The health and sanitation status of specific low-cost housing communities as contrasted with those occupying backyard dwellings in the City of Cape Town, South Africa

by
Thashlin Govender

Dissertation presented for the degree of
Doctor of Philosophy (Community Health)
at the University of Stellenbosch

Promoter: Dr J.M. Barnes
Co-promoter: Prof C.H. Pieper
Faculty of Health Sciences
Division of Community Health

December 2011

Declaration

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

December 2011

Abstract

South Africa embarked on an ambitious program to rehouse the informally housed poor. These initiatives were formerly called the RDP and later the BNG programmes. This was aimed at improving the living conditions of the urban poor and consequently their health and poverty status. These low-cost houses were quickly augmented by backyard shacks in almost all settlements. The present study is an epidemiological assessment of the health and sanitation status of inhabitants of specific low cost housing communities in the City of Cape Town as contrasted with those occupying 'backyard dwellings' on the same premises. The study was undertaken in four low-cost housing communities identified within the City. A health and housing evaluation, together with dwelling inspections were carried out in 336 randomly selected dwellings accommodating 1080 inhabitants from Tafelsig, Masipumelela, Driftsands and Greenfields. In addition, the microbiological pollution of surface run-off water encountered in these settlements was assessed by means of *Escherichia coli* levels (as found by Colilert™ Defined Substrate Technology) as an indication of environmental health hazards.

The study population was classified as 'young' - 43% of the study population was aged 20 years or younger. Almost a third of households were headed by a single-parent female. In all four communities combined, 47.3% of households received one or other form of social grant. At the time of inspection 58% of the toilets on the premises were non-operational, while all the houses showed major structural damage - 99% of homeowners reported not being able to afford repairs to their homes. In 32% of dwellings one or more cases of diarrhoea were reported during the two weeks preceding the survey. Five percent of the participants willingly disclosed that they were HIV positive, while 11% reported being TB positive (one of them Multiple Drug Resistant TB). None of the HIV positive or TB positive persons was on any treatment. The *E. coli* levels of the water on the premises or sidewalks varied from 750 to 1 580 000 000 organisms per 100 ml of water - thus confirming gross faecal pollution of the environment.

Improvements in health intended by the re-housing process did not materialise for the recipients of low-cost housing in this study. The health vulnerability of individuals in these communities has considerable implications for the health services. Sanitation failures, infectious disease pressure and environmental pollution in these communities represent a serious public health risk. The densification caused by backyard shacks also has municipal service implications and needs to be better managed. Policies on low-cost housing for the poor need realignment to cope with the realities of backyard densification so that state-funded housing schemes can deliver the improved health that was envisaged at its inception. This is in fact a national problem affecting almost all of the state funded housing communities in South Africa. Public health and urban planning need to bridge the divide between these two disciplines in order to improve the health inequalities facing the urban poor.

Opsomming

Suid-Afrika is besig met 'n ambisieuse program om diegene wat in informele behuising woon te hervestig. Hierdie inisiatiewe is voorheen die HOP en tans die “BNG” programme genoem. Hierdie hervestigingsprogramme is gemik daarop om die lewensomstandighede van die stedelike armes en dus hulle gesondheid- en armoedestatus te verbeter. Hierdie laekoste huise is algou in byna alle nedersettings aangevul deur krotwonings in die agterplase. Die huidige studie is 'n epidemiologiese beoordeling van die gesondheid en sanitasiestatus van inwoners van spesifieke laekoste behuisingsgemeenskappe in die Stad Kaapstad in vergelyking met diegene wat krotwonings op dieselfde erwe bewoon. Die studie is onderneem in vier laekoste-behuising gemeenskappe geselekteer in die stadsgebied. 'n Gesondheid- en behuisingevaluasie tesame met 'n inspeksie van elke woning is uitgevoer in 336 ewekansig geselekteerde wonings wat 1080 inwoners gehuisves het. Die woonbuurte was Tafelsig, Masipumelela, Driftsands en Greenfields. Mikrobiologiese besoedelingsvlakke van oppervlak-afloopwater in hierdie gemeenskappe is bepaal deur middel van die bepaling van *Escherichia coli* vlakke (met behulp van Colilert™ Gedefinieerde Substraat Tegnologie) as aanduiding van gesondheidsgevare in die omgewing.

Die studiepopulasie is as ‘jonk’ geklassifiseer - 43% was 20 jaar of jonger. Amper een-derde van die huishoudings het 'n enkelouer-vrou aan die hoof gehad. In al vier gemeenskappe gesamentlik het 47.3% van die huishoudings die een of ander vorm van maatskaplike toelae ontvang. Tydens inspeksie is 58% van die toilette op die erwe as "nie-funksioneel" bevind, terwyl al die huise substansiële strukturele skade getoon het - 99% van die huiseienaars het gerapporteer dat hulle nie herstelwerk aan hulle huise kan bekostig nie. In 32% van die wonings is daar een of meer gevalle van diarree gedurende die voorafgaande twee weke voor die opname gerapporteer. Vyf persent van die deelnemers het vrywillig gerapporteer dat hulle HIV positief was terwyl 11% gerapporteer het dat hulle TB positief was (een was Veelvuldige Middelweerstandige TB). Nie een van die HIV positiewe of TB positiewe persone was op enige behandeling nie. Die *E. coli* vlakke van die water op die erwe of sypaadjies het gewissel vanaf 750 to 1 580 000 000 organismes per 100 ml water - wat erge fekale besoedeling van die omgewing bevestig het.

Die verbetering in gesondheid wat deur die hervestigingsproses voorsien is, het nie gematerialiseer vir die ontvangers van die laekoste-behuising in hierdie studie nie. Die kwesbaarheid van die gesondheid van die individue in hierdie gemeenskappe hou groot implikasies vir gesondheidsdienste in. Sanitasiefalings, infektiewe siektedruk en omgewingsbesoedeling hou groot openbare gesondheidsrisiko in. Die verdigting wat deur agterplaaskrotte meegebring word asook die gevolge vir munisipale dienste benodig beter bestuur. Beleide oor laekoste-behuising vir armes kort herbeplanning om die realiteite wat saamgaan met verdigting deur agterplaaskrotte te kan hanteer sodat die verwagte verbetering in

gesondheid kan materialiseer. Hierdie is inderwaarheid 'n nasionale probleem wat omtrent alle staatsbefondste laekoste-behuising gemeenskappe in Suid-Afrika affekteer. Openbare gesondheid en stadsbeplanning behoort die skeiding tussen hierdie twee dissiplines te oorbrug om sodoende die ongelyke gesondheidstatus van die stedelike armes aan te spreek.

For my brothers,
Shogan & Kershion

Acknowledgements

"Knowledge is in the end based on acknowledgement," and it is with much esteem and gratitude that I pay homage to the many people that have assisted me during the preparation of this dissertation.

- I am most grateful to my supervisor Dr J.M. Barnes for her commitment, technical expertise, time, planning, mentorship and the stimulating discussions. You have gone beyond the call of duty and I am blessed to have had the fortunate opportunity to work with you. Your passion for Community Health has inspired me to continue in your strides and create a legacy of excellence. Baie Dankie!

- With much admiration, I am also honoured to have worked with my co-supervisor Prof C.H. Pieper. I am most appreciative for all the encouragement, guidance, time and support. Your enthusiasm and leadership on the study has certainly contributed towards its success and my fine training. Haben Sie vielen Dank!

Khalil Gibran wrote "the teacher who is indeed wise does not bid you to enter the house of his/her wisdom but rather leads you to the threshold of your mind," and both of you certainly have.

- I would like to thank the German Academic Exchange Service (DAAD), the National Research Foundation, the Harry Crossley Foundation and Stellenbosch University for the funding of the study.

- This study would not have been possible without the cooperation of the participants from the Masipumelela, Driftsands, Greenfield, Tafelsig, Mfuleni and Westbank communities. Thank you for your patience and candidness.

- I am indebted to Sister N. Lethuka for her assistance with the fieldwork. Your eagerness and attention to detail contributed towards the superior quality of the study data. Enkosi kakhulu!

- A special thank you to Prof T.J. Britz and Amanda Brand from the Department of Food Science at Stellenbosch University for the use of the laboratory and assistance with the water analyses.

- I would like to thank Prof M. Kidd from the Centre for Statistical Consultation at Stellenbosch University for statistical support.

- My sincere appreciation goes to Marie Kotze for all the scheduling and administrative support.

- Many thanks to Tiro Modisane, Farzana Rahiman, Randal Graeme Fisher, Preesha Persad, Shaloshini Naidoo, Joy Kistnasamy, Anusha Karamchand, and Petra De Koker for all of the assistance and encouragement.

- I am heartily thankful to my family for all of the support, faith and generosity over the years.

- Above all, salutations and prostrations to God for having blessed me with happy endings.
  Jai Hind!

ॐ भूर्भुवः स्वः
तत्सवितुर्वरेण्यं
भर्गो देवस्य धीमहि ।
धियो यो नः प्रचोदयात् ।।

Table of Contents

Declaration…… ii
Abstract…….... iii
Opsomming…….. iv
Acknowledgements…… vii
List of Figures……... xii
List of Tables…… xiii
List of Abbreviations…… xv
List of Addenda..…….... xvi

Chapter 1: The Phenomenon of Poverty……..……..……..... 1
1.1 What is poverty?..... 1
1.2 Defining poverty using different measures of income..... 3
1.3 The global extent of the problem of poverty..... 4
1.4 Root causes of poverty……..…….. 5
1.5 Social aspects of poverty……..…….. 6
1.5.1 Gender aspects of poverty……..……..... 6
1.5.2 Ignorance (poor problem-solving)……..……..... 7
1.5.3 Apathy (hopelessness) and depression in poverty……..……..... 8
1.5.4 Corruption, dishonesty and inappropriate utilisation of resources…..…..…… 9
1.5.5 Dependency on social assistance……..…… 10
1.6 Migration in and out of poverty……..……..... 11
1.7 Attributes of the urban poor as a subgroup……..…… 12
1.8 Urban poverty in South Africa……..……... 13
1.9 Interrelated forces shaping the health of the urban poor:
Poverty, Sanitation and Housing……..……. 17
1.9.1 Urban poverty and health……..……. 18
1.9.2 Urban sanitation and health……..……. 18
1.9.3 Urban housing and health……..……..... 21
1.10 Communicable diseases……..….... 21
1.11 Non-communicable diseases…….. 25
1.11.1 Risk factors……..……..……... 25
1.12 References…… 28

Chapter 2: Housing the Urban Poor..... 38
2.1 Introduction – Housing and health of the urban poor..... 38
2.2 The disconnect between community health and urban planning..... 42
2.3 International housing needs..... 42
2.3.1 International housing policies and programmes..... 43
2.3.2 Problems and constraints in the international provision of low-cost housing..... 45
2.4 Housing needs in South Africa..... 47
2.5 South Africa's response to housing needs..... 48
2.6 Low-cost housing settlements in South Africa..... 51
2.7 Backyard dwellings in South Africa..... 53
2.8 City of Cape Town housing needs..... 56
2.9 Challenges of low-cost housing settlements in the City of Cape Town..... 57
2.10 References..... 62

Chapter 3: Aim and Objectives of the study..... 70
3.1 Background 70
3.2 Aim and objectives of the present study 71
3.3 Ethical aspects of the study 73
3.4 Notes regarding the reporting of findings of the study 74

Chapter 4: General Information on Study Design, Procedures and Findings..... 75
4.1 Background to the study area..... 75
4.2 Design of the study..... 76
4.3 Sampling strategy..... 76
4.4 Research tools..... 79
4.5 Data analysis..... 83
4.6 Advantages and limitations of the study design..... 84
4.7 Declaration of participation of study leaders..... 86
4.8 References..... 87

Chapter 5: Research Papers 89
5.1 Paper 1: Living in low-cost housing settlements in Cape Town, South Africa – The epidemiological characteristics associated with increased health vulnerability..... 89

5.2 Paper 2: Housing conditions, sanitation status and associated health risks in selected subsidized low-cost housing settlements in Cape Town, South Africa 103

5.3 Paper 3: Contribution of water pollution from inadequate sanitation and housing quality from diarrhoeal disease in low-cost housing settlements of Cape Town, South Africa..... 118

5.4 Paper 4: The impact of densification by means of informal shacks in the backyards of state-funded low-cost housing on municipal services delivery in Cape Town, South Africa..... 136

Chapter 6: Overall Conclusions and Recommendations..... 155

6.1 Conclusion..... 155

6.2 Recommendations emanating from the findings of the study..... 157

6.2.1 Community Health Aspects..... 157

6.2.1.1 Poverty-related issues..... 157

6.2.1.2 Issues affecting heath status..... 159

6.2.1.3 Behavioural issues..... 162

6.2.1.4 Design of home infrastructure..... 163

6.2.1.5 Service delivery issues..... 164

6.2.1.6 Health care issues..... 165

6.2.1.7 Policy aspects..... 167

6.3 Lessons from the experience..... 168

6.4 References..... 170

List of Figures

Chapter 2

Figure 2.1: An adaptation of the Robert Wood Johnson foundation's model on how housing influences health…….. 40

Chapter 5

5.1 Research Paper 1

Figure 1: Comparison age frequency distribution of inhabitants in main house (mean age 25.02 ± 17.33years) and shack (mean age 24.5 ± 14.28 years)……..... 93

5.2 Research Paper 2

Figure 1: Diarrhoeal cases classified into age groups……... 111

5.3 Research Paper 3

Figure 1: Distribution of housing quality indices in low-cost houses…… 123
Figure 2: Disposal practices for two classes of household waste…… 124

List of Tables

Chapter 2

Table 2.1: The WHO assessment of evidence linking Health and Housing…..... 41
Table 2.2: Housing units completed or under construction (1994 to March 2008)…. 52

Chapter 5

5.1 Research Paper 1

Table 1: Sociodemographic characteristics of the study population…….. 94
Table 2: Aspects of economic status of the study population per dwelling type….. 95
Table 3: Reported health aspects of participants separated into dwelling types…. 96
Table 4: Meal frequency and substance usage per dwelling type.....….. 97

5.2 Research Paper 2

Table 1: Housing type and inhabitants in all four settlements in the study…..... 107
Table 2: Sites and design of low-cost houses in the study (*n*=173)……..... 108
Table 3: Housing quality indices of main houses…….. 109
Table 4: Health aspects of households in survey……..... 111

5.3 Research Paper 3

Table 1: Results of inspection of sanitation infrastructure (only for main houses, shacks did not have these amenities)…..…. 123
Table 2: Diarrhoeal cases (*n*=153) as per age group, gender and educational status.....…. 125
Table 3: Frequent signs and symptoms reported by participants in the different dwelling types……..... 125
Table 4: Percentage of respondents from both types of dwelling (n=336) reporting inappropriate disposal of household wastewater……..... 126
Table 5: Environmental run-off water samples from six different sample points in each of the four study sites…….. 127

5.4 Research Paper 4

Table 1: Sociodemographic characteristics of the study population……..... 141
Table 2: Distribution of observations of poor condition of low-cost (main) houses…..... 142

Table 3: The percentage of dwellings who dispose of household waste water inappropriately (n=336). 143
Table 4: Gender and age group of reported cases of diarrhoea……..... 144
Table 5: Five most frequent illnesses diagnosed at a clinic* and treated by medication as reported by participants, differentiated by housing type..... 145
Table 6: Reported ailments and treatment…….....…….... 145

List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ANC	African National Congress
BNG	Breaking New Ground
CCTM	City of Cape Town Metropole
CMA	Cape Metropolitan Area
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Disease
DALY	Disability-Adjusted Life Year
DOTS	Directly Observed Treatment, Short-course
E.coli	*Escherichia Coli*
HIV	Human Immunodeficiency Virus
HOP	Heropbou- en Ontwikkelings Program
ICESCR	International Covenant on Economic, Social and Cultural Rights
MDG	Millennium Development Goal
MDR-TB	Multi-Drug-Resistant Tuberculosis
NCD	Non-communicable Disease
RDP	Reconstruction and Development Programme
SAIRR	South African Institute for Race Relations
SAMRC	South African Medical Research Council
TB	Tuberculosis
USA	United States of America
USDA	United States Department of Agriculture
UN	United Nation
UNCHS	United Nations Centre for Human Settlements
WHO	World Health Organization
XDR-TB	Extensively Drug-Resistant Tuberculosis

List of Addenda

Appendix A:	Health Evaluation Questionnaire……..	171
Appendix B:	Housing Evaluation Questionnaire……...	175
Appendix C:	Dwelling Checklist……..	180
Appendix D:	Participant Information Leaflet and Consent Form……..……..	181
Appendix E:	Photographs from Study Areas…….....	185

CHAPTER 1

THE PHENOMENON OF POVERTY

Over the millennia access to adequate shelter has been a basic human need to be met on a priority basis.[1,2] Shelter is a broader concept than housing alone.[1,3] Although the links are complex, adequate shelter bears a strong relationship to health and other measures of well-being such as a sense of community and belonging.[1]

Housing, food and water are considered to be basic requirements for daily living.[2] Our livelihoods are intricately related to the place where we live.[2] A home is where families come together and it represents a place of security and shelter.[1] As described by the WHO, "a safe and intimate home has psychosocial benefits as a refuge from the outside world. This contributes to a sense of identity and attachment. Any intrusion of external factors or stressors decreases feelings of safety, intimacy and control, which may affect heath."[1]

The South African government embarked on an ambitious programme in 1994 to rehouse impoverished sections of the community through a scheme by which basic low-cost houses are allocated to poor families free of charge. The recipients of these houses were recruited from informal settlements and all successful candidates had to be poor as set out in a set of indigence criteria. The aim of this rehousing scheme was inter alia to improve the living conditions and the health status of the informally housed urban poor.

