), 1853-1858. Waldorf, USA: American Public Health Association (APHA)

Wang, C. and Bennet, G. (2010) A practical guide to cockroach control in multi-family housing units. *Purdue Extension: E-241-W* [Online], Perdue University: Department of Entomology, Indiana [Online]. Available from: http://extension.entm.purdue.edu/publications/E-241.pdf [Accessed 20th October 2011]

Wang'ombe, J.K. (1995) Public health crises of cities in developing countries. *Social Science and Medicine,* **41**(6), 857-862, Great Britain: Elsevier

Wasylishyn, C. and Johnson, J.L. (1998) Living in a housing co-operative for low-income women: issues of identity, environment and control. *Social Science and Medicine* [Online], **47**(7), 973-981. Available from: PII:S0277-9536(8)00170-1 [Accessed 10th October 2011]

Watson, T. (2006). Public Health investment and the infant mortality gap: evidence from federal sanitation interventions on U.S. Indian reservations. *Journal of Public Economics* [Online], **90**, 1537-1560. Available from: doi:10.1016/j.jpubeco.2005.10.002 [Accessed 12th May 2011]

Wekesa, B.W., Steyn, G.S. and Otieno, F.A.O. (2010) The response of common building construction technologies to the urban poor and their environment. *Building and Environment* [Online], **45**, 2327-2335. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271434*and*_user=3956543*and*_pii=S0360132310001381*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=2010-10-31*and*wchp=dGLzVlt-zSkzk*and*md5=7658dcb887af6b852aafb90a5c2d975a/1-s2.0-S0360132310001381-main.pdf [Accessed 25th July 2011]

Wekesa, B.W., Steyn, G.S. and Otieno, F.A.O. (2011) A review of physical and socio-economic characteristics and intervention approaches of informal settlements. *Habitat International* [Online], **35**, 238-245. Available from: doi:10.1016/j.habitatint.2010.09.006 [Accessed 15th September 2011]

Wells, N.M. and Harris, J.D. (2007) Housing quality, psychological distress and the mediating role of social withdrawal: a longitudinal study of low-income women. *Journal of Environmental Psychology* [Online], **27**, 69-78. Available from: doi:10.1016/j.jenvp.2006.11.002 [Accessed 31st May 2011]

Westaway, M. and Viljoen, E. (2000) Health and hygiene knowledge, attitude and behavior. *Health and Place* [Online], **6**, 25-32. Available from: PII:S1353-8292(99)00027-1 [Accessed 15th August 2010]

Westaway, M. S. (2006) A longitudinal investigation of satisfaction with personal and environmental quality of life in an informal South African housing settlement, Doornkop, Soweto. *Habitat International* [Online], **30**, 175-189. Available from: http://www.sciencedirect.com/science?_ob=MiamiImageURL*and*_cid=271760*and*_user=3956543*and*_pii=S0197397504000852*and*_check=y*and*_origin=search*and*_zone=rslt_list_item*and*_coverDate=2006-03-31*and*wchp=dGLbVlV-zSkzV*and*md5=2ca12045f7a4474e6a46e5022b4d9145/1-s2.0-S0197397504000852-main.pdf [Accessed 6th April 2011]

Westaway, M.S. (1993). Perceptions of refuse and household refuse removal in Rabie Ridge, *CHASA Journal of Comprehensive Health*, **4**, 84-86. Cited in Westaway, M. and Viljoen, E. (2000) Health and hygiene knowledge, attitude and behavior. *Health and Place*, **6,** 25-32. Available from: PII:S1353-8292(99)00027-1 [Accessed 15th August 2010]

Western Cape Government. (2004) Free water and electricity. Cape Town [Online]. Available from: http://www.westerncape.gov.za/eng/directories/services/14709/22195 [Accessed 8th October 2011]

Wilkinson, P., Smith, K.R., Davies, M., Adair, H., Armstrong, B.G., Barret, M., Bruce, N., Hamilton, I., Oreszczyn, T., Ridley, I., Tonne, C. and Zaid, C. Public health benefits of strategies to reduce greenhouse-gas emissions: household energy. *The Lancet: Health and Climate Change 1 Series* [Online], **374**, 1917-1929. Available from: doi:10.1016/S0140-6736(09)61713-X [Accessed 4th April 2011]