The rationale behind this research project was to investigate the living conditions and the qualitative and quantitative aspects of the sanitation of these rehoused groups to ascertain whether the goal of improved living conditions had led to a healthy home environment. As all the housing settlements are by legal requirement of the national housing scheme inhabited by impoverished persons who were not formally housed before. The common background to all the inhabitants of our study settlements is one of urban poverty. Since poverty is inextricably linked to housing and health, this chapter will review the complex challenges facing the poor, with emphasis on the urban poor - the subject of this study.

1.1 What is poverty?

Poverty has many facets, changing in space and time, and can be described in many ways.[4] Dr Margaret Chan of the World Health Organisation (WHO) said recently that people do not really live in squalid conditions – "they are stranded there."[5]

The debate on alternative perceptions of poverty has been continuing for a long time.[6] Three major approaches to define the phenomenon of poverty have been identified:[6]

- *An absolute approach:* poverty refers to people having less than an equitably defined absolute minimum income
- *A relative approach:* poverty refers to people having fewer financial resources than others in the community
- *A subjective approach:* poverty refers to people who feel that they do not have the resources or financial wear with all to 'make ends meet'

Each country defines poverty according to its level of values and the norms of society.[7] Since these factors differ, the poverty level will change from country to country. It therefore follows that there is no uniform poverty line.[7] The poverty line is an indication of the amount of financial resources the government or a society believes is necessary for people to enjoy a minimum level of subsistence or standard of living.[7]

There does not exist a common definition of poverty that is acceptable to all countries. Generally, poverty is not categorised in terms of material deprivation.[8] Poverty is principally defined as the state of being poor or deficient in financial resources or means of subsistence.[8] Increasingly, the notion of basic subsistence is measured inter alia by the availability of basic services, such as safe water supplies, adequate sanitation and solid-waste disposal[7] as well as malnutrition.[9]

The United Nations (UN) defined poverty as "the total absence of opportunities, accompanied by high levels of undernourishment, hunger, illiteracy, lack of education, physical and mental ailments, emotional and social instability, unhappiness, sorrow and hopelessness for the future.[10] Poverty is also characterised by a chronic shortage of economic, social and political participation, relegating individuals to exclusion as social beings, preventing access to the benefits of economic and social development and thereby limiting their cultural development."[10]

Poverty and people that are from the economic mainstream are present in all regions of the world according to the UN. A variety of reasons therefore exists why people cannot meet their basic needs.[10] The UN concluded that "two conditions - social and individual - limit the possibility of access to resources, knowledge and benefits to fulfill human needs. For the individual inequality translates to limitations in access to services and benefits such as education, health, recreation, potable water and public hygiene." Poor people also face a lack of opportunities for employment. The poor have scant access to jobs with decent payment and working conditions, work stability, occupational safety, security and other service benefits. Poor people are forced to take jobs with

low pay and few opportunities for advancement, risky working conditions and may face arbitrary dismissal.[10] "The combination of malnutrition, illiteracy, disease, high birth rates, underemployment and low income closes off the avenues of escape."[11]

1.2 Defining poverty using different measures of income

Most individuals live in households and share resources with others.[12] Household income per person is not a reliable measure of individual socioeconomic status.[12] The same resources when shared by several others can 'stretch further'.[12]

A significant limitation of a household equivalent income measure (i.e. an average) is that "it assumes equal sharing of resources within a family, a situation that may or may not reflect reality."[12] For example, children may not share equally in the available resources, parents may make sacrifices on behalf of their children; or married persons may not distribute resources proportionally.[12] Other limitations stated by Phipps (2003) were that it is notoriously difficult to collect reliable information on personal income; annual income does not account for past accumulation of either assets or debts; annual income does not take into account the amount of time required to acquire the income and annual disposable income does not account for differences in social goods provided to families.[12] These social goods can include free or low-cost public health care, government grants (e.g. for child support), etc.[12]

Even with these limitations in mind, Phipps (2003) stated that "household income after taxes and transfers (appropriately adjusted to account for differences in family size and assigned to each individual within the family) is the best readily available measure" of individual socioeconomic status for Canada.[12]

In the United States of America (USA) the measure of poverty is based on a Department of Agriculture (USDA) survey in the 1950s which showed that families spent about one-third of their incomes on food.[13] Consequently, the poverty threshold was set at three times the cost of an economy food plan defined by the USDA.[13] The thresholds vary according to the size and age composition of a family and it is updated every year to reflect the cost of living increases.[13] This measure of poverty relates to the absolute approach in defining poverty (i.e. having less than an equitably defined absolute minimum income).[13]

The USA national poverty measure has remained fairly standard since it was introduced in the 1960s.[14] Under this definition, poverty is determined by comparing pretax cash income with the

poverty threshold, which adjusts for family size and composition.[14] In 2008, according to the official measure, 39.8 million people (13.2% of the total USA population) lived in poverty.[15]

The existing official measure of poverty in the USA has been widely criticized.[14,15] Under the procedures by which the official poverty rate is calculated in that country, only cash income is taken into account in determining whether a family can be classified as poor.[15] Cash welfare payouts count for this calculation, but benefits from non-cash support programs, such as food stamps, medical care, social services, assistance with education and training, and housing are not included.[14]

In the context of affluent First World Countries, clear consensus among scholars in the field of poverty research deem that the relative approach to measuring poverty makes the most sense in the context of measuring poverty.[12] Measures of poverty in underdeveloped and developing nations are complicated by the lack of or unreliability of official data required for such calculations.[12]

1.3 The global extent of the problem of poverty

The problem of poverty is growing worldwide - more than 80% of the world's population lives in countries where income differentials are widening.[16] It has been estimated that half of the global population is made up of people living with poverty and a large proportion of these people live in cities, many of them in informal settlements.[17] Internationally, 1.2 billion people live in extreme poverty where education levels are often low.[18] As reported by Sen[19] as well as Kawachi and Wamala[20] "poverty is not only a question of money, but it has four other dimensions: lack of opportunities (for employment and access to productive resources), lack of capabilities (access to education, health and other public services), lack of security (vulnerability to economic risks and violence), and lack of empowerment (absence of voice, power, and participation)."[19,20] Kjellstrom *et al.* (2007) suggested adding a fifth dimension, "lack of a health supporting physical living environment. These five dimensions stem from inequality as the root causes of poverty."[21]

The UN has created the Millennium Development Goals (MDG) to reduce poverty and improve health globally by 2015.[22] The goals address many health-related issues, including reducing extreme poverty, reducing child mortality, improving maternal health, halting the spread of HIV/AIDS, and providing universal education.[22]

1.4 Root causes of poverty

There is no single cause of poverty.[23] Poverty is too complex an issue to be a consequence of just one set of circumstances. There are many inter-related factors that contribute to poverty – as many as the varying dimensions that define poverty.[23,24] Some of these inter-related drivers in the development or persistence of poverty are:[25,26]

1. *Economics* – The poor are often marginalized in the economy of their area or country. They have limited choices of jobs and many factors prevent them from obtaining the financial benefits they need to lift them out of poverty.
2. *Health* – Lack of family resources for adequate nutrition, clothing and shelter or to treat illness that can lead to chronic poor health, which in turn can worsen the income of poor families. Poor families also tend to contribute disproportionately to degradation of their environment, leading to further disease. Poverty is furthermore a barrier to accessing health services needed to improve their well-being.
3. *Governance* – Government structures that are dysfunctional, with weak oversight roles and that allow corrupt practices to flourish, contribute in large measure to poverty within such a country. Restrictive or inherently unfair policies contribute to making it difficult for the poor to establish businesses or participate in political decisions. Even at a community level, community leaders who enrich themselves at the cost of their people and who prevent much-needed resources from reaching the intended targets contribute to an exacerbation of an already seriously inequitable situation.
4. *Education and training* – Ignorance (or lack of information or skills needed to solve problems) is a severe stumbling block to poor individuals in their efforts to improve their circumstances and that may deepen their poverty.

Bartle (2007) identified the factors that contribute to the continuation of poverty as disease, ignorance, apathy, dishonesty and dependency.[27] The aspects of health conditions that contribute to poverty and in turn may cause continuation of poverty will be discussed separately as they form an important focus of this dissertation.[27] The other aspects are more 'social' in nature. According to Bartle (2007) financial aid will only alleviate the symptoms of poverty and not provide a durable solution.[27] Transfer of funds will not eradicate or reduce the deep-seated causes of poverty.[27]

1.5 Social aspects of poverty

Social determinants are the conditions under which people are born, grow, live, work and age.[28,29] These circumstances are shaped by the distribution of money, power and resources at global, national and local levels, which are themselves influenced by policy choices.[28] The social determinants of health, for instance, are mostly responsible for health inequities - that is the unfair and avoidable differences in health status that are seen within and between countries.[28]

The poor experience "clusters of interlocking disadvantage that make it highly unlikely that they can draw on social capital to ameliorate their poverty."[29] Collective action and local institutions may structurally reproduce the exclusion of the poorest.[29] Under such circumstances even the strengthening of public participation of the poor is unlikely to lead to their greater inclusion or to significant poverty alleviation.[28,29]

1.5.1 Gender aspects of poverty

Poverty is not a gender-neutral condition since the number of poor women exceeds that of poor men, while women and men experience poverty in distinctive ways.[30,31] Six out of every ten of the world's poorest people are women, who in the vast majority of cases must, as the primary caretakers of their families, shoulder the burden of growing and preparing food, fetching water and fire wood.[32] Even though they provide a large amount of labour about 75% of women globally cannot get bank loans because they do unpaid work or have insecure jobs and are not entitled to property ownership.[32] This is one important reason why women comprise more than 50% of the world population, but only own 1% of the world's wealth.[32]

Apart from issues of fundamental human rights, empowering impoverished women makes sound economic sense.[32] When women have greater access to land, jobs and financial resources, their improved prospects translate into improved well-being for their children, thereby reducing poverty in future generations. Thus empowering women to escape poverty is a condition for inclusive, democratic, violence-free and sustainable development.[32]

Various factors contribute to women's vulnerability to poverty, such as issues related to the labour market, lone motherhood, ageing and education.[33] Quisumbing *et al*. (2001) analysed the poverty profiles in ten developing countries and found that poverty measures were higher for female-headed households and for females as a total category.[33] The differences were however statistically significant in only 20% to 30% of the datasets. In Ghana and Bangladesh females were consistently worse off.[33] Cultural and institutional factors may have been responsible for

higher poverty among women in these countries.[33] Their results pointed to the need to analyse determinants of household income and consumption using multivariate methods and that greater attention should be paid to the processes underlying female headship of families.[33]

Even in affluent democracies the nearly universal 'feminization' of poverty became evident over the last three decades of the previous century.[34] These studies showed that women's, men's and overall poverty are highly correlated, but that the feminization of poverty emerges as a distinct social problem.[34] The gender imbalance towards more impoverished women were found to be influenced by social security grants, single motherhood, the gender ratios of the elderly and labour force participation.[34]

1.5.2 Ignorance (poor problem-solving)

Poverty is more easily defined than ignorance, which is an even more complex concept.[35] Poverty and ignorance do not always go together but the combination can be devastating.[35]

Ignorance implies lack of knowledge or lack of information. It is not synonymous with lack of intelligence or lack of discretion.[36] Ignorance can be classified into two types – real and informed.[36] Real ignorance refers to the lack of information on some aspect, while informed ignorance (partial ignorance) refers to the situation where persons may be aware of the basic facts, but for some or other reason refuse to believe some facet of the information.[36] Therefore overcoming ignorance involves more than just providing the basic facts that will empower people to come to sound conclusions and make informed decisions. Not for nothing the old adage in community education goes "teaching is not just *telling* people things."

Ignorance is a barrier to lifting people out of the poverty trap and thus basic education projects such as literacy programmes are often employed to ameliorate this lack.[37] Unfortunately, education programmes do not sufficiently take into account important daily life issues of the intended learners, including nutritional deficiencies that may hinder learning or children-parent-society interactions that may improve or impede learning.[37]

A further consideration to overcoming the knowledge gap imbedded in the concept of ignorance is that few programmes seem to determine exactly what essential information is missing among a group of poverty-stricken people.[27] Education is widely advocated to overcome the ignorance barrier, but what education? Academic knowledge may be of no use to a resource-poor person who needs to know what kind of seed to plant in the local soil.[27] Strengthening of capacity is needed under these circumstances and not general enlightenment.[27]

The transfer of information to the wider impoverished community does not always follow after any education programme.[27] If a poor person is provided with essential information or is trained in some or other skill that information will not necessarily trickle down into the rest of the community.[27] In some cases, persons want to keep newly acquired information or skills to themselves for strategic reasons - to obtain some sort of advantage over others or they may even hinder others in their efforts to also improve their knowledge or skills base. This negative behaviour will impact on that particular community's ability to lift themselves out of poverty.[27]

Some cultural beliefs and attitudes may compound the problem of ignorance further.[36] For example, the belief that asking questions is rude or that women or children should 'be seen and not heard' may significantly impede the ability of important subsections of that community to acquire much needed information or skills to better their lives or to keep them from engaging in high-risk activities.

1.5.3 Apathy (hopelessness) and depression in poverty

There are obvious material stresses accompanying poverty.[38] The daily worries about meeting essential expenses, buying food at ever increasing prices and facing insecure employment could be expected to result in depression even for strong minded individuals.[38] The ability to deal with new difficulties is harder for those with less money.[38]

The psychological impact of living in poverty is further influenced by shame, stigma and the humiliation of poverty.[39] Apathy is one manifestation of low self-esteem. The person with very little sense of self-worth can be perpetually numb to any possibility for change, thus exhibit a tendency to escape from the challenges of responsibility.[40] Some persons in this situation may not be insensible to responsibility but aggressive instead, which is "nonetheless just another face of apathy to a point that for most of the unorganised poor, nothing that you suggest will be doable."[40]

A longitudinal Canadian study of 35 parents over 18 months garnered 115 in-depth interviews focusing on parent views.[41] The analysis indicated that parents uniformly identified poverty as the primary barrier to their capacity to provide adequate care for their children.[41] The results showed that financially parents were living precariously close to margins of defeat. Parents linked poverty to their depression and accepted personal responsibility for their economic and parental failings, equating no income with bad parenting.[41] Depression and despair as well as social isolation associated with poverty were acknowledged to impair parenting and to increase self-doubt about parenting capacity.[41]

1.5.4 Corruption, dishonesty and inappropriate utilisation of resources

Corruption is both a major cause and a result of poverty around the world.[42] It occurs at all levels of society, from local and national governments, civil society, the judiciary, business and the military. Corruption affects the poorest the most, whether in developed or developing nations.[42,43]

It may not be very useful to distinguish between various types of corruption, as its mechanism is the same in the end - the abuse of public office for private gain.[44] The scale of corruption however, varies from petty corruption involving relatively minor amounts of money or gifts changing hands, grand corruption involving larger sums of money and higher-ranking officials, to 'looting' (or large-scale economic delinquency).[45] Looting involves such large sums of money that it has macro-economic implications and is perpetrated by government elite, especially in developing countries where institutions of governance are particularly weak.[45] According to the African Centre for Economic Growth, looting is most prevalent in a number of developing countries and also in a few countries in transition.[45] In many African countries money obtained from looting is spent on unfair election campaigns and even private militias.[45] All corruption impact on the most vulnerable members of such societies the hardest, but looting can entrench poverty to such an extent that lifting an entire population out of the poverty trap becomes a daunting task.[45]

An example of the interrelated consequences of corruption or inappropriate utilisation of resources

The following press report in the Jakarta Globe, titled "Corruption Causes Poverty and Hunger In East Nusa Tenggara, Claim Activists" by Nivell Rayda, published on 9 May 2010 illustrates the complex situation involving inappropriate utilisation of resources:[46]

> "During a discussion at the Indonesia Corruption Watch office in Jakarta on 9 May 2010, Indonesia Forum for Development chairman Don K Murat blamed public officials and law enforcement agencies for the high levels of disease and malnutrition in the East Nusa Tenggara province. East Nusa Tenggara "used to be one of the biggest producers of cattle and meat in the country. But farmers chose to grow crops rather than have their cattle stolen at night and extorted by rogue police officers during the day," Don said. However, "the cattle acted like an emergency bank account for farmers who would sell their livestock during droughts," he said.