Wilson, D.C., Velis, C. and Cheeseman, C. (2006) Role of informal sector recycling in waste management in developing countries. *Habitat International* [Online], **30**, 797-808. Available from: doi:10.1016/j.habitatint.2005.09.005 [Accessed 15th September 2011]

Winkelstein Jnr., W.(2011) History of Public Health. *Encyclopedia of Public Health* [Online]; Available at: http://www.enotes.com/public-health-encyclopedia/history-public-health [Accessed: 10th October 2011]

Winkler, H., Simões, A.F., La Rovere, E.L., Alam, M., Rahman, A and Mwakasonda, S. (2011) Access and affordability of electricity in developing countries. *World Development* [Online], **39**(6), 1037-1050. Available from: doi:10.1016/j.worlddev.2010.02.021 [Accessed 10th October 2011]

Worger, H. and Byrnes, R.M. (2011) History of South Africa. South Africa [Online]. Available from: http://www.nationsOnline.org/oneworld/History/South-Africa-history.htm [Accessed 8th October 2011]

World Health Organisation (WHO) (1948) Ottawa charter for health promotion. Switzerland: WHO. Cited in WHO (1998) *Health promotion glossary*. Geneva, WHO [Online]. Available at http://www.who.int/hpr/NPH/docs/hp_glossary_en.pdf [Accessed 5th August 2010]

World Health Organization (*undated*) Sanitation and health program, Chapter Four: bedbugs, fleas, lice ticks and mites [Online], 237-261, WHO, Geneva, Switzerland. Available from: http://www.who.int/water_sanitation_health/resources/vector237to261.pdf [Accessed 20th October 2011]

Wutich, A. and Ragsdale, K. (2008) Water insecurity and emotional distress: coping with supply, access, and seasonal variability of water in a Bolivian squatter settlement. *Social Science and Medicine* [Online], **67**, 2116-2125. Available from: doi:10.1016/j.socscimed.2008.09.042 [Accessed 29th August 2011]

Yose, C. (1999) *From Shacks to Houses: Space Usage and Social Change in a Western Cape Shanty Town.* Cited in: Smit, W. (2003) The impact of the transition from informal housing to formalized housing in low-income housing projects in South Africa. *Journal of the Development Action Group (DAG), Cape Town,*1-22. In: *Conference Proceedings: Nordic Africa Institute Conference on the Formal and Informal City- What Happens at the Interface?, Copenhagen, 15-18 June, 2000* [Online]. Available from: http://www.j:dagpubs\mariken3.rtf [Accessed 19th August 2011]

ANNEXURE A: CONSENT FORM

UNIVERSTY OF THE WESTERN CAPE

FACULTY: COMMUNITY AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH: PUBLIC HEALTH PROGRAMME

Dear Sir/Madam

You are invited to partake in this study conducted by Louella Daries, a post-graduate student at the University of the Western Cape (UWC), enrolled for the Masters Degree in Public Health. The aim of the study is to find out factors about your community circumstances while living in the informal settlement and then again after you relocate to the low-cost RDP housing. This will help me to understand the make-up of the community and how the move affects the health of your household and the environmental conditions. I will also ask questions regarding the health of the household members and about the health of the environment. You are selected to be part of this study as all persons living in Pelikan-Park-Zeekoevlei and Phumlani Village will form part of the study.

If you decide to take part in the study, …….(fieldworker name) will interview you by asking questions and recording answers while you are living in the informal settlement. They will return again in 2 years time after you have relocated and conduct another interview. This should take approximately 60 minutes. This study is merely to collect data and may not be of any benefit to you. Your participation is voluntary, i.e. you will not receive any payment for agreeing to partake in the study. You may withdraw at any point during the interview without providing any reasons for doing so.

Any information that you provide will be treated as confidential. Your will be used to identify your responses.