> In June last year, the East Nusa Tenggara health agency reported that more than 12 600 children less than 5 years old were malnourished and at least 25 youngsters had died from malnutrition. It also said the province's infant mortality rate was 31 in 1,000, with hundreds dying each year from health problems, such as malaria, malnutrition, tuberculosis, respiratory infections and dehydration.
>
> The Health Ministry blames lack of personal hygiene and lifestyle for the high infant mortality rate while the Ministry of Agriculture blames climate change for drought and malnutrition. Lerry Mboeik, a member of the Regional Representatives Council from East Nusa Tenggara, said that the government had done little to change the situation. "Instead of focusing on famine prevention and establishing a climate and weather monitoring station, the local government spent money on buying new Toyota Fortuners [4x4 vehicles]," she said.
>
> Roy Salam, a researcher at the Indonesian Budget Center, said that more than half, 52 percent, of the province's money is spent on public official's salaries and expenses. "Only 18.4 percent is dedicated to economic development and job creation, while only 5.4 percent is spent on social aid," he said. Roy cited a 2008 report by the Supreme Audit Agency which found that out of 1804 expenses, 1568 were dubbed "irregular" and some have indications of corruption. According to a 2009 survey by Transparency International Indonesia, East Nusa Tenggara is listed as the most corrupt province in the country."

1.5.5 Dependency on social assistance

There is considerable concern about the long-term nature of social assistance in many Western countries today.[47] Social assistance is intended to be a temporary relief for unforeseen individual problems, but it is of concern long-term receiving of social assistance may lead to dependency.[47] Mendes (2004) argued that while "everyone agrees that increasing numbers of Australians are reliant on welfare, they differ vastly on the causes and potential solutions." He stated that the concept of welfare dependency is associated with various socio-political definitions which shape the discourse on the existence of such a concept.[48] He proposed a relatively neutral definition of welfare dependence, namely "the increasing (and prolonged) financial reliance of individuals or families on income-support payments for their primary source of income."[48]

In a study of the duration of social assistance periods using Norwegian administrative data covering the years 1992–2002, Hansen (2009) found that most periods of social assistance were relatively short.[47] However, there was variation, including some long-term periods, and a large

proportion of those who exited social assistance later re-entered.[47] Immigrants, especially those from African, Asian and Eastern European countries were found to receive more social assistance payments, and for longer periods, than people born in Norway.[47]

An investigation into some of the factors that were associated with welfare dependency among immigrants in Australia examined the role of factors such as gender, age, migration category, birthplace, period after arrival and educational background in explaining immigrants' dependence on government pensions and benefits as their main source of income.[49] The study found that there were significant differences in welfare dependency by birthplace and migration category even after controlling for age, education and employment status. Immigrants from Vietnam, Lebanon and Turkey were more likely than others to be dependent on welfare.[49] Refugees were also more likely than other immigrants to be dependent on welfare; however, the effect of refugee status on welfare dependency diminished with duration of residence in Australia.[49]

Using data from the Survey of Labour and Income Dynamics (1996-2001) and event history models, Cooke (2009) investigated the duration of social assistance receipt for lone mothers and other household heads in Canada.[50] The study found that lone mothers' education and work experience were less important predictors for their duration on social assistance than their previous marital history.[50] Although receipt of welfare was generally short term, the study found evidence of negative duration dependence or a 'welfare trap' after controlling for unobserved heterogeneity.[50] This illustrated one way in which receipt of welfare was not only the result of particular life course trajectories but also shaped lives.[50]

Contini and Negri (2006) pointed out however, that negative duration dependence in the exit rate from welfare does not imply welfare dependence, "the observed pattern may be due to effects of persistence in poverty or in unemployment."[51]

1.6 Migration in and out of poverty

It has become almost an archetypal image of life in the developing world - faced with diminished economic prospects, rural people move to the city in search of new opportunities.[52] But once there, they are at risk of becoming trapped in a downward cycle. Living in poverty - without access to proper sanitation, clean water, or garbage collection - means the marginal lands they occupy may become unhealthy living environments.[52] These worsening environmental conditions, in turn, damage residents' health and entrench the stigma and isolation of living in informal settlements, making it all the more difficult to escape from poverty.[52]

A study in Egypt investigated the migration in and out of poverty in 347 households over a two-year period.[53] The number of households who had fallen into poverty was over twice as large as the number of households who had climbed out of poverty.[53] About two-thirds of overall poverty in that study was chronic (average consumption over time was below the poverty line), and almost half of all poor were always poor.[53]

A study from India found that 14% of households in 36 villages of three districts in Andhra Pradesh escaped from poverty over the preceding 25 years, but another 12% of these 5 536 households fell into poverty during the same time.[54] Escaping poverty and falling into poverty were responsive to different sets of factors.[54] While ill health and high healthcare costs, social and customary expenses, high-interest private debt and drought were associated most often with falling into poverty, diversification of income sources and land improvement were most closely related with escape.[54]

1.7 Attributes of the urban poor as a subgroup

The UN Population Division has made projections that by 2050, two-thirds of the global population are likely to be urban.[55] Amid the current rates of urban growth, dramatic inequalities already dominate the urban poor today. The conditions under which people grow, live, work and age are having a powerful influence on their health.[56] Approximately 1.5 billion people currently live in polluted urban areas, and 65% of the world's population is anticipated to live in cities by 2025.[57] More than 40% of the world's children are estimated to live in polluted cities of the developing world.[58]

The urban poor are a heterogeneous group and are not easy to categorise as a class.[59] Many of them can be described as a range of in-migrants from rural areas in search of work and a better life.[59] These individuals come from socially disadvantaged classes or low castes and in some cases are internally organised according to traditional social systems, replicating rural village hierarchies and customs.[59] On the other hand, they may also be organised in newly emerged community structures based on current needs and situations.[59]

The urban poor are often slum or even pavement dwellers, some with no permanent address.[60] Some settlements are permanent, while others are temporary or even illegal, with uncertain land tenure.[60] When not occupying squatter dwellings, the urban poor are generally renters. The majority of these people work in the informal sector and depend on a cash economy with unstable access to healthcare, with food insecurity and subsequent malnutrition.[60] Children and youth

comprise a large proportion of the urban poor - for example in urban Bangladesh children under the age of 15 years are the majority of the population.[59]

Health conditions and issues of the urban poor have been masked by urban averages for all socio-economic groups in traditional large data sets.[55] The results show that urban dwellers appear to be better off than rural populations, with lower morbidity and mortality rates and better access to health services, confirming the supposed 'urban advantage' to health programmers.[55] But these advantages are only exhibited by large urban areas. Studies have found that smaller urban areas i.e., those under 100 000 in population size are considerably underserved.[55] The urban poor are distinctly inferior in terms of access to basic amenities.[61]

The urban poor are also more vulnerable to economic, social and political crises and environmental hazards and disasters compared to the urban non-poor.[59] Settlement sites on which the urban poor reside can be on marginal land such as flood plains or garbage dumps, or on dangerous ground next to railroad tracks, or on riverbanks, and near worksites such as factories or construction sites.[59] Squatter settlements and many slums lack accessible roads, which make utilising public health facilities difficult. This inaccessibility also hampers proper municipal services such as trash collection.[59] Similar situations prevail in South Africa and in particular in the low-income area of Cape Town.[8]

1.8 Urban Poverty in South Africa

In South Africa the apartheid regime imparted a tough and obstinate racial character to the country's poverty level and distributions of income and wealth.[62] "In 2005/6 – more than a decade after democratisation – the incidence of poverty among black and coloured individuals remained dramatically higher than that among whites. One implication of the particularly heavy incidence of poverty among black Africans is that the black groups' share of poor individuals markedly exceeded that predicted by its population share. Although blacks make up 80.1% of the South African population, 93.3% of blacks are classified as poor."[62]

In South Africa the major categories of chronically poor people needing outside intervention to improve their condition are: the rural poor, female-headed households, people with disabilities, many elderly, retrenched farm workers, cross-border migrants, the 'street homeless' and AIDS orphans and households with AIDS sufferers.[62,63,64,65] This is a broad cross-section of people comprising 641 000 to 971 00 persons when estimated with the base year of 2000.[62]
The analysis of income data in South Africa provides an insightful view into the distribution and definition of poverty among the people of the country. When using the official 2001 census data

and a 'cost of basic needs' approach to define poverty, the average percentage estimated to be poor was calculated to be 58% of the population.[63]

Urbanisation is well advanced in South Africa, and the Income and Expenditure Survey of Households 2005/6 (IES2005) conducted by Statistics South Africa found that "65.1% of all households (58.8% of the population) resided in urban areas. The poverty rates of households and individuals in the rural areas were 54.2% and 67.7%, respectively – more than double the corresponding rates for urban areas (21.9% and 32.7%). Therefore, 57.1% of all poor households and 59.3% of poor individuals were rural dwellers despite the fact that the rural areas housed well below one-half of the South African population. On the other hand, the second poorest quintile, 53.2% of the households lived in urban areas while only 46.8% lived in rural areas. In fact, only in the lowest income quintile was rural households in the majority."[64,65] Thus South Africa has a particularly large burden of poverty in urban areas.

One of the major reasons why South Africa's social indicators are relatively unsatisfactory for an upper-middle income country is that the distribution of income is particularly skewed.[62,63] South Africa's Gini-coefficient exceeds those of all the countries used for comparison, except Namibia.[62] In most middle-income countries, growth in per capita incomes was accompanied by widespread improvements in standards of living and, hence, social indicators.[62] In South Africa, by contrast, the performance on social indicators remained relatively inadequate, partly because the exceptionally unequal distribution of income has prevented large sections of the population from sharing in the benefits of economic growth.[62]

The 2005/6 poverty rates in the various provinces ranged from "24.9% of population in Gauteng and 28.8% in the Western Cape to 57.6% in the Eastern Cape and 64.6% in Limpopo. The three provinces with the highest poverty rates (KwaZulu-Natal, the Eastern Cape and Limpopo) are also relatively populous – at the time of the IES2005 survey, they were home to 47.4% of the South African population. Approximately 60.1% of the individuals lived in these three provinces. The two richest provinces, Gauteng and the Western Cape, were home to about one-sixth of the poor."[62,64,65,66]

The provincial distribution of the households who made up the first (poorest) and fifth (richest) quintiles of the South African population in 2005/6 confirms the picture that has emerged during previous analyses.[62,64,65,66] Almost 62% of the households in the first or poorest quintile resided in the three poorest provinces (KwaZulu-Natal, the Eastern Cape and Limpopo), while Gauteng and the Western Cape housed 53% of the households in the fifth (richest) quintile.[64,65,66]

According to Malherbe (2007) the Western Cape has only 1.6% of households with incomes that lie below the $1 a day per capita household income poverty line, whereas the Eastern Cape has more than 16% of households living below that poverty line.[67] The Western Cape also has the lowest level of income inequality.[67]

The “lower-bound” poverty line, which provides for essential food and non-food consumption, was set by Statistics South Africa at R322 per capita per month in 2000 prices.[64,65,66] The “upper-bound” poverty line, which included an additional R271 for non-essential non-food items, amounted to R593 per capita per month.[64,65,66]

IES2005 reported that “45% of all female-headed households in South Africa lived below the lower-bound poverty line, compared to only 25% of single-male headed households. Thus, the proportion of households headed by women fell from 51.6% of the poorest two quintiles of households to 23.1% of those in the richest quintile. Female-headed households were seriously overrepresented among those below the lower-bound poverty line.”[62,64,65,66]

Poverty (as measured by the lower-bound poverty line) affected “66.3% of those who had no schooling and 59.9% of those who had not completed primary schooling. The poverty rates among those with some secondary schooling and a school-leaving certificate (44.9% and 23.3%, respectively) were below the poverty rate for the population as a whole (47.1%), but nonetheless were high in absolute terms.”[62,64,65,66]

In households in the lowest expenditure category, 27.3% of the children aged 17 or below and 25.7% of the adults reportedly experienced hunger.[62,64,65,66] It was reported that 6.6% of the children and 7.5% of the adults in this expenditure category often or always went hungry.[64,65,66] The incidence of hunger, however, decreased markedly as household expenditure levels increased.[62]

Social assistance expanded dramatically in recent years. South African government spending on such grants increased from 1.9% of gross national product in 2000/1 to an estimated 3.3% in 2007/8, while the number of beneficiaries increased from 3.0 million to an estimated 12.4 million.[64,65,66] These increases reflected various factors, including rapid growth in the take-up of the disability grant by victims of the HIV/AIDS pandemic and especially, the gradual raising of the age limit for eligibility for the child support grant from seven to the current 15 years.[62] The findings of the General Household Survey 2006 (GHS2006) completed by Statistics South Africa confirm that grants are a very importance source of income for poor households.[62] About 69% of the households in the first quintile and 70% of those in the second quintile reported that they earned

income from grants. Grants were actually the main source of income for 47.7% and 51% of the households in these quintiles.[62]

Poverty in the Cape Metropole

Average household income of all population groups in the Cape Peninsula, also known as the Cape Metropole, increased by more than the inflation rate between 2001 and 2004, indicating an increase in the living standard of the average household.[62] The increase in household income during the three years amounted to 9.5 % per year for black Africans, 7.4 % for so-called Coloureds and 6 % per year for Whites while the inflation rate was 5.4 % per year during the three years.[68] However, the increase in the welfare of the average household does not mean that all households benefited during the three years.[68]

Martins (2005) found that huge income inequalities still prevailed between the different population groups but also between households in a specific population group.[69] Income distribution by population group in the Cape Peninsula was the most skewed for black Africans, followed by Whites and the least for so-called Coloureds.[69] The average annual household income for 2004 of the 20% poorest households in the Cape Metropole was R15 107 (US$ 2014.26).[69]

A study on the income and expenditure patterns in Cape Town (2005) revealed that of all the men older than 15 years who were included in the survey, 41% of black African men are employed as salary/wage earners as opposed to 53% of so-called Coloured men and 40% of White men.[69] A total of 19% of African men 16 years and older were full-time scholars or students while this percentage is 15% for Coloured men and 14% for White men.[69] With regards to unemployment, the percentage is 33% for African men, 13% for Coloured men and 4% for White men.[69]

In the Cape Peninsula survey (2005) another factor that played an important role in the welfare of people was household size.[69] The average income of single black Africans without dependents was R34 999 per year in 2004 as against an income of R8 584 per person for a black African household of six or more members.[69] The average income for so-called Coloureds dropped from R39 791 for a single person household to R11 417 per person for a household of six and more in 2004.[69]

Housing and electricity made the biggest inroad into household budgets in the Cape Metropole in 2004, followed by food and income tax (51% of the cash budgets of households were spent on these items).[68] Black Africans spent almost identical amounts (23% of their cash budget) on food and housing while so-called Coloureds spent more on food (25%) than on housing (20%).[68]

1.9 Interrelated forces shaping the health of the urban poor: poverty, sanitation and housing

Diseases of poverty reflect the dynamic relationship between poverty and poor health.[55] Diseases associated with poverty can be caused directly by poverty, but they can also deepen indigence by diminishing health and financial resources.[70] For example, malaria decreases growth in Gross Domestic Product (GDP) by up to 1.3% in some developing nations. By killing tens of millions in sub-Saharan Africa, AIDS alone threatens "the economies, social structures, and political stability of entire societies."[55,70]

It is difficult to divide the overall health risks that the urban poor face into the risks attributable to household poverty and the additional risks produced by the spatial concentration of poverty in slum neighbourhoods.[71] Some of the additional risk factors named by Montgomery (2005) in Nairobi slums may be due to the poor quality and quantity of water and sanitation in these communities; inadequate hygiene practices; poor ventilation and dependence on hazardous cooking fuels; the transmission of disease among densely settled slum dwellers and poor access to the health care system.[71]

In previous centuries, poverty was greatest in scattered rural areas. Today, poverty has become heavily concentrated in cities.[5] In fact, the health risks in the urban slums are greatly increased because of the increased population density and crumbling infrastructure in these slums.[5] More than 90% of slums are located in cities of the developing world. In many of these cities, slums have become the dominant type of human settlement.[5]

People with unmet housing needs tend to experience higher death rates, poor health and are more likely to have serious chronic illnesses.[72] Evidence suggests strong linkages between poor housing and infrastructure and subsequent impact on health.[72] The issues of poverty, housing and health are all multi-dimensional, thus the linkages are extremely complex - the causal relationships are thus also multidirectional.[73] Despite the large number of academic publications on these subjects,[74] there is no widely shared consensus about the nature of this interrelationship, primarily due to this complexity.