If you have any questions, please feel free to pose them to …….(fieldworker name) or you may contact me, Louella Daries directly at (021) 959 6034 during office hours.

If you agree, ……(fieldworker name) will tick the box that says ‘YES’ . This simply means that you have made a decision to take part in the study and that you have read the above/or the fieldworker has explained the details of the study to you.

I agree to take part in this study.

YES	NO

Fieldworker Name:……..Date: ……

ANNEXURE B: "BASELINE" QUESTIONNAIRE

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION:

1. Questionnaire number:

2. Where did you live before moving to this area? (mark appropriate box with an "X")

Lived in Cape Town	Lived outside Cape Town

3. Before moving to this area, did you live in formal or informal housing?

Lived in **informal** housing	Lived in **formal** housing

4. Who is the household head?

Male	Female	Male & Female

5. How many people, including children, live in this house? (record number of people)

6. How many **MALE** household members are **OLDER** than 16 years? (record number)

Number of Males >16yrs	

7. How many **FEMALE** household members are **OLDER** than 16 years? (record number)

Number of females >16yrs	

8. How many **MALE** household members are **YOUNGER** than 16 years? (record number)

Number of Males <16yrs	

9. How many **FEMALE** household members are **YOUNGER** than 16 years? (record number)

Number of Females <16yrs	

10. How many children who live in this household are ≤ 6 years old? (record number)

Number of children ≤6yrs	

11. How many adult persons (males and/or females) from this household have formal employment?

NO adult in formal employ	At least **ONE** adults in formal employ	Insert no. of adults in formal employ

12. How many persons (Males & females) from this household are employed in formal and/or informal employment?

NO adult employed	At least **ONE** adult employed	Insert no. of adults employed

13. How many **MALES** from this household are employed in formal and/or informal employment?

NO Male employed	At least **ONE** Male employed	Insert no. of Males employed

14. How many **FEMALES** from this household are employed in formal and/or informal employment?

NO female employed	At least **ONE** female employed	Insert no. of females employed

SECTION B: ENVIRONMENTAL HEALTH CONDITIONS

I. **INTERVIEWER OBSERVATIONS:**

15. Please mark the appropriate box (es) with an "X" regarding the environmental health conditions you observe and provide additional comments where applicable:

Littering and refuse dumps	No littering or refuse dumps

Comment:……

……

……

Evidence of pests/pest activity	No evidence of pests/pest activity

Comment:……

……

……

Stagnant pools of waste water	No stagnant pools of waste water

Comment:……

……

……

Bad odours	No bad odours

Comment:……

……

……

Environmental health conditions not acceptable	Environmental health conditions acceptable

Comment:……

……

……

NB: Additional commentary with regards to environmental health conditions observed:

……

……..……

……..……

II. HOUSEHOLD CROWDING

16. What is the size of the space/ area (m^2) used for sleeping purposes?

m^2	**"X"**
0-3	
3.1-6	
6.1-9	
>9	

17. **For Office use only:**

Space available for sleeping purposes p/person: # people/area:	**House overcrowded**	**House not overcrowded**

III. HOUSEHOLD WATER USAGE:

18. Where do you obtain your water from? **Baseline:**

Communal standpipe	Other

19. If answer to the previous question was "Other", please identify the source (s) where you obtain your water from. (Interviewer: Please record all sources mentioned by respondent)

……

……

……

……

……

20. How many times **per day** do you collect water?

Times/day

21. How much water do you collect each time? (Interviewer please record total container size(s))

Liters

22. **Where** do you store the water that you collect?

Indoors	Outdoors	Do not store

23. **How** do you store the water that you collect?

Open container	Closed container

24. **For office use only:**

Amount of water used per month: **Total amount of water used p/day x 30 days/month:**	**Use ≤ 3000L water/month**	**Use ≥3000L water/month**

25. Can you please explain/describe what you do with your waste water?

……

……

……

……

…….