Even in many urban areas in the developing world where sanitary systems existed for a long time, these systems are now overtaxed by in-migration and urban sprawl.[75] In fact, the past success of such systems allowed even more development to take place.[75] In many cities in the developing world, the supply of basic sanitary services - safe drinking water, sewers, garbage removal and sewage treatment works - have become a gargantuan task that is not adaptable enough to

handle the accelerating demands of urbanisation, especially the influx of rural poor.[61,76] The result of this service delivery discrepancy in many cities are an increasing population in urban slums living in conditions resembling the health risks faced by the rural poor who exist without any improved facilities at all.[61]

1.9.1 Urban poverty and health

In his 2001 address to the World Health Assembly, UN Secretary General Kofi Annan said, “The biggest enemy of health in the developing world is poverty. Globally, there is a stark relationship between poverty and poor health. Poverty creates ill-health because it forces people to live in environments that make them sick, without decent shelter, clean water or adequate sanitation. Poverty creates hunger, which in turn leaves people vulnerable to disease. Poverty denies people access to reliable health services and affordable medicines, and causes children to miss out on routine vaccinations. Poverty creates illiteracy, leaving people poorly informed about health risks and forced into dangerous jobs that harm their health.”[77]

Infectious diseases of all types are present in poor areas where basic services fail.[18] Close contact among persons sharing housing and limited sewage and waste treatment means that infections can spread more easily, including infections spread by vectors.[18] Even in developed countries, people living in poor areas often lack preventative health care or the means to manage chronic diseases.[18]

Implicit in the use of the term poverty is the tight inter-relationship of poverty and inequality.[78] In this interrelationship the term poverty extends to include individuals, households, communities, and countries. It refers to the individuals and households affected by infectious diseases, the effects of continuing untreated infection, and the impoverishment that occurs as a direct result of disease and the high costs of health care.[78] It refers to the material circumstances of communities at risk - in poor, isolated and ill-served rural areas and in the substandard conditions of urban slums and squatter settlements.[78]

1.9.2 Urban sanitation and health

The availability of safe water supply and the sanitary disposal of human wastes are generally considered as two prerequisites of a healthy life.[79] However, a large proportion of the population living in developing countries are still deprived of access to hygienic and safe sanitary facilities.[79] Among them, the poor suffer the most because they lack both the means to get such facilities and knowledge on how to minimise the negative effects of the unsanitary environment.[79]

In the developing world, more than 1 billion people continue to lack an adequate supply of clean water and adequate disposal of excreta.[80] The overall global burden of water, sanitation and hygiene related diseases remains high even though oral rehydration therapy has led to reductions in mortality.[80] Despite this demonstrated need for water, sanitation and hygiene improvements, our understanding of integrated control strategies remains poor.[80]

Diarrhoea, worm infections and other infectious diseases spread via contaminated water, while lack of water is an obstacle to proper hygiene.[21] Almost half of the urban population in Africa, Asia and Latin America suffer from these diseases attributed to poor access to improved water and sanitation.[21]

There is increasing evidence that the efficacy of household water quality interventions depends on the level of sanitation within the targeted community.[21] This dependency may explain why many household level water quality intervention studies have shown impressive reductions in health burden. The results have however been highly variable.[21] These interpretive challenges arise in part because enteric pathogens are transmitted through a complex set of interdependent pathways, including both contaminated food and water along with household and community level person-to-person routes. Transmission pathways are mediated, inter alia, through food, fingers, fomites and flies.[21]

Water can be contaminated through runoff from blocked drains and discarded household sullage and this may expose individuals to pathogens via drinking water or recreational, bathing, or washing activities.[21] Food may be contaminated through contact with contaminated water or soil or via infected animals. Inadequate hygiene may result in contamination of fomites in common living spaces; infection may then be transmitted in many ways.[21] Soil in the immediate surroundings in urban slums is contaminated through poorly functioning sewerage systems or other improper management of excreta.[21]

The existence of multiple transmission pathways and the contagious nature of many pathogens in an environment polluted by human sewage, result in transmission risks that are dependent on the disease status of the community.[21] Many enteric pathogens can be transmitted from infectious human excreta to susceptible humans either directly or indirectly through the environment. Thus they are sustained through chains of transmission that may pass through combinations of pathways.[21] The importance of each pathway depends on the pathogen and specific environmental conditions as well as the vulnerability of the inhabitants of that environment to the diseases in question.[21]

Impact on the urban environment

The process of rapid urbanisation brings environmental hazards and health risks in its wake.[81] Providing city dwellers with basic sanitation services – drinking water, sewers, and garbage removal – has enormous effects on ecosystems.[75]

Driving forces such as urbanisation, food availability, agriculture, water needs or energy demand impact on environmental processes.[82] The driving forces exert pressures on the environment - these pressures occur in the form of human occupation or of exploitation of the environment, thereby causing the release of chemical and biological pollutants.[82] Because of such pressures the state of the environment is changed, in some cases irrevocably. Such changes include high concentrations of pollutants in air; water and soil.[83] The health impact of these pollutants in the environment are dependent on the degree of exposure, which in turn is influenced by the degree of inhalation, ingestion or dermal absorption.[83]

Environmental damage almost always hits those living in poverty the hardest.[84,85] "All over the world poor people generally live nearest to dirty factories, busy roads and waste dumps."[85] According to the exhaustive review contained in the UN Development Programme's Human Development Report[85] there is an irony in these statements. "Even though poor people bear the brunt of environmental damage, they seldom are the principal creators of that damage. The affluent generate far more waste and consume far more resources."[85] Yet, there are also environmental challenges that stem from growing poverty, not only growing affluence. As a result of increasing impoverishment and the absence of alternatives, a swelling number of poor and landless people migrating to peri-urban areas are putting unprecedented pressure on the natural resource base as they struggle to survive.[85,86]

"Poor people and environmental damage are often caught in a downward spiral. Past resource degradation deepens today's poverty, while the poverty of today makes it very hard to care for or restore their resource base. Poor people are forced to deplete resources to survive and this degradation further impoverishes them. When this downward spiral becomes extreme, poor people are forced onto marginal land and fragile ecosystems in ever increasing numbers."[85] About half of the world poorest people (about 500 million people) live on marginal lands.[85]

1.9.3 Urban housing and health

It is widely acknowledged that a strong relationship exists between environment and human physical condition, with living conditions in particular contributing to the health and wellbeing of communities and population groups.[72] More specifically, various studies have concluded that there are strong linkages between housing, especially housing infrastructure, and health.[87]

The relationships between housing and health are complex, but despite these complexities, many of these relationships are well understood and clearly enunciated.[88,89] For example, the Australian National Health Strategy (1992) stated that people with unmet housing needs tended to be socioeconomically disadvantaged.[90,91] They had much higher death rates compared with people from more advantaged backgrounds, they had the poorest health and they were more likely to have serious chronic illnesses.[91] To demonstrate this, a landmark study of housing conditions and the health status of Aboriginal people in the Pitjantjara lands in South Australia found that improvements in essential health hardware (repairs, clean running water, waste drainage and removal), led directly to health improvements, especially for children.[90]

The effectiveness of home maintenance and home modifications in prolonging the safety and suitability of dwellings is also an important health consideration, along with related environmental factors such as high and low density environments, social relations in neighbourhoods and social isolation.[72] The latter subject may have a particular impact on women.[72]

There has been little research specifically linking housing design and health outcomes.[72] Yet, design of housing logically forms a critical part of the human health outcomes.[72] Many design principles have been long established as providing the basis for proper hygiene and safe living.[72] Fiedler (2000) quoted the work of Gärtner in 1886 who initiated the development of hygiene in the fields of construction, housing and communities, having formulated important requirements for indoor climate, e.g. for heating, ventilation, indoor air temperature and thermal insulation of houses.[92]

1.10 Communicable diseases

Diseases of poverty reflect the dynamic relationship between poverty and poor health. Diseases associated with poverty can be caused directly by poverty, but they can also deepen indigence by diminishing health and financial resources. For example, malaria decreases GDP growth by 1.3% in some developing nations, and by killing tens of millions in sub-Saharan Africa. HIV/AIDS alone threatens “the economies, social structures, and political stability of entire societies.”[32]

In the latter half of the previous century, it was widely assumed that infectious diseases would continue to decline, especially among the poor, as improved sanitation, vaccines and antibiotics were becoming more widespread.[93] Globally at least 30 new or re-emerging infectious diseases have been recognised since 1975.[94] This widespread increase in infectious diseases was unexpected.[94] The pandemic of HIV/AIDS has become a serious health crisis in most parts of the world.[95] The prevalence of several long-established infectious diseases, including tuberculosis (TB), cholera and dengue fever, have proven unexpectedly difficult to lower because of increased antibiotic resistance, new ecological niches, ineffectual public health services and activation of pathogens (e.g. TB) in people whose immune systems are weakened by HIV/AIDS.[95] Diarrhoeal disease, acute respiratory infections and a host of other infections continue to kill more than seven million infants and children annually.[95] The most important driver in the increase of infectious diseases, however, is the persistence of poverty and the exacerbation of regional and global inequalities.[93]

Major diseases of poverty affecting the urban poor

Urban populations in low-income countries are viewed as carrying a double burden of health problems from communicable diseases as well as health problems associated with economically advanced societies, such as chronic diseases, accidents, and violence.[96] The WHO reported in 2008 that the leading global risks for burden of disease as measured in disability-adjusted life years (DALYs) for low income countries (% of total deaths) are: lower respiratory infections (11.2%), coronary heart disease (94%), diarrhoeal diseases (6.9%), HIV/AIDS (5.7%), stroke and other cerebrovascular diseases (5.6%), chronic obstructive pulmonary disease (3.6%), TB (3.5%), neonatal infections (3.4%), malaria (3.3%), prematurity and low birth weight (3.2%).[97]

The three major diseases of poverty are often cited as HIV/AIDS, malaria, and TB.[98] Developing countries account for 95% of the global AIDS prevalence[98] and 98% of active tuberculosis infections.[99] Furthermore, it is estimated that 90% of malaria deaths occur in sub-Saharan Africa.[56] Together, these three diseases account for 10% of global mortality.[56]

The designation of the three diseases associated with poverty (HIV/AIDS, malaria, and TB) as ‘major’ is based on mortality figures.[56] This can be a misleading view because other symptomatology or diseases can in certain circumstances place a huge disease burden on the poor without being classified as a direct cause of death. The most notable of these conditions is diarrhoea - a symptom associated with many diseases afflicting the poor. The impact of diarrhoea is under-estimated when diseases associated with poverty are classified by looking at mortality figures only.

Measles, pneumonia and diarrhoeal diseases are also closely associated with poverty, and these diseases are often grouped together with AIDS, malaria, and tuberculosis in broader definitions of diseases of poverty.[100] Preliminary results released in an October 2009 global report on diarrhoeal diseases show they alone kill some 2.6 million people annually - many more than previously thought.[101]

More than 70% of countries and territories affected by infectious diseases other than TB, HIV/AIDS and malaria (also referred to as the 'neglected diseases of poverty') are low-income and lower middle-income countries.[78] This is due to multiple factors, including increased vulnerability, high morbidity and mortality due to ill health in general.[78] Various social determinants (e.g., poverty, gender, education, and migration) interact to establish local patterns of co-morbidity of previously neglected diseases of poverty and other pertinent public health problems (e.g., malnutrition, diarrhoeal diseases, and violence).[78]

Almost all of the so-called neglected tropical diseases are absent from the present study area. The endemic diseases in the urban environment of the present study area rather resemble the disease profile encountered in middle-income or high-income countries such as the United States of America (USA). Hotez (2008) stated that in the USA, "there is a large hidden burden of disease caused by a group of chronic and debilitating parasitic, bacterial, and congenital infections known as the *neglected infections* of poverty. Like their neglected tropical disease counterparts in developing countries, the neglected infections of poverty in the USA disproportionately affect impoverished and under-represented minority populations. The major neglected infections include the helminth infections, toxocariasis, strongyloidiasis, ascariasis, and cysticercosis; the intestinal protozoan infection trichomoniasis; some zoonotic bacterial infections, including leptospirosis; the vector-borne infections Chagas disease, leishmaniasis, trench fever and dengue fever and congenital infections such as cytomegalovirus, toxoplasmosis, and syphilis."[102]

The HIV/AIDS pandemic has caused huge burdens of disease and exacted enormous direct and indirect economic costs since it began its slow worldwide spread a quarter of a century ago.[103] In developed countries, where HIV prevalence among adults generally is much less than 1%, the main economic impact has been on escalating health expenditures.[103] In many of the poorest countries most affected by the disease however, HIV prevalence among working-age adults tops 20%. Sub-Saharan Africa is the area hit hardest overall.[104]

HIV/AIDS have devastated urban poor communities in Africa.[105] In 2007, 2 million people died due to HIV/AIDS - of those, 1.85 million lived in Africa.[105] South Africa has been hardest hit by the AIDS epidemic. More than 5 million people are said to be living with HIV/AIDS in South Africa, the

highest number of any country in the world.[105] South Africa also has one of the highest number of children under 15 living with HIV/AIDS in the world; estimates ranged from 180 000 to 280 000 in 2007.[105]

Measles, lower respiratory infections, malaria and diarrhoeal illnesses are common paediatric medical problems that are often fatal in the context of extreme poverty.[106] From a public health perspective, relatively simple measures can reduce the deadly effects of these diseases until successful vaccines become available and immunization programs are established.[106] Infants and children are especially vulnerable to poor outcomes from infections when under nutrition and other circumstances of poverty are present.[106]

Since many countries with malaria are already among the poorer nations, the disease maintains a vicious cycle of ill health and poverty.[105] The people, who can neither afford a bed net for prevention nor access appropriate treatment when they fall sick, are the ones who suffer the most.[105] Severely anaemic patients might receive blood transfusions which, in developing countries, can expose them to HIV and other blood borne diseases.[105] There is no malaria in the area to which this dissertation pertains and thus this disease will not be discussed further in any great depth.

TB is a disease of poverty.[107] The vast majority of TB deaths occur in the developing world with large numbers of TB sufferers living in urban slums. TB is contagious and spreads through the air; if the infected person is not treated.[107] One untreated TB-positive person or a patient not adhering to the proper drug regimen can allow for the spread of the disease, especially in a crowded environment such as the densely occupied dwellings in urban slums.[105] People who are HIV-positive and carry TB bacilli are up to 50 times more likely to develop active TB in their lifetime. Uneven monitoring and non-adherence to drug regimens and poor health infrastructure have encouraged drug-resistant strains of TB to thrive.[105] Multi-drug resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) are forms of tuberculosis that are extremely difficult to treat since they fail to respond to traditional drugs.[105]

The leading global risk for burden of infectious disease as measured in DALYs are caused by unsafe water and sanitation and improper hygiene practices.[77] These risks are particularly high in the dense settlements occupied by the urban poor. Inadequate sanitation and refuse collection, polluted run-off and children playing in soil or water contaminated by untreated waste result in infectious diseases that thrive on filth and crowded conditions.[5] Especially diarrhoeal diseases spread easily in highly concentrated populations.[80] The multiple pathways of infection thus

created by slum conditions can result in high background levels of diarrhoea that are difficult to reduce by single-pathway interventions.[80]

According to a 1986 report from the WHO technical meeting on quantifying disease from inadequate housing,[108] the burden of disease caused by inadequate housing may be rather large and the WHO committee felt that future studies are required to enhance the knowledge base of the relationship between burden of disease and inadequate housing.[108]

1.11 Non-communicable diseases

There are many non-communicable diseases (NCDs) also associated with poverty.[56,109] The prevalence of NCDs in developing countries were traditionally regarded as being associated with the more affluent urban sectors.[109] The distribution of NCDs however by income groups is currently changing towards a pattern closer to that of groups with a lower socio-economic status.[109] In this brief summary only the health conditions pertaining to the present study will be reviewed.

1.11.1 Risk factors

Smoking, alcohol consumption and the use of chemical substances

The use of addictive substances, especially among the urban poor have grown into a massive global problem.[110] Socially or psychologically fragile members of any population group are more likely to abuse self-destructive legal and illegal drugs,[111] while this problem is compounded among the poor. The move towards globalisation that started in the 1990s and the global economic crises of the past few years caused widespread unemployment in many industrialised as well as developing nations.[112] The lifestyle adaptations driven by the conditions of unemployment that goes hand in hand with increased abuse of alcohol and cigarettes are part of the negative consequences of these global realities.[112]

In 2000, there was an estimated 1.4 billion smokers worldwide and on a global scale there were 4 million tobacco-related deaths every year.[113] Research into the influence of social status and poverty on the different phases of cigarette smoking showed that negative social status was significantly related to an increased risk of initiation, a greater probability of progressing to habitual cigarette smoking and a decline in willpower to stop smoking.[114] The poor social and educational status of a child (equivalent to the parents' status) furthermore correlates with all three phases of cigarette use (initiation, habitual smoking and smoking cessation).[114]

In France the prevalence of smoking amongst neighbourhoods living in poverty decreased since the 2000s.[115] A study investigating the decline in smoking between 2000 and 2007 showed that interventions which do not specifically target smoking but which contributes to improving poor smoker's living conditions are necessary to promote smoking cessation.[115]

Alcohol consumption is an important contributor to the global burden of disease and accountable for 4% of DALYs.[116] Problematic alcohol use is associated with economic disadvantage in both resource-rich[117] and resource-poor countries.[118] Alcohol dependence has been linked to chronic health conditions, such as liver and cardiovascular disease, and to higher rates of alcohol-related morbidity and mortality.[119] In addition, alcohol dependence has also been associated with acute and chronic social consequences of drinking,[120] problems with relationship, employment, finances and the law. It is therefore plausible to assume that social and dependence-related problems might precede or co-occur with adverse alcohol-related health conditions.[119]

Studies have shown that socially excluded families have more problems related to use and abuse of psychoactive substances.[118] According to the WHO, illicit drug use is the third highest risk factor for health problems in developed countries and it is the highest risk factor in developing nations.[118] The association between poverty and drug abuse is a complex phenomenon and has many contributing factors. A major difficulty in evaluating the effect of illicit drugs is the range of socio-demographic, psychosocial, behavioural, and biological risk factors associated with both illicit drug use and adverse health outcomes.[121] Beyond the shortage of money, poverty encourages a particular world view, influencing activities and behaviours and affecting living conditions. These attitudes and conditions can contribute toward drug usage. Poverty deprives people of material resources and as a result the loss of prestige and status in society.[121]

Nutrition

Poverty is a multidimensional concept and is both a cause and consequence of poor nutrition. The relationship between poverty, poor nutrition and underdevelopment has been acknowledged and understood for many years.[122,123] The link between poverty and nutrition is ‘intergenerational’ as the inadequate resources of human capital and competency to create food security in developing countries will make it difficult for families to escape poverty and malnutrition in the next generation.[124] On the other hand, cities tend to promote unhealthy lifestyles, for example cheap and convenient diets that depend on processed foods rich in fats and sugar, yet low in essential nutrients.[5,122]

The cycle of poverty and malnutrition starts during pregnancy, often leading to low birth-weight and undernourished babies who may become stunted children and adolescents and turning into disadvantaged adults when exposed to further nutritional insults during their life cycle.[123] These individuals have reduced physical as well as mental development and resultant lower competence and human capital.[123] Human capital refers to well-nourished, healthy, educated, skilled and alert individuals - an improved human condition - resulting in a healthy labour force that would be any country's most productive asset.[124] Fostering of attitudes such as cognitive and non-cognitive abilities and skills, nutrition and health begins early in infancy and continues throughout the life of the individual and early choices, inputs and events will have the power to either debilitate or facilitate development at more advanced stages.[125]

Malnutrition is associated with an estimated 54% of childhood deaths from diseases of poverty.[97] Worldwide, almost 28% of children from developing countries are estimated to be either underweight or stunted - most of whom originate in South Asia and sub-Saharan Africa.[97] Progress in these countries are noted to be slow and if current trends persist then the MDG of halving the proportion of underweight children by 30 million children, will be missed.[16]

The preceding review gave an in depth look into the literature on the complex issues surrounding the poor, with emphasis on those who live in settlements, whether formal or informal in an urban setting. The present study utilised the setting of government sponsored low-cost housing in the City of Cape Town to investigate the living conditions and qualitative and quantitative aspects of their sanitation behaviour. Chapter 2 will now look at the contribution of housing to this multifaceted problem.

1.12 References

1. WHO. World Health Organization approach to housing and health. [online] 2004 [cited on 28 April 2009]. Available from: http://www.euro.who.int/Housing/Activities/20041012_1.
2. WHO. Health Principles of Housing. [online] 1989 [cited on 25 March 2009]. Available from: http://whqlibdoc.who.int/publications/1989/9241561270_eng.pdf.
3. UN Centre for Human Settlements (Habitat) Low-income rental land and housing in Bangkok: an overview. In, Rental Housing: Proceedings of an expert group meeting; (eds.) Yap KS, de Wandeler K. Nairobi; 1990.
4. World Bank. Overview: Understanding, measuring and overcoming poverty. [online] 2010 [cited 12 May 2010]. Available from: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPA/0,,contentMDK:20153855~menuPK:435040~pagePK:148956~piPK:216618~theSitePK:430367,00.html.
5. Chan M. Urban Health threatened by inequities, World Health Organization Press Briefing. [online] 2010 [cited 4 June 2010]. Available from: http://www.who.int/dg/speeches/2010/urban_health_20100407/en/index.html.
6. Hagenaars A, De Vos K. The Definition and Measurement of Poverty. Journal of Human Resources. 1988;23:211-221.
7. Marriage and Family Encyclopaedia. Poverty - Definition of poverty, global poverty, measuring poverty, welfare response, categories of dependence, weakened families and kinship systems. [online] 2010 [cited 13 May 2010]. Available from: http://family.jrank.org/pages/1314/Poverty.html#ixzz0no6sYUkX.
8. Barry MB. Evaluating Cadastral systems in periods of uncertainty: A study of Cape Town's Xhosa-speaking communities [dissertation]. Durban: University of Kwazulu Natal; 1999.
9. Radhakrishna R, Hanumantha RK, Ravi C, Reddy BS. Chronic Poverty and Malnutrition in 1990s. Economic and Political Weekly. 2004;39:3121-3130.
10. Blanco RO. Eradicating Extreme Poverty and Hunger - How We Define Poverty. [online] 2002 [cited on 6 June 2010]. Available from: http://www.thefreelibrary.com/How+we+define+poverty.+%28Eradicating+Extreme+Poverty+and+Hunger%29-a096951797.
11. Brandt W. North-South: a programme for survival. Report of the Independent Commission on International Development Issues. Cambridge: MIT; 1980. pp 49.
12. Phipps S. The impact of poverty on health - a scan of research literature. [online] 2003 [cited on 6 March 2010]. Available from: http://www.courseweb.uottawa.ca/epi6181/images/Poverty%20in%20Canada.pdf.
13. Golan E, Stewart H, Kuchler F, Dong D. Can low-income Americans afford a healthy diet? Amber Waves. 2008;6:26-33.

14. Hoover G, Formby JP, Kim H. Poverty, non-white poverty, and the Sen index. The Review of Income and Wealth. 2004;50:543-559.
15. University of Wisconsin-Madison Institute for Research on Poverty. Who is poor? [online] 2009 [cited on 7 February 2010]. Available from: http://www.irp.wisc.edu/faqs/faq3.htm.
16. United Nations Development Program. Human Development Report 2007/2008. Fighting climate change: human solidarity in a divided world. [online] 2008 [cited on 6 December 2009]. Available from: http://hdr.undp.org/en/media/HDR_20072008_Summary_English.pdf.
17. Graham JP, Corella-Barus V, Avitia-Diaz R, Gurian P. The in-home environment and household health: A cross-sectional study of informal urban settlements in Northern Mexico. International Journal of Environmental Research and Public Health. 2005;2:394-402.
18. Torpy JM, Lynm C, Glass RM. Poverty and Health. JAMA Patient Page. The Journal of the American Medical Association. 2007;298:1968.
19. Sen A. Development as Freedom. New York: Alfred A Knopf Publication; 1999. pp366.
20. Kawachi I, Wamala S. Globalization and Health. New York: Oxford University Press; 2007. pp340.
21. Kjellstrom T, Friel S, Dixon J, Corvalan C, Rehfuess E, Campbell D, Gore F, Bartman J. Urban environmental health hazards and health equity. Journal of Urban Health. 2007;84:86-97.
22. UN. Resolution adopted by the General Assembly 55/2: United Nations Millennium Declaration. [online] 2000 [cited on 15 June 2009]. Available from: http://www.un.org/millenium/declaration/ares552e.pdf.
23. Rodriguez AG, Smith SM. A comparison of determinants of urban, rural and farm poverty in Costa Rica. World Development. 1994;2:381-397.
24. Mehanna RM. Poverty and economic development: not as direct as it may seem. Journal of Socio-Economics. 2004;33:217-228.
25. Wilkinson R, Marmot M, editors. Social determinants of health: the solid facts. Copenhagen: World Health Organization; 2003. p 32.
26. Dasgupta P. World poverty: causes and pathways. Proceedings of a plenary lecture at the World Bank Conference on Development Economics; 21-22 May 2003; Bangalore, India. 2003. Available from: http://website1.wider.unu.edu/lib/pdfs/WB-ACDE-Accelerating-Development-2004.pdf#page=167.
27. Bartle P. The Nature of Monitoring and Evaluation: Definition and Purpose. [online] 2007 [cited on 29 April 2010]. Available from: http://www.scn.org/cmp/modules/mon-wht.htm.

28. WHO Commission on Social Determinants of Health. Closing the gap in a generation: Health equity through action on the social determinants of health. Final report of the commission on social determinants of health. [online] 2008 [cited on 15 April 2009]. Available from: http://whqlibdoc.who.int/hq/2008/WHO_IER_CSDH_08.1_eng.pdf.
29. Cleaver F. The inequality of social capital and the reproduction of chronic poverty. World Development. 2005;33:893-906.
30. Bastos A, Casaca SF, Nunes F, Pereirinha J. Women and poverty: A gender-sensitive approach. Journal of Socio-Economics. 2009;38:764-778.
31. Albelda R. Women and poverty: Beyond earnings and welfare. The Quarterly Review of Economics and Finance. 1999;39:723-742.
32. United Nations Population Fund. State of the World Population. [online] 2009 [cited on 20 December 2009]. Available from: http://www.unfpa.org/swp/2002/english/ch6/page2.htm.
33. Quisumbing AR, Haddad L, Peña C. Are women overrepresented among the poor? An analysis of poverty in 10 developing countries. Journal of Development Economics. 200;66:225-269.
34. Brayd D, Kall D. Nearly universal but somewhat distinct: The feminization of poverty in affluent Western democracies, 1969-2000. Social Science Research. 2008;37:976-1007.
35. Wallace A. Ignorance and poverty are barriers to sustainable agriculture. Communications in Soil Science and Plant Analysis. 1994;25:73-75.
36. United Nations Education, Scientific and Cultural Organization. The driving force of HIV infection in Africa - Lesson 10. [online] No publication date [cited on 13 May 2010]. Available from: http://www.harare.unesco.org/viheafmodules/m1-hivaidseduc/lesson_10.htm.
37. Nordtveit BH. Poverty alleviation and integrated service delivery: Literacy, early childhood development and health. International Journal of Educational Development. 2008;28:405-418.
38. Patel V. Is depression a disease of poverty? WHO Regional Health Forum. 2001;5:14-23.
39. Narayan D, Patel R, Schafft K, Rademacher A, Koch-Schulte S. Voices of the poor: can anyone hear us? New York: Oxford University Press for the World Bank; 2000. p. 26-60.
40. Clavecillas F. Self-esteem and community organizing [online] 2009 [cited on 18 November 2009]. Available from: http://www.self-esteemandcommunityorganizing.com/apathy-tends-to-eat-up-self-esteem.html.
41. Russell M, Harris B, Gockel A. Parenting in Poverty: Perspectives of high-risk parents. Journal of Children and Poverty. 2008;14:83-98.
42. Wade RH. On the causes of increasing world poverty and inequality, or why the Matthew effect prevails. New Political Economy. 2004;9:163-188.

43. Chetwynd E, Chetwynd C, Spector B. Corruption and poverty: A review of recent literature. Final Report. [online] 2003 [cited on 7 February 2010]. Available from: http://www.u4.no/document/literature/corruption-and-poverty.pdf.
44. African Centre for Economic Growth. The link between corruption and poverty: Lessons from Kenya case studies. [online] 2000 [cited on 15 October 2009]. Available from: http://unpan1.un.org/intradoc/groups/public/documents/IDEP/UNPAN005215.pdf.
45. World Bank. World Development Report 2000/2001: Attacking Poverty. [online] 2001 [cited on 6 March 2009]. Available from: http://siteresources.worldbank.org/INTPOVERTY/Resources/WDR/overview.pdf.
46. Rayda N. Corruption Causes Poverty and Hunger in East Nusa Tenggara, Claim Activists. [online] 2010 [cited on 25 May 2010]. Available from: http://www.thejakartaglobe.com/home/corruption-causes-poverty-and-hunger-in-east-nusa-tenggara-claim-activists/374099.
47. Hansen HT. The Dynamics of Social Assistance Recipiency: Empirical Evidence from Norway. European Sociological Review. 2009;25:215-231.
48. Mendes P. Is there such a thing as welfare dependency? [online] 2004 [cited on 10 May 2010]. Available from: http://findarticles.com/p/articles/mi_hb6469/is_69/ai_n29075092/?tag=content;col1
49. Khoo S. Correlates of welfare dependency among immigrants in Australia. International Migration Review. 1994;28:68-92.
50. Cooke M. A welfare trap? The duration and dynamics of social assistance use among lone mothers in Canada. Canadian Review of Sociology. 2009;46:179-206.
51. Contini D, Negri N. Would Declining Exit Rates from Welfare Provide Evidence of Welfare Dependence in Homogeneous Environments? European Sociological Review. 2006;10:1093.
52. Dale S. Breaking the cycle of poverty. [online] 2008 [cited on 13 September 2009]. Available from: http://www.idrc.ca/en/ev-129440-201-1-DO_TOPIC.html
53. Haddad L, Ahmed A. Chronic and Transitory Poverty: Evidence from Egypt, 1997–1999. World Development. 2003;31:71-85.
54. Krishna A. Pathways out of and into poverty in 36 villages of Andhra Pradesh, India. World Development. 2006;34:271-288.
55. UN. World Urbanization Prospects: The 2007 Revision. [online] 2008 [cited on 8 December 2009]. Available from: http://secint24.un.org/esa/population/publications/wup2007/2007WUP_Highlights_web.pdf.
56. WHO. Health and the Millennium Development Goals. [online] 2008 [cited on 4 June 2009]. Available from: http://www.who.int/hdp/publications/mdg_en.pdf.

57. WHO/UNICEF. Global water supply and sanitation assessment 2000 report. WHO/UNICEF Joint Monitoring Programme. [online] 2000 [cited on 8 July 2009]. Available from: http://www.who.int/entity/water_sanitation_health/monitoring/jmp2000.pdf.
58. Davis DL, Saldiva PHN. Urban Air Pollution Risks to Children: A Global Environmental Health Indicator. [online] 1999 [cited on 7 May 2010]. Available from: http://pdf.wri.org/urbanair_health.pdf.
59. USAID Agency for International Development. Environmental Health Project, Strategic Report 12. Improving the Health of the Urban Poor learning from USAID Experience. [online] 2004 [cited on 3 March 2010]. Available from: http://www.ehproject.org/PDF/Strategic_papers/SR12-UH%20ImproveHealth.pdf.
60. UN Centre for Human Settlements - Habitat. UN Cyber School Bus: Cities of Today, Cities of Tomorrow, Unit 5: What is Wrong with Cities? [online] 2003 [cited on 5 December 2009]. Available from: http://www.un.org/cyberschoolbus/habitat/index.asp.
61. Montgomery M, Hewitt S. Urban Poverty and Health in Developing Countries. Household Neighbourhood Effects. Policy Research Division Working Paper No. 184. [online] 2004 [cited on 26 February 2009]. Available from: http://www.popcouncil.org/pdfs/wp/184.pdf.
62. Armstrong P, Lekezwa B, Sieberts K. Poverty in South Africa: A profile based on recent household surveys. Stellenbosch Bureau for Economic Research Working paper: 04/08. [online] 2008 [cited on 10 January 2010]. Available from: www.ekon.sun.ac.za/wpapers/2008/wp042008/wp-04-2008.pdf.
63. Hoogeveen JG, Ozler B. Not separate, not equal: Poverty and Inequality in Post-Apartheid South Africa. William Davidson Institute Working Paper, (739). [online] 2005 [cited on 5 February 2010]. Available from: http://deepblue.lib.umich.edu/bitstream/2027.42/40125/3/wp739.pdf.
64. Statistics South Africa. Income and expenditure survey 2005/06. [online] 2008 [cited on 10 January 2010]. Available from: http://www.statssa.gov.za/Publications/Report-01-00-01/Report-01-00-012005.pdf.
65. Statistics South Africa. Income and expenditure of households 2005/06 – Analysis of results, Report No. 01-00-01. [online] 2008 [cited on 26 May 2009]. Available from: http://www.statssa.gov.za/ies/IES_Presentation_4-7%20March_2008_ver01.pdf.
66. Statistics South Africa. Income and expenditure of households 2005/06. Statistical Release No. P0100. [online] 2008 [cited on 3 September 2009]. Available from: http://www.statssa.gov.za/ies/IES_Presentation_4-7%20March_2008_ver01.pdf.
67. Malherbe JE. An analysis of income and poverty in South Africa [dissertation]. Stellenbosch: Stellenbosch University; 2007.