IV. HOUSEHOLD INDOOR AIR POLLUTION:

26. Where do you cook your main meal of the day?

Indoors	Oudoors

27. What types of fuel(s) do you use for cooking? (please tick appropriate box(es))

FUEL TYPE	**"X"**
Wood	
Paraffin	
Gas	
Electricity	
Other	

For office use only:

28. Is household exposed to indoor air pollution(IAP) due to cooking?

Exposed to IAP due to cooking	**Not exposed to IAP due to cooking**

29. What types of fuel(s) do you use for heating? (please tick appropriate box(es))

FUEL TYPE	**"X"**
Wood	
Paraffin	
Gas	
Electricity	
Other	

30. Where do you use the heating fuel?

Indoors	Outdoors

For office use only:

31. Is household exposed to indoor air pollution(IAP) due to heating?

Exposed to IAP due to heating	**Not exposed to IAP due to heating**

For office use only:

32. Is household exposed to indoor air pollution(IAP) due to cooking and heating?

Exposed to IAP due to cooking & heating	**Not exposed to IAP due to cooking & heating**

33. What type of fuel do you intend using once you have relocated to the formal house? (interviewer, please tick appropriate box(es))

FUEL TYPE	**"X"**
Wood	
Paraffin	
Gas	
Electricity	
Other	

V. <u>HOUSEHOLD SANITATION:</u>

34. What do you and your household members use as a toilet facility? (Interviewer, please tick both **<u>IF</u>** applicable)

Communal bucket toilet	Other

35. If answer to previous question included "Other", please identify the alternative(s) or additional facility(ies) used as a toilet.(Interviewer please list)

……

……

……

……

…….

36. Please explain, or provide reasons, why you and/or you household do not use the communal toilet facility.

……

……

……

……

……

For office use only:

37. Is household exposed to inadequate toilet facilities?

Exposed to inadequate toilet	**Not exposed to inadequate toilet**

VI. HOUSEHOLD SOLID WASTE MANAGEMENT:

38. Where do you store your refuse?

Indoors	Outdoors	Both indoors & outdoors

39. How do you store your household refuse?

Open container	Closed container	Both open and closed container

40. Please describe the container(s) you use to store your household refuse. (Interviewer please **LIST)**

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For office use only:

41. Does household practice inadequate refuse storage?

Inadequate refuse storage	**Adequate refuse storage**

42. Is your household refuse collected by the municipality?

YES	NO

43. How often is your household refuse collected by the municipality?(Please tick only **ONE** box)

Once p/week	More than once p/week	Refuse not collected by mun.	Unsure

44. Based on your answer to the previous question, do you feel that the household refuse collection frequency is adequate?

Inadequate	Adequate

45. If answer to previous question was “Inadequate”, please explain, or provide reasons why you feel the frequency of collecting household refuse is inadequate.

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46. Do you dispose of your refuse in any manner additional to the municipal collection process?

YES	NO

47. If answer to previous question was “YES”, can you please describe the additional way(s) in which you dispose of your household refuse? (Interviewer please record all)

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VII. HOUSEHOLD PEST MANAGEMENT & PEST CONTROL:

48. Do you and/your household experience any pest problems?

YES	NO

49. If answer to previous question is "YES", can you identify or describe the pests that you and/or your household members experience problems with?(Interviewer please tick appropriate box(es) and record description)

Pest type identified	Description	"X"
Crawling		
Flying		
Rodents		
Stray animals		
Other		

50. Based on your answer to the previous question, can you explain, or provide reasons why you or your household members are experiencing problems with the pest (s) identified?

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SECTION C: PERSONAL AND HOUSEHOLD GENERAL HEALTH CONDITIONS

51. Did any children under the age of 6 years (including babies), experience ill-health due to any of the following during the last two (2) weeks?: (Interviewer please tick **ALL** applicable boxes)

Ill-health experienced	"X"
Diarrhoea/Runny stomach	
Respiratory infections	
Skin infections	
Eye infections	
Other ill-health events	

Thank you for taking part in this interview.