68. Martins J. Household income and expenditure in the Cape Peninsula by living standards measure (LSM) group and expenditure by type of outlet. [online] 2004 [cited on 15 July 2009]. Available from: http://www.unisa.ac.za/contents/faculties/ems/docs/Report%20343&345.pdf.
69. Martins J. Income and expenditure patterns of households in the Cape Peninsula. [online] 2005 [cited on 28 August 2009]. Available from http://www.unisa.ac.za/contents/faculties/ems/docs/Press341.pdf.
70. WHO Roll Back Malaria Partnership. Economic costs of Malaria. [online] No publication date available [cited on 30 October 2009]. Available from: http://rbm.who.int/cmc_upload/0/000/015/363/RBMInfosheet_10.htm.
71. Montgomery MR, Hewett PC. Urban poverty and health in developing countries: Household and neighbourhood effects. Demography. 2005;42:397–425.
72. Garner GO. The inter-relationship between housing and health outcomes. Proceedings of the Pacific Rim Real Estate Society Conference; 22-25 January 2006. [online] 2006 [cited on 6 March 2009]. Available from: http://eprints.qut.edu.au/7216/1/7216.pdf.
73. Smith SJ, Easterlow D, Munro M, Turner KM. Housing as health capital: How health trajectories and housing paths are linked. The Journal of Social Issues. 2003;59:501-525.
74. Lawrence RJ. Housing and health: from interdisciplinary principles to transdisciplinary research and practice. Futures. 2004;36:487-502.
75. Knowlton K. Urban history, urban health. American Journal of Public Health. 2001;91:1944-1946.
76. Vlahov D, Freudenberg N, Proietti F, Ompad D, Quinn A, Nandi V, Galea S. Urban as a Determinant of Health. Journal of Urban Health. 2007;84:i16-i26.
77. UN. Poverty, biggest enemy of health in the developing world, Secretary-General tells the World Health Assembly. Press Release [online] 2001 [cited on 28 June 2009]. Available from: http://www.un.org/News/Press/docs/2001/sgsm7808.doc.htm.
78. Manderson L, Aagaard-Hansen J, Allotey P, Gyapong M, Sommerfeld J. Social research on neglected diseases of poverty: Continuing and emerging themes. PLoS Neglected Tropical Diseases. 2009;3:e332.
79. Hadi A. A participatory approach to sanitation: experience of Bangladeshi NGOs. Health Policy and Planning. 2000;15:332-337.
80. Eisenberg JNS, Scott JC, Porco T. Integrating public health control strategies: Balancing water sanitation and hygiene interventions to reduce diarrheal disease burden. American Journal of Public Health 2007;97:1-7.
81. Tran P, Shaw R. Towards an integrated approach of disaster and environment management: A case study of Thua Thien Hue province, central Viet Nam. Environmental Hazards. 2007;7:271-282.

82. Meyer WB, Turner BL. Human Population Growth and Global Land-Use/Cover Change. Annual Review of Ecology and Systematics. 1992;23:39-61.
83. Evans GW, Kantrowitz E. Socioeconomic Status and Health: The Potential Role of Environmental Risk Exposure. Annual Review of Public Health. 2002;23:303-33.
84. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation Chapter 2: Global Status. In: Global Water Supply and Sanitation Assessment 2000 Report. Geneva: Water Supply Collaborative Council; 2001. pp. 7-14.
85. UN Population Division. World Urbanization Prospects: The 2007 Revision. [online] 2008 [cited on 30 October 2009]. Available from: http://www.un.org/esa/population/publications/wup2007/2007WUP_ExecSum_web.pdf.
86. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. Chapter 5: Challenges, future needs and prospects. In: Global Water Supply and Sanitation Assessment 2000 Report. Geneva: WHO Water Supply Collaborative Council Geneva; 2001. pp. 29-40.
87. Curtis V, Cairncross S, Yonli R. Review: domestic hygiene and diarrhoea – pinpointing the problem. Tropical Medicine and International Health. 2000;5:22-32.
88. Bannan M, Watson L. Review of supported housing in South West England. Housing, Care and Support. 2005;8:139.
89. Breysse P, Farr N, Galke W, Lanphear B, Morley R, Bergofsky L. The Relationship between Housing and Health: Children at Risk. Environmental Health Perspectives. 2004;112:1583-1588.
90. Shannon C, Wakerman J, Hill P, Barnes T, Griew R. Achievements in Aboriginal and Torres Strait Islanders' Health: Final Report. [online] 2002 [cited on 10 May 2010]. Available at http://crcweb.crcah.org.au/publications/downloads/Achievements_in_Aboriginal.pdf.
91. Leeder SR, Alexander J. Australia's national health strategy. Medicare under the microscope. British Medical Journal. 1992;305:1042.
92. Fiedler K, Lindner, M. August Gärtner and building, housing and communal hygiene: 100 years of housing hygiene in Jena. International Journal of Hygiene and Environmental Health. 2000;203:65-70.
93. McMichael AJ, Butler CD. Emerging health issues: The widening challenge for population health promotion. Health Promotion International. 2007;21:15-24.
94. Weiss RA, McMichael AJ. The social and environmental risk factors in the emergence of infectious diseases. Nature Medicine. 2004;10:S70–S76.
95. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO Child Health Epidemiology Reference Group. WHO estimates of the causes of death in children. The Lancet. 2005;365:1147–1152.

96. Stephen B. The impact of housing expenditure on the incidence and severity of poverty. GSBGM Working paper series 11/94. Wellington: Public Policy group; 1994. Cited in: Howden-Chapman P, Isaacs N, Crane JY, Chapman R. Housing and Health: the relationship between research and policy. International Journal of Environmental Health Research. 1994;6:173-186.
97. WHO. Fact Sheet No. 310, Top ten causes of death. November 2008. [online] 2008 [cited on 5 November 2009]. Available from: http://www.who.int/mediacentre/factsheets/fs310.pdf.
98. WHO. Burden of disease in DALYs by cause, sex and mortality stratum in WHO regions. [online] 2002 [cited on 1 March 2009]. Available from: http://www.who.int/whr/2003/en/Annex3-en.pdf.
99. Tuan HN, Odermatt P, Slesak G, Barennes H. Risk of latent tuberculosis infection in children living in households with tuberculosis patients: a cross sectional survey in remote Lao People's Democratic Republic. BMC Infectious Diseases. 2009;9:96.
100. Kent MM, Yin S. Controlling infectious diseases. Population Bulletin. 2006;61:1-
101. WHO Child and Adolescent Health Reaching Out. Child and Adolescent Health and Development. [online] 2009 [cited on 15 February 2010]. Available from: http://www.who.int/child_adolescent_health/documents/media/newsletter_november2009.pdf.
102. Hotez PJ. Neglected infections of poverty in the United States of America. PLoS Neglected Tropical Diseases. 2008;2:1-10.
103. Prince-Smith A, Daly JL. Downward spiral: HIV/AIDS, state capacity and political conflict in Zimbabwe. [online] 2004 [cited on 28 December 2009]. Available from: http://www.usip.org/resources/downward-spiral-hivaids-state-capacity-and-political-conflict-zimbabwe.
104. Hecht R, Alban A, Taylor K, Post S, Andersen NB, Schwarz R. Putting It Together: AIDS and the Millennium Development Goals. PLoS Medicine. 2006;3:e455
105. Worldwatch Institute. Charting a New Course for Urban Public Health. [online] 2007 [cited on 5 September 2009. Available from: http://www.worldwatch.org/node/4836.
106. Kaler SG. Diseases of poverty with a high mortality in infants and children. Annals of the New York Academy of Sciences. 2008;1136:28-31.
107. Lee JW, Loevinsohn E, Kumaresan JA. Response to a major disease of poverty: the Global Partnership to Stop TB. Bulletin of the World Health Organization. 2002;80:428.
108. WHO. Ottawa Charter on Health Promotion. [online] 1986 [cited on 24 August 2009]. Available from: http://www.iuhpe.org/upload/File/PE_Ottawa_07a.pdf.
109. Sen A. Non-communicable Diseases and Achieving the Millennium Development Goals. [online] 1998 [cited on 14 March 2010]. Available from: http://www.unescap.org/esid/hds/issues/NCD-MDG.pdf.

110. Peto R, Lopez AD, Boreham J, Thun M, Heath C. Mortality from tobacco in developed countries: indirect estimation from national vital statistics. Lancet. 1992;339:1268–1278.
111. Haustein KO. Cigarette smoking, nicotine and pregnancy. International Journal of Clinical Pharmacology Therapy. 1999;37:417–427.
112. Haustin K. Smoking and Poverty. European Journal of Cardiovascular Prevention and Rehabilitation. 2006;13:515-522.
113. Ezzati M, Lopez AD. Estimates of global mortality attributable to smoking in 2000. Lancet. 2003;362:847–852.
114. Gilman SE. Childhood socioeconomic status, life course pathways and adult mental health. International Journal of Epidemiology. 2002;31:403–404.
115. Perretti-Watel P, Seror V, Constance J, Beck F. Poverty as a smoking trap. International Journal of Drug Policy. 2009;20:230-236.
116. Rehm J, Taylor B, Room R. Global burden of disease from alcohol, illicit drugs and tobacco. Drug Alcohol Review. 2006;25:503–513.
117. Grant B. Prevalence and correlates of alcohol use and DSM-IV alcohol dependence in the United States: results of the National Longitudinal Alcohol Epidemiology survey. Journal of Studies on Alcohol and Drugs. 1997;58:464–473.
118. WHO. Neuroscience of psychoactive substance use and dependence. [online] 2004 [cited on 29 December 2009]. Available from: http://books.google.co.za/books?id=G9OhG-dZdAwC&dq=WHO.+Neuroscience+of+psychoactive+substance+use+and+dependence&printsec=frontcover&source=bn&hl=en&ei=Y6Y1TOeCGdPFsgaytY3OAQ&sa=X&oi=book_result&ct=result&resnum=4&ved=0CCcQ6AEwAw#v=onepage&q&f=false.
119. Dawson DA. Alcohol consumption, alcohol dependence, and all-cause mortality. Alcoholism: Clinical Experimental Research. 2000;24:72–81.
120. Drummond DC. The relationship between alcohol dependence and alcohol-related problems in a clinical population. British Journal of Addiction. 1990;85:357–366.
121. Bauer CR, Shankaran S, Bada HS, Lester B, Wright LL, Krause-Steinrauf H, Smeriglo VL, Finnegan LP, Maza PL, Verter J. The Maternal Lifestyle Study: drug exposure during pregnancy and short-term maternal outcomes. American Journal of Obstetrics and Gynaecology. 2002;186:487–495.
122. Berg A. The Nutrition Factor: It's Role in National Development. Washington, DC: The Brookings Institution; 1973. pp 290.
123. UN Childrens' Fund. Strategy for improved nutrition of children and women in developing countries. Policy review paper. E/ICEF/1990/1.6. [online] 1990 [cited on 23 January 2010]. Available from: http://www.adb.org/Documents/Books/Nutrition/Investing_Child/R01Mason_Hunt.pdf.

124. Streeten P. Human development: means and ends. American Economic Review. 1994;84:232–237.
125. Institute for Fiscal Studies. Human development and poverty reduction in developing countries. [online] 2006 [cited on 15 August 2009]. Available from: www.ips.org.uk.

CHAPTER 2

HOUSING THE URBAN POOR

2.1 Introduction - Housing and health of the urban poor

Housing, food and water are considered to be basic requirements for daily living. Where we live is the very core of our livelihoods. A home is where families come together and it represents a place of security and shelter.[1]

Affordable and appropriate housing protects people from hazards and promotes good health and wellbeing.[2] Deficient housing may compromise the most basic needs of water, sanitation and safe food preparation and storage, permitting the rapid spread of communicable and food borne diseases.[3] In addition, poor temperature and humidity regulation can lead to respiratory disease.[3] Overcrowding of houses introduces both physical and psychological dangers and living in or in close proximity to industrial areas can expose people to toxic chemicals that can cause both acute and chronic health effects.[3] Noise and physical safety, including vulnerability to violent crime, contribute to anxiety and depression in both developed and developing countries.[3]

The relationship between housing and health inequality, particularly within urban neighbourhoods, has been acknowledged for some time.[4] Studies have linked housing-related factors and health; however the existing published research is minimal.[5] Poor housing has been used both as an indicator of poverty and as a target for interventions to improve public health and reduce inequalities in health.[64] Although housing is high on the health inequalities agenda, it has a larger significance for the overall health domain because small health effects can have a large impact at population level.[7]

Increasing population, rapid industrialization and regional development are major factors that have exacerbated the housing situation over many years. The problem has been compounded further by rapid migration into urban areas.[1] According to the WHO, “housing, public and retail services, greenery, parks, playgrounds, and walking areas are all being recognized as factors that affect health related outcomes, such as physical activity, obesity, children’s cognitive development and the ability to socialize.”[1]

Housing is culturally defined and varies greatly between cities and countries across the globe.[8] Along with conditions in the home, conditions in neighbourhoods can have powerful effects on

health.[8] The social, physical and economic characteristics of neighbourhoods have been increasingly shown to affect short and long-term health quality and longevity.[8,9] The UN Committee on Economic, Social and Cultural Rights defined adequate housing in terms of the following:[9]

- Legal security of tenure
- Availability of services
- Materials (facilities and infrastructure)
- Affordability
- Habitability (protection from physical and environmental hazards)
- Accessibility
- Location and
- Cultural adequacy

All of the above have been shown to influence health. The balance among these factors will determine the influence housing has on health.[9] It is estimated that there are more than 100 million homeless and about 1 billion people who are inadequately housed in the world – the majority of these people are living in developing regions.[10]

Epidemiological studies have linked substandard housing with an increased risk of chronic illness.[11] Damp, cold and mouldy housing is associated with asthma and other chronic respiratory symptoms, even after potentially confounding factors such as income, social class, smoking, crowding and unemployment.[11] The lack of safe drinking water, absence of hot water for washing, ineffective waste disposal, intrusion by disease vectors and inadequate food storage have long been identified as contributing to the spread of infectious diseases.[12]

Overcrowding of houses has fostered physical health problems such as tuberculosis and bronchitis, as well as post-traumatic stress disorder and depression. In a report compiled on Health and American Housing for the Robert Wood Johnson foundation by Pollack *et al.* three interrelated aspects of residential housing and their links to health were illustrated in a model.[13] Having reviewed the literature on health and housing, an adaptation to the model by Pollack *et al.* (2008)[13] by adding an additional sphere representing the environment is suggested below (Figure 2.1).

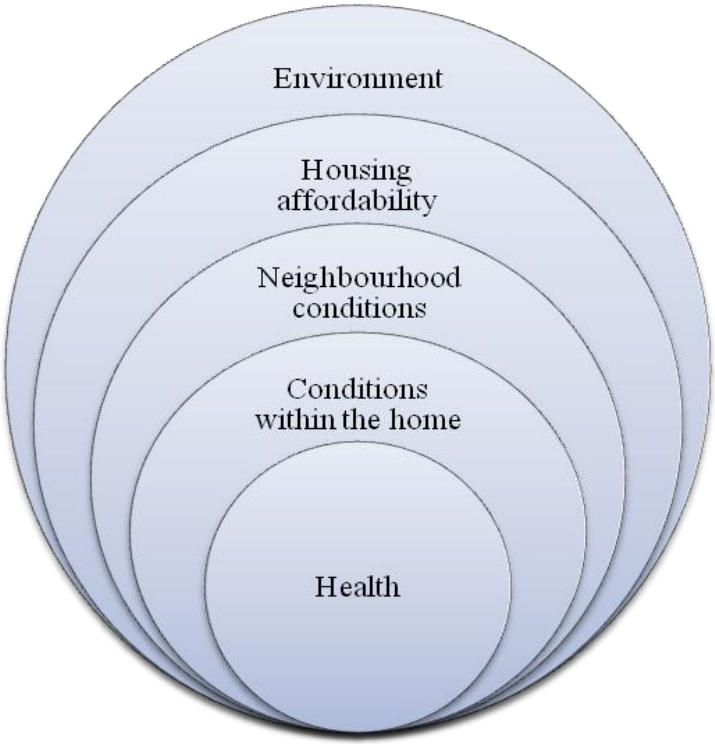

Figure 2.1: An adaptation of the Robert Wood Johnson Foundation model[13] on how housing influences health

Environmental living conditions, including housing conditions, are among the primary determinants of an individual's health and have attracted the interest of public health scientists since ancient times.[14,15] However, recently a growing evidence emerged suggesting that physical and mental health problems (anxiety, depression, attention deficit disorder, substance abuse, aggressive behaviour, asthma, heart disease and obesity) relate to the built environment, predominantly to poor urban planning and inadequate housing.[16,17]

Poor or inferior quality housing has led to many factors that cause ailments in deprived communities.[18] Research undertaken by Goebel (2007) concluded that "low-cost housing projects must understand and prioritize health and livelihoods issues for the poor. In terms of health, basic needs for sanitation and affordable services still remain, with solutions to be found in both the technical and political realms. People require dignified and improved sanitation systems; cleaner, safer and cheap cooking and heating energy sources; larger low-cost housing designs and other low cost options such as rental properties."[18] The WHOs assessment[19] of evidence linking health and housing are described in Table 2.1.

Table 2.1: The WHO assessment of evidence linking Health and Housing[19]

Linkages with sufficient evidence for estimating burden of disease	
Physical factors	• Heat and related cardiovascular effects and/or excess mortality • Cold indoor temperatures and winter excess mortality • Energy efficiency of housing and health • Radon exposure in dwellings and cancer • Neighbourhood and building noise and related health effects
Chemical factors	• Environmental tobacco smoke exposure in dwellings and respiratory and allergic effects • Lead-related health effects
Biological factors	• Humidity and mould in dwellings and related health effects • Hygrothermal conditions and house dust mite exposure
Building factors	• Building and equipment factors and injuries/domestic accidents • Injury database on domestic accidents and injuries • Estimating the number of home accidents from injuries
Social factors	• Multifamily housing, high-rise housing and housing quality and mental health
Linkages with some evidence for estimating burden of disease	
Physical factors	• Ventilation of the dwelling and respiratory and allergic effects • Chemical factors • Volatile organic compounds and respiratory, cardiovascular and allergic effects
Biological factors	• Cockroaches and rodents in dwellings and respiratory and allergic effects • Pets and mites and respiratory, allergic or asthmatic effects
Building factors	• Sanitation and hygiene conditions and related physical health effects
Social factors	• Social conditions of housing and fear/fear of crime • Poverty and social exclusion and related health effects • Crowding and related health effects • Social factors/social climate and mental health
Linkages with insufficient evidence for estimating burden of disease	
Physical factors	• Lighting conditions in the dwelling and mental and other health effects • Particulate matter in indoor air and respiratory and allergic effects

2.2 The disconnect between community health and urban planning

Historically public health and urban planning originated with a common goal of preventing urban outbreaks of infectious disease, yet today only minor overlaps between the two fields exist.[20] The separation of the fields have contributed to the health inequalities facing the urban poor.[20,21,22] While public health increasingly concentrated on biomedical factors that might contribute to different morbidity and mortality rates between the affluent and underprivileged, the field is just beginning to investigate seriously the role of land use decisions and how the built environment influences population health.[21,23]

As a result of the separation of the aims of public health and urban planning, both disciplines are failing to account meaningfully for the economic, social and political factors that contribute to public health disparities.[23] In exploring the impact of the built environment on public health, research indicates that the burden of illness is greater among minorities and lower income communities.[23] Lower-socioeconomic status communities have limited access to quality housing and live in neighbourhoods that do not support physical activity or provide many healthy food options.[17,24] Diarrhoea, worm infestations and other infectious diseases spread via contaminated water and lack of water creates difficulties for families to carry out basic hygiene around the home.[25]

The previous political dispensation in South Africa segregated population groups and thus living areas according to racial classification.[26] This resulted in unequal access to resources and created a large group of impoverished and underprivileged people (sometimes referred to as the under-class). During the apartheid dispensation these previously disadvantaged individuals were particularly hard hit by their poor living conditions.[26] These inequalities are still reflected in the layout and town plans of many South African cities and towns.[26]

Several authors suggested that an integrated approach to housing and health needs to be developed.[1,11,15,27] The built environment, through the quality of urban design, has a distinct impact on public health.[27] Housing plays a central role in everyday life and is fundamentally bound up in one's sense of control over one's circumstances.[28]

2.3 International Housing needs

The present world population is estimated to be 6.8 billion people.[29] By the year 2050, the world population is expected to exceed 8.9 billion, with most of the increase occurring in the expanding cities and towns of the developing world.[30] Urbanization has increased rapidly over the past

century, creating major changes in several aspects of human life such as economics, education, housing and public health.[31]

It is estimated that there are more than 100 million homeless and about 1 billion people that are inadequately housed in the world – the majority of these people are living in developing regions.[32] With the current rates of urban growth and the poor delivery of houses in developing countries it is estimated that in the next two decades about 35 million units need to be constructed annually to accommodate newly formed households and the replacement of inadequate houses in urban areas.[10] Roughly two-thirds of this need is estimated to arise in Asia and the Pacific region, some 16% in South America and the Caribbean, 11% in Sub-Saharan Africa and 8% in North Africa and the Middle East.[10] Africa is the least urbanized but fastest urbanizing continent.[10]

In addition, half of the global population is made up of people living in poverty and a large proportion of these individuals inhabit cities, living in informal settlements.[33] Informal settlements can be defined as human settlements that are distinguished by a dense proliferation of small, makeshift structures.[34] The arrangements of these structures are unplanned and they are built of assorted (often inadequate) materials.[34] Informal housing has received international attention as articulated in the UN MDG 7 (target 10 and 11).[34] Target 10 focuses on the provision of potable water and proper sanitation to all individuals and Target 11 aims to significantly improve the lives of slum dwellers.[34]

At the 12th session of the Commission on Sustainable Development, held in New York in April 2004, Mutume (2004) remarked in an article titled, “Rough road to sustainable development” that an estimated 1.5 billion people remain without safe drinking water.[32] Progress in the world’s poorest region, Africa, remains slowest on the provision of water, sanitation and adequate housing.[32] The UN Development Programme reports that the proportion of urban dwellers with access to safe drinking water in Sub-Saharan Africa only declined slightly, from 86% in 1990 to 83% in 2000.[32]

2.3.1 International housing policies and programmes

Based on international experience the Asian Development Bank advised that housing policies should adopt an integrated approach connecting the provision of low-income housing to social programs to address the new housing needs arising from demographic and social changes.[35] In this process, it is important to clearly define targets and eligibility criteria to enhance policy effectiveness.[35]

Countries tend to opt for one of two major strategies for the provision of affordable housing, i.e. universal or targeted approaches.[35] Countries including Singapore, the Netherlands, Sweden and Denmark have applied a universal approach, which aims to provide the entire population with decent and affordable housing.[35] The generally applied target approach is based on the supposition that while the market plays a crucial role in housing provision, particular programs should be implemented to address the needs of low-income or vulnerable groups who are frequently excluded from the open market system. Examples of targeted approaches include Canada, Malaysia, US and most of the European Union.[35]

Owing to the existing low-income housing shortage, it seems suitable to rely more on supply-side incentives in the short-to-medium term, while targeting an augmented reliance on demand subsidies in the longer term.[35] From the institutional point of view, low-income housing policies are normally decentralized and the most successful programs worldwide have relied on superior coordination amid central and local institutions which are supported by appropriate legislation and incentives at both levels.[35] Institutional arrangements are usually underpinned by measures to improve the access of low-income groups to housing finance, including public mortgages or guarantees, more flexible borrowing terms and preferential rates.[35]

Housing is a valuable asset, but has a much wider economic, social, cultural and personal significance. The Universal Declaration of Human Rights, adopted by the UN in 1948, recognizes housing as a fundamental part of the right to benefit from an acceptable standard of living for all of the world's residents.[1]This acceptable standard of living has not yet been achieved.[1] The way in which housing is delivered has an impact on development goals such as equity and poverty eradication. The construction techniques and location of housing influence environmental sustainability as well as the mitigation of natural disasters.[10] The design of dwellings reflect and protect important elements of culture and often religious beliefs.[10] In addition, Article 11(1) of the International Covenant on Economic, Social and Cultural Rights (ICESCR) states that "the state has a duty to recognise the right of everyone to adequate housing."[36]

In the past two decades there has been considerable progress achieved in policy formulation in developing countries.[10] A shift of the public sector's role towards strengthening of enabling strategies occurred by focussing on the potential and capacity of informal sectors.[10] There is however a widening gap between policy formulation and the implementation process, and the status of low-income housing delivery is far less than satisfactory.[10] The explanation for this situation lies in the existence of many constraints. Major constraints that had been noted were "lack of effective implementation strategies, poor promotion of security of tenure, inadequate supply of affordable land and infrastructure, inadequacy of housing finance systems, poor

utilisation of local building materials and technologies, lack of support for small-scale construction activities, inappropriate standards and legislation, inadequate participation of communities in the shelter development process and support to self-help, lack of focused research and experimental projects, poor utilisation of research findings."[10]

Information gathered from countries abroad demonstrate that the provision of low-income housing has led to excessive spatial concentrations, social segregation and exclusion from basic services and facilities.[35] Consequently, at present, housing policies increasingly opt for an integrated approach linking low-income housing to social programs in education, employment, health care, infrastructure and transportation. Most policies in addition, include improved environmental sustainability and energy efficiency criteria for the development of low-income housing.[35]

2.3.2 Problems and constraints in the international provision of low-cost housing

United Nations Centre for Human Settlements – Habitat (UNCHS) is contributing to the implementation of the Habitat Agenda's specific goal of "Adequate shelter for all" by undertaking diverse activities in the fields of knowledge creation, facilitation of information and experience exchange, awareness raising and advocacy, policy formulation and advice, and technical cooperation.[10] A great majority of these activities focus specifically on the needs of low income and other vulnerable groups and in this context related to low-cost housing. This organisation has summarised the main constraints in the provision of low-cost housing in urban areas as due to the following factors:[10]

- *Lack of effective implementation strategies*: Most governments in the developing world have adopted enabling shelter strategies and initiated actions to support the institutions involved in housing delivery process. These activities should however be considerably improved and the gap between policies and what is really happening in practice should be closed.
- *Poor security of tenure:* Promoting security of tenure is a prerequisite for sustainable improvement of housing and environmental conditions. Upgrading of squatter settlements need to address tenure issues to prevent/reduce evictions. Promoting security of tenure can also support better functioning of rental housing markets.
- *Inadequate supply of affordable land:* Lack of adequate land for urban development, particularly for low-income housing, is perhaps the single most important impediment in achieving the goal of shelter for all. It is estimated that only about 1% of land in the Sub-Saharan African countries are covered by any kind of cadastral system, thus available land is not easy to identify. Scarcity of land leads to escalating land prices, overcrowding

of existing neighbourhoods, illegal invasion of vacant land and growth of squatter settlements.

- *Improving municipal infrastructure and services*: Financing and maintaining infrastructure to meet basic needs of many urban communities have been difficult for the majority of governments and local authorities. This is, in most cases, due to high engineering standards that make provision of infrastructure very costly. Too often, infrastructure services are unnecessarily subsidized and often the subsidies are wrongly directed. As public authorities have not been able, in general, to provide infrastructure to the rising number of urban communities, individual households, community groups and informal enterprises have increasingly taken over this task.
- *Promotion of housing finance mechanisms:* Housing finance institutions in developing countries and particularly in Africa provide services only to a small affluent proportion of population. Financing of low-cost housing to the less affluent mostly comes through informal sources of credit. This is a result of national policies that are not successful in encouraging domestic savings and the development of small-scale domestic financial institutions and instruments. Persons with a low income lack collateral to offer as security for loans and lack a regular and recorded income. The informal credit sources that they are forced to use are expensive and mostly short-term.
- *Utilization of local building materials and technologies*: Building materials often constitute the single largest input to housing construction in most developing country cities, particularly in Africa. Up to 70% of the cost of construction of a formal low-cost dwelling can be taken up by the cost of building materials alone. Many African countries depend largely on imported building materials and technologies despite the fact that they have ample natural resources that can yield suitable building materials. In some countries extensive research is carried out on replacing imported building materials with locally available materials, only few of these research findings have been implemented by the builders of low-cost houses in those countries.
- *Support of small-scale construction activities*: There is a lack of suitable small-scale construction firms which can operate particularly in informal settlements. Unrealistic planning and building standards and complex administrative procedures to obtain permits and licenses are impediments to the encouragement of such small-scale firms. Small-scale firms also lack credit mechanisms suitable for small entrepreneurs; they need co-operative agreements with other partners to operate and they have difficulty in obtaining construction equipment. The lack of provision of training and advisory assistance impede the improvement of performance of small-scale firms and the lack of opportunities to participate in larger public sector contracts deny these firms the chance to learn and expand.

- *Adjusting standards for building and land subdivision*: In many African countries, standards for building and land subdivisions do not consider affordability issues and have a general nature. Standard subdivisions are often based on regulations of the pre-independence periods prescribing large plots and banning building close to property boundaries. This results in large plot sizes and high infrastructure costs.
- *Promotion of community participation and self-help*: The provision of state funded houses by governmental agencies to the urban poor has been proven to be unsustainable. The poor have demonstrated that they can effectively participate in the housing process; however, they have to be supervised and provided with the necessary training, credit and technical assistance.

2.4 Housing needs in South Africa

In developing countries, such as South Africa, a sizable proportion of the rural dwellers in-migrating into the cities ended up in informal settlements[31] especially around the city perimeter. The rate of urbanization due to migration from within and outside the country imposes great strain on the capacity of central and local government to deliver municipal services and to regulate economic activities and conditions to absorb the increasing population. The consequences of this situation impacts on the quality of life of urban dwellers, especially those without the means to support their basic needs.

South Africa has an ecological footprint of 5.2 hectares per person, which is much higher than the global average.[37] Expanding settlements and urban sprawl lead to the destruction of natural habitats and the loss of high potential and income generating agricultural land.[37]

The expansion of informal settlements around the urban centres and peri-urban areas has been rapid. Whilst nearly 58% of South Africa's population lives in urban areas, housing backlogs in cities have increased dramatically.[38] According to the South African Institute of International Relations (2008), "between 1996 and 2007 the total number of households residing in informal dwellings grew by 24.2%, from 1.45 million to 1.80 million. During this period, the number of households living in backyard informal dwellings rose by 46% from 403 000 to 590 000. The number of households staying in free-standing makeshift dwellings in informal settlements grew by 16% in comparison, from just over one million to 1.2 million. At the same time, backyard informal structures as a proportion of total informal dwellings grew by 18% while those built in informal settlements declined by 7%."[38]

According to the South African Census 2001 Atlas (2003), an estimated 16.4% of households nationally are of an informal (or squatter) type, including those that are in backyards and elsewhere, such as municipal or private land.[39] The rate of provision of subsidized housing in South Africa has been inadequate in the face of the number of existing households that are in need of housing, as well as the new households that are forming as a result of in-migration and population growth.[39]

In addition to the overwhelming backlogs, inadequate housing provision and resource inefficiencies and the repercussions of the apartheid dispensation created particular problems.[40] The main housing-related consequences were that the apartheid policies:[40]

- Separated and divided the city and its land uses into racially-divided group areas
- Created discrete pockets of land uses and mono-functional housing estates
- Used planning standards based on quantity, not quality that sought to create substandard suburban environments instead of urban environments

The concentration of substandard housing in less advantaged neighbourhoods further compounded racial, ethnic as well as socioeconomic disparities in health[41] and further infringed on the rights of individuals.

At present, local municipalities are faced with a severe shortage of capacity and resources and experience increasing levels of corruption.[37] Many poorer households still lack access to basic services, particularly adequate sanitation facilities.[37] Access to adequate health care and quality schooling is varied across the country and particularly problematic in poor rural areas.[37] Unpermitted waste disposal sites are found across the country and many of these sites do not meet required environmental health standards.[37] Many settlements are located near 'unhealthy areas' such as industrial areas and polluted streams which poses many health risks to adjacent communities.[37]

2.5 South Africa's response to housing needs

The South African housing policy is mainly based on the promotion of fully subsidised home-ownership for the poor and seeks to eradicate informal housing, including backyard shacks.[42] The White Paper on Housing of 1994 prioritized the needs of the poor. The African National Congress (ANC) Reconstruction and Development Program document of 1994 and the Constitution (1996, page 12) also committed to providing housing for the poor.[43,44] Section 26 of the South African Bill of Rights states that "everyone has the right to have access to adequate

housing."[43,44] In addition to providing this right for everyone, Section 28 of the constitution affords children extra protection, in that "every child has the right to shelter."[43,44]

The policies of the National Department of Housing aiming to reduce the urban housing deficit, estimated at 2-3 million units, have resulted in the creation of a tertiary sector of subsidized housing also referred to as low-cost housing.[45] Since 1994, the low-cost housing programme has typically involved building serviced townships on urban peripheries, which in itself resulted in a myriad of environmental, social and political concerns.[18] Government has responded to these emerging problems by making some changes to the housing policy, for example, the adoption of the Habitat Agenda after the Habitat II conference of 1996.[46] The Agenda promoted a "people's housing process" approach, meant to support local people's initiatives and sustainability in housing.[46] The South African government then promulgated the Urban Development Framework (1997) which has been criticized as overly supporting market-led urban development and reforms.[46]

In September 2004 the South African government adopted the Breaking New Ground (BNG) initiative (previously known as the Reconstruction and Development Programme or RDP) which aims to address a sustainable habitat agenda.[47] The BNG initiative includes support for *in situ* upgrades and social housing options while explicitly linking health and housing.[47] The initiative accepted the criticisms of the inappropriate utilization of urban green fields and open spaces and the problems associated with a mass delivery approach to housing.[47] In addition, a Housing Indaba held in September 2005 identified as the first of their targets. "The removal or improvement of all slums in South Africa as rapidly as possible, but not later than 2014," bringing together stakeholders in low cost housing from government, the private sector, civil society and academia.[18] More than 1.6 million houses have reportedly been built between 1994 and 2004 through the subsidized program of the national government.[48]

Goebel (2007) documented many problems that have been identified with the delivery of BNG houses, including:[18]

- The allocation of plots of land.[18]
- The formation of 'slums' on urban peripheries, far from jobs and services caused by new low-cost housing schemes and townships.[49]
- The poor quality and rapid deterioration of new houses and infrastructure (such as sewerage services) and the large burden of subsequent maintenance.[46]