ANNEXURE C: "2 YEARS RELOCATED" QUESTIONNAIRE

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION:

1. Questionnaire number: | |

2. Where did you live before moving to this area? (mark appropriate box with an "X")

Lived in Cape Town	Lived outside Cape Town

3. Before moving to this area, did you live in formal or informal housing?

Lived in **informal** housing	Lived in **formal** housing

4. Who is the household head?

Male	Female	Male & Female

5. How many people, including children, live in this house? (record number of people)

6. How many **MALE** household members are **OLDER** than 16 years? (record number)

Number of Males >16yrs	

7. How many **FEMALE** household members are **OLDER** than 16 years? (record number)

Number of females >16yrs	

8. How many **MALE** household members are **YOUNGER** than 16 years? (record number)

Number of Males <16yrs	

9. How many **FEMALE** household members are **YOUNGER** than 16 years? (record number)

Number of Females <16yrs	

10. How many children who live in this household are ≤ 6 years old? (record number)

Number of children ≤6yrs	

11. How many adult persons (males and/or females) from this household have formal employment?

NO adult in formal employ	At least **ONE** adults in formal employ	Insert no. of adults in formal employ

12. How many persons (Males & females) from this household are employed in formal and/or informal employment?

NO adult employed	At least **ONE** adult employed	Insert no. of adults employed

13. How many **MALES** from this household are employed in formal and/or informal employment?

NO Male employed	At least **ONE** Male employed	Insert no. of Males employed

14. How many **FEMALES** from this household are employed in formal and/or informal employment?

NO female employed	At least **ONE** female employed	Insert no. of females employed

SECTION B: ENVIRONMENTAL HEALTH CONDITIONS

I. **INTERVIEWER OBSERVATIONS:**

15. Please mark the appropriate box (es) with an "X" regarding the environmental health conditions you observe and provide additional comments where applicable:

Littering and refuse dumps	No littering or refuse dumps

Comment:……

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Evidence of pests/pest activity	No evidence of pests/pest activity

Comment:……

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Stagnant pools of waste water	No stagnant pools of waste water

Comment:……

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Bad odours	No bad odours

Comment:……

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Environmental health conditions not acceptable	Environmental health conditions acceptable

Comment:……

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NB: Additional commentary with regards to environmental health conditions observed:

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II. HOUSEHOLD CROWDING

16. What is the size of the space/ area (m^2) used for sleeping purposes?

m^2	**"X"**
0-3	
3.1-6	
6.1-9	
>9	

17. For Office use only:

Space available for sleeping purposes p/person: # people/area:	**House overcrowded**	**House not overcrowded**

18. Have you extended this dwelling, either formally or informally

YES	NO

19. If answer to the previous question was "Yes", what happened to the extension?

Extension still there	Extension demolished

20. What do you use the extended space for?

Sleeping purposes	Other purposes

21. Do you intend to extend or extend further?

Yes	No

22. What do you intend using the future extension for?

Sleeping purposes	Other purposes

III. <u>HOUSEHOLD WATER USAGE:</u>

23. Where do you obtain your water from?

In-House Tap	Other

24. If answer to the previous question was "Other", please identify the source (s) where you obtain your water from. (Interviewer: Please record all sources mentioned by respondent)

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25. **<u>For office use only:</u>**

<u>Amount of water used per month:</u> **Total amount of water used p/day x 30 days/month:**	**Use ≤ 3000L water/month**	**Use ≥3000L water/month**

26. Have you/Are you experiencing any interruptions in your water supply?

YES	NO

27. Can you explain what the nature of the interruption is/provide some information regarding the interruption?

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28. How much (in Rands) do you pay for water per month? (Interviewer: please record amount in Rands)

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29. Can you please explain/describe what you do with your waste water?

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IV. <u>HOUSEHOLD INDOOR AIR POLLUTION:</u>

30. Where do you cook your main meal of the day?

Indoors	Oudoors

31. What types of fuel(s) do you use for cooking? (please tick appropriate box(es))

FUEL TYPE	**"X"**
Wood	
Paraffin	
Gas	
Electricity	
Other	

<u>For office use only</u>:

32. Is household exposed to indoor air pollution(IAP) due to cooking?

Exposed to IAP due to cooking	**Not exposed to IAP due to cooking**

33. What types of fuel(s) do you use for heating? (please tick appropriate box(es))

FUEL TYPE	**"X"**
Wood	
Paraffin	
Gas	
Electricity	
Other	

34. Where do you use the heating fuel?

Indoors	Outdoors

For office use only:

35. Is household exposed to indoor air pollution(IAP) due to heating?

Exposed to IAP due to heating	**Not exposed to IAP due to heating**

For office use only:

36. Is household exposed to indoor air pollution(IAP) due to cooking and heating?

Exposed to IAP due to cooking & heating	**Not exposed to IAP due to cooking & heating**

V. HOUSEHOLD SANITATION:

37. What do you and your household members use as a toilet facility? (Interviewer, please tick both **IF** applicable)

In-house flush toilet	Other

38. If answer to previous question included "Other", please identify the alternative(s) or additional facility(ies) used as a toilet.(Interviewer please list)

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39. Please explain, or provide reasons, why you and/or you household do not use the in-house flush toilet facility.

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For office use only:

40. Is household exposed to inadequate toilet facilities?

Exposed to inadequate toilet	**Not exposed to inadequate toilet**

VI. <u>HOUSEHOLD SOLID WASTE MANAGEMENT:</u>

41. Where do you store your refuse?

Indoors	Outdoors	Both indoors & outdoors

42. How do you store your household refuse?

Open container	Closed container	Both open and closed container

43. Please describe the container(s) you use to store your household refuse. (Interviewer please **<u>LIST)</u>**

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44. * Do you own an "Otto-Bin"?

YES	NO

45. If answer to previous question if "YES", please explain what do you use the 'Otto-Bin" for?

Storing refuse	Other

46. Where do you store your "Otto-Bin"?

Indoors	Outdoors

47. If answer to previous question is “Indoors”, please explain, or provide reasons why you store the “Otto-Bin” indoors.

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For office use only:

48. Does household practice inadequate refuse storage?

Inadequate refuse storage	**Adequate refuse storage**

49. Is your household refuse collected by the municipality?

YES	NO

50. How often is your household refuse collected by the municipality?(Please tick only **ONE** box)

Once p/week	More than once p/week	Refuse not collected by mun.	Unsure

51. Based on your answer to the previous question, do you feel that the household refuse collection frequency is adequate?

Inadequate	Adequate

52. If answer to previous question was “Inadequate”, please explain, or provide reasons why you feel the frequency of collecting household refuse is inadequate.

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53. Do you dispose of your refuse in any manner additional to the municipal collection process?

YES	NO

54. If answer to previous question was “YES”, can you please describe the additional way(s) in which you dispose of your household refuse? (Interviewer please record all)

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VII. <u>HOUSEHOLD PEST MANAGEMENT & PEST CONTROL:</u>

55. Do you and/your household experience any pest problems?

YES	NO

56. If answer to previous question is “YES”, can you identify or describe the pests that you and/or your household members experience problems with?(Interviewer please tick appropriate box(es) and record description)

Pest type identified	**Description**	**“X”**
Crawling		
Flying		
Rodents		
Stray animals		
Other		

57. Based on your answer to the previous question, can you explain, or provide reasons why you or your household members are experiencing problems with the pest (s) identified?

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SECTION C: PERSONAL AND HOUSEHOLD GENERAL HEALTH CONDITIONS

58. Did any children under the age of 6 years (including babies), experience ill-health due to any of the following during the last two (2) weeks?: (Interviewer please tick **ALL** applicable boxes)

Ill-health experienced	**"X"**
Diarrhoea/Runny stomach	
Respiratory infections	
Skin infections	
Eye infections	
Other ill-health events	

59**.** Please rate **YOUR CURRENT** health status at this moment.

Excellent	Good	Average	Poor

60. Please rate **YOUR** health status since relocating to the RDP house (Mark only **ONE** with **"X"**).

Better	Worse	No change	Unsure

61. Please rate **HOUSEHOLD** health status since relocating to the RDP house (Mark only **ONE** with **"X"**).

Better	Worse	No change	Unsure

Thank you for taking part in this interview.