- The inadequacy of the dominant model of free-hold tenure in dealing with the dynamics of poverty and several categories of the urban poor. These categories include temporary workers and many women, who would be better served by rental accommodation.[49]
- The unpopularity of the existing model of housing. Larger houses were needed and the main model was changed in 1998 when Department of Housing increased minimum size of new houses to 30 square metres.[46]
- Selling or renting of BNG houses by the new owners for financial gain or to alleviate debt.[46,50,51] This renting or selling is illegal.[47] Such owners then moved back to squatter or other informal settlements closer to their economic activities as the cost of transport from the new townships to their work was more affordable.[18]
- Environmental concerns regarding the new developments including increases in vehicle traffic caused by urban sprawl and land use changes.[18]
- Competition between family rights versus those of the registered owner. There have been cases where spouses have become estranged and the registered owner then sold the house from underneath the family and kept the proceeds.[52]
- Informal sale of registered properties in a secondary market – after a house has been granted to a land reform programme beneficiary, it is then sold. However, the transaction is not registered in the Deeds Office. Consequently, these houses cannot be mortgaged. Financial institutions do not issue a loan against a house if the “owner” is not the person whose name appears on the deed.[53]
- Informal transactions involving parcels of land or houses prior to registration of title. In Khayelitsha, Cape Town, when the first batch of 21 000 houses were to be transferred, some 20% of the names on the list of people who had been assigned a house, did not match those claiming the house. In November 1997, 4 427 of the registrations that were in progress had been referred to a dispute resolution committee set up by the City Council.[53]

Another obstacle in the provision of low-income housing is the difficulties encountered by commercial banks in extending loans in this market.[54] The housing finance situation in South Africa is fundamentally determined by two interwoven factors:[54]

a) Income distribution
b) The legacy of apartheid, which enforced racial separation of residential areas and differentiated ownership rights according to race and area

Even though there are problems experienced with BNG housing, for example: small size of houses, poor construction quality and peripheral locations, the role of the BNG housing system has created renewed opportunities for informal housing.[45,46,55] The BNG is a housing strategy

which formalizes residents' occupancy and land tenure.[56] Houses and their accompanying plots in BNG settlements offer a new location for backyard dwellings, leading to changes in the nature of backyard housing.[56] These backyard shacks differ from those in informal squatter settlements in that they are erected on a serviced site and provide additional accommodation and/or rental income to new homeowners.[57]

Three sectors of housing now co-exist in South Africa: the private formal sector, the informal sector and the publicly subsidized sector.[58] South Africa's state-funded housing policy is based on a once-off housing subsidy to be used for the provision of a nuclear home that can be extended over time. This subsidized sector is largely driven by the centralized intervention of the government and public agencies, often relying on direct housing procurement by the municipalities.[45] The final products of this sector are mostly houses built on contract by non-governmental organizations (NGOs) or private builders with public subsidies allocated to individual beneficiaries.[59] The self-help approach envisaged in the policy is called the "People's Housing Process." This community-based approach promotes the active participation of the beneficiaries in the development of their own housing products.[59] The initiatives often take the form of mutual self-help projects supported by local or international NGOs.[58]

2.6 Low-cost housing settlements in South Africa

South Africa has been implementing a land reform and housing programme since the early 1990s. In 1994, at the time of South Africa's first non-racial democratic elections, an estimated 1.06 million households comprising 7.7 million people lived in informal settlements.[60] Coupled to this an estimated 720 000 serviced sites required upgrading and a further 450 000 people lived in various (often inadequate) forms of hostel accommodation.[60] Many of these subdivisions are non-permanent (by means of non-structural, i.e. furniture or curtains).

Extended families, sometimes of more than a dozen inhabitants, may share the confined space in a BNG house.[61] Family members often have to sleep on the floor, increasing the risk of acquiring infections while the deprived living conditions sometimes make it more difficult to recover from such infections.[61] Most BNG homes consist of a single room which owners have to subdivide themselves. A typical subdivided layout would include a bedroom, a small living and cooking area around the single tap and an area cordoned off around the toilet.[62] Table 2.2 indicates the number of housing units that are completed or under construction as part of the RDP (later BNG) programme up to 2008.[63]

Table 2.2: Housing units completed or under construction (1994 to March 2008)[63]

Province	Number of Houses	Provincial Distribution
Eastern Cape	300 915	12%
Free State	173 732	7%
Gauteng	683 343	27%
Kwazulu-Natal	424 569	17%
Limpopo	199 782	8%
Mpumalanga	186 531	7%
North West	248 306	10%
Northern Cape	57 831	2%
Western Cape	293 053	11%
South Africa total	**2 568 062**	**100%**

The data in Table 2.2 were accompanied by the following note, "Housing delivery in the first five years of democracy varied greatly from year to year and from province to province as different systems of reporting and monitoring had to be unified. It is also important to note that no government elsewhere in the world provides free houses."[63]

Land and shelter are emotive issues in South Africa, and has the potential to create social schisms.[64] The BNG policy document introduced new options for delivery, allowing for a range of delivery modes and housing/subsidy configurations, including emphasis on the rental market and significant variation in local approaches.[65] Housing allocation in South Africa therefore has the potential for serious conflict.[43,66] The allocation of state subsidized houses has been beset with a number of difficulties, one of which is the allocation of houses in particular communities. Establishing rules and procedures to decide who should be a beneficiary of the system, who is entitled to a house or a government subsidy when a settlement is upgraded are particularly challenging.[67]

Urban planning research demonstrated that South African cities are largely fragmented and suffer the post-apartheid consequences of social segregation and compartmentalization, aggravated by suburban-type low densities.[68,69] This resulted in numerous technical, urban, social and economic problems associated with service delivery of low-cost housing projects in South Africa.[70]

A background research paper produced for the South Africa Environment Report on behalf of the Department of Environmental Affairs and Tourism revealed that the main issues around South Africa's settlements are the integration of urban settlements to remove the distortion of apartheid

planning and the deliverance of basic services and needs.[37] These services included housing, water, sanitation, electricity and waste removal. The condition of the informal settlements across the country has been described as still being socially and economically divided.[37]

There are many well documented examples of community groups taking charge of the housing needs of a particular community despite a lack of government assistance. For example, in South Africa a popular movement known as the South African Homeless Peoples Federation has been encouraging local communities to organize themselves into informal savings groups to build their own houses.[32] Since its establishment in the early 1990s, the federation has seen 14 000 low-cost houses built across South Africa by former slum-dwellers, the majority of them woman. The federation is currently supporting similar savings groups in Ghana, Kenya, Madagascar, Namibia, Swaziland, Uganda, Zambia and Zimbabwe.[32]

Insecure occupancy of housing and limited prospects of secure employment makes living conditions difficult for the underprivileged worldwide. Such living conditions include poorly constructed housing from inferior quality building materials and limited building skills; the location of housing on contaminated or disaster prone sites; limited basic services like clean water, garbage collection and sewage treatment.[71] An emerging source of housing-related health problems is caused by the type of building materials commonly used in new housing. For example, composite wood panels such as particle-board are vulnerable to moisture damage that can encourage mould growth.[72]

Poor maintenance of houses over long periods leads to dilapidated housing – leaking pipes, peeling paint or cracks and holes in roofs and ceilings.[73] This may be a stressor that affects the human immune system.[73,74] Housing disrepair among the poor exposes them disproportionately to lead contamination, pests, air pollutants, contaminants and greater social risks.[73,75] Disease carrying vectors and pests increase where buildings are dilapidated and no amount of cleaning can remove a pest problem where such structural disrepair remains uncorrected. Furthermore, pesticide use in dilapidated structures may jeopardize the health of inhabitants.[76]

2.7 Backyard dwellings in South Africa

Statistics provided by UNCHS (2003) suggest that South Africa has a higher proportion of urbanized dwellers than anywhere else in Africa, as a result of its relatively high level of industrialization and its role as an economic powerhouse of the continent.[9] The urbanized proportion of South Africa's population was estimated at 56.9% for the year 2000, with its projected 2010 figure at 64.2%.[9] Urbanization is often linked to massive unplanned peri-urban

growth[77] as well as informal settlements within urban boundaries.[78] This proved to be the case in South Africa.

Renting space on which to build a shelter is not a feature unique to Cape Town or even South Africa. It has been observed in the Caribbean[79,80,81] in the 'rent yards'; in the 'ciudades perdidas' of Mexico[82] and their equivalents in Lima;[83] in the 'bustees' of Calcutta;[84] and in the land rental settlements of Bangkok.[85,86] From a financial perspective, squatting in South Africa appears to be a cheaper option than renting a shack in the backyard.[42] The success of backyard shacks seems to have some correlation with the size of the city.[42] While 55% of the population of African townships in six major cities was renting in 1993,[87] this estimate varies according to the size of the city. Backyard shacks were very popular in Guguletu and Kayelitsha in 1994 and were found on 87% of the plots, and this proportion varied from 68% to 100% according to different areas in Cape Town.[88]

South Africa is facing a low-income housing crisis, with the current backlog estimated at over three million units.[54] Lemanski (2009) argued that South Africa's formal housing policies have indirectly encouraged backyard dwellings and have thereby augmented informality in South African cities.[56] With the rising need for adequate housing and safe water and sanitation in close proximity to urban areas, a uniquely South African phenomenon[8] of informal housing side-by-side with formal low-cost housing has evolved in state-assisted housing settlements – referred to as 'shacks in the backyard.' Although backyard dwellings can be brick-built outhouses this is encountered very infrequently. The usual structure of a backyard shack consists mainly of flimsy building materials often constructed as a lean-to structure attached to a wall of the main house. The primary focus of this dissertation is on informal shacks erected in the backyard of government subsidized houses.

Recycled materials like corrugated iron, plastic bags and fence posts are often utilized to construct backyard shacks. A typical shack consists of one room where all of the family will eat, sleep and live. The shacks are highly susceptible to fires from paraffin stoves.[61] These shacks do not have a tap or toilet facilities and often depend on either the main BNG house or the municipal tap and bucket system for these amenities. Official statistics on informal housing first differentiated between informal dwelling in backyard and informal dwelling not in backyard in the Census of 1996.[61]

In 2006, just over 2.6 million children in South Africa lived in backyard dwellings or shacks in informal settlements.[89] The principal reasons that have been identified for living in a backyard dwelling are for the purposes of access to services, more convenient location, flexibility and

reduced threat of eviction, as well as structural reasons related to the failures of the housing policy.[56] An example of a structural reason is that the size of the main house may not be large enough to accommodate all members of the family.[56] The most important reasons for property owners of BNG houses having backyard dwellings are the need for additional space and income generation.[56]

Although a few backyard dwellings existed as early as the 1920s,[90] Lemenski (2009) described widespread backyard housing as having "originated in Coloured communities in the 1960s and were referred to as hokkies (a Dutch word meaning shack or doghouse), which accommodated relatives, with payment in kind, rather than formal tenants for financial rent."[56] During the same period, backyard dwellings emerged in Black African townships as a dual consequence of the halt on building houses for urban Black Africans during the late 1960s and the prohibition of informal settlements.[56] Unlike "hokkies" in Coloured communities, backyard dwellings in Black African townships accommodated paying tenants, rather than family.[91,92]

Many backyards of government subsidized houses host more than one shack and landlords share electricity, water, sanitation and refuse collection with backyard tenants in return for rent.[56] Backyard dwellings merge into existing residential areas and are functioning alongside neighbours with formal occupancy rights and access to infrastructure and services. In this way backyard dwellings generate income for cash poor home owners and provide serviced accommodation for poor tenants.[56]

In 1990, almost 60% of township properties in Gauteng province hosted backyard dwellings, which housed 44% of the black African population of the province and represented 85% of shacks in Johannesburg.[91,93] By the late 1990s almost all backyard space in the Soweto Township hosted an informal shack or outhouse structure, accommodating 30% of Sowetans.[94] Backyard dwellings were also prevalent in Cape Town townships over the same period. In 1994 shacks existed in the backyards of 87% of township houses in Guguletu and Khayelitsha.[88] Lizarralde and Massyn (2008) explained that despite the negative mind-set and controversial concern towards backyard dwellers, the following realities should be taken into account:[70]

- The rental space in backyard shacks provides an additional source of income to poor families. During the year 2000 it was estimated that rent for accommodation in an informal shack in the Cape Town area ranged from R75 to R200 for a single room.[95]
- A shack is a method of accumulating capital for the poorest families. In 2004 it was reported that residents of informal housing estimated that their units had a value of R4000.[96]

- Backyard shacks serve as a rental housing solution in the Cape Town market, providing a housing solution for the poorest families that could not access to property or governmental subsidies.[70]
- Shacks can be described as environmentally friendly. Members of society that are familiar with traditional standards of formal construction, consider shacks as unpleasant anomalies in urban areas. This is, however, a prejudice that ignores optimistic advantages of shacks - they take full advantage of space, their construction relies on local know how and skills, members of the community utilize locally available materials, their location often minimize transportation costs and they are an example of reuse and recycling of materials.[70]

Backyard dwellings remain an under-researched area, and the existing literature on the subject matter is fragmentary.[56] With the exception of a handful of in-depth studies[8,42,56,87,90,93,95] reference to backyard dwellings tends to be only a small fragment of research that focused on other aspects of housing. A significant commonality of the existing research is its focus on backyard dwellings in urban townships. Research undertaken by Lemenski (2009) investigated the ways in which the growth of this relatively new segment in South Africa's housing market, subsidized houses for low income households affects the backyard housing sector.[56]

Prior to 1996, housing policies disregarded backyard dwellers and most national surveys captured them in the informal settlement bracket, though their circumstances and challenges are dissimilar.[56] According to the South African Institute of Race Relations (SAIRR), 590 000 households (approximately one-third of all households living in informal housing settlements) reside in backyard shacks[38] representing 5.7% of all South African households.[97] The SAIRR have indicated that "the proportion of households living in backyard dwellings is increasing more rapidly than the proportion in informal settlements, indicative of the growing popularity of this housing type in the context of massive housing shortages."[38]

The South African government is promoting homeownership rather than rental housing, despite indications that private renting is the fastest growing form of accommodation for low-income households. It has been demonstrated that poor tenants are most likely to rent from poor landlords rather than wealthier individuals, private or public institutions.[9,65]

2.8 City of Cape Town housing needs

The Cape Town Metropole, like the rest of South Africa, has vast disparities between the wealthiest communities living in comfortable first world conditions, and the poorest, who live in conditions that are as bad as some of the worst found in developing countries.[98] Cape Town is an

old city by South African standards - the first European settlers arrived in 1652 to find an established but sparse indigenous population at the Cape.[99] The present Cape Metropolitan Area (CMA) however came into being in 1997 through the amalgamation of 39 local authorities into 6 municipalities and one co-ordinating body called the Cape Metropolitan Council (CMC).[99]

Cape Town is the largest city in the Western Cape Province which is the southernmost province of South Africa.[100] The demographics of the Western Cape are unique to South Africa as it is the only province that does not host a Black African majority.[100] According to the 2001 South African census, the so-called 'coloured' community shows the single largest population growth (48%), followed by black Africans (32%) and Whites (19%).[100]

Housing development in the Western Cape has been a fundamental problem that affected most historically disadvantaged people, especially those residing in economically deprived areas in what are called informal settlements.[47] The definition of persons eligible to apply for a government subsidized house used by the Provincial Housing Department and local municipalities, is any person who does not have a place of their own to stay or who may live in hostels, backyard shacks and various other forms of informal dwellings'.[47] Shacks that are situated in the backyard of a formal house (often state-funded) are still considered informal dwellings and if the backyard dwellers do not formally own the property then they too are eligible for a subsidized low-cost house.

The service delivery challenges facing elected local authorities in Cape Town date back many decades.[100] Almost 10.5% of Cape Town's Black-African headed households reside in backyard accommodation in informal shacks and 7.5% of Coloured headed households reside in backyard accommodation.[101] The 2006 General Household Survey Analysis of Cape Town found that 48.9% of the dwellings in the survey could be described as a house on a separate stand. About 9.4% of dwellings were classified as informal dwellings in a backyard and a further 13.1% as informal dwellings not in a backyard.[102]

2.9 Challenges of low-cost housing settlements in the City of Cape Town

A considerable number of urban communities in the City of Cape Town still lack basic services such as housing, running water, access to electricity, sanitation and refuse removal. Rampant crime, high levels of unemployment and a high rate of illiteracy are common in these economically depressed areas in the City.[103]

The City of Cape Town housing department estimates that 75 400 households live in backyard dwellings[101] and are almost exclusively Black African and Coloured-headed households.[56] Lemenski (2009) is of the opinion that "the inadequate size and quality of backyard dwellings, as well as unhealthy living environment, are similar to living in an informal settlement, backyard shacks differ in being situated on a demarcated plot within a formal fully-serviced housing area, and their proliferation throughout urban South Africa is linked to the massive housing shortage for poor households."[56]

Case study: Missionvale

The unintended consequences of low-cost housing settlements are a prominent problem elsewhere in South Africa too. A model project in Missionvale, Port Elizabeth, South Africa is an example of a 'failed' venture and its failures offer some hard lessons about shelter, poverty, and equity which are illustrated in the following case study (quoted in its entirety).[104] The housing initiative was managed by community-based organization, the Missionvale Housing Development Trust, which was established in 1997 by the General Motors Foundation. The project provided 500 houses to the poor with the intention of addressing some of the physical and social needs of the community.

CASE STUDY – MISSIONVALE[104]

Cities of the Poor II: Housing and Poverty

December 19, 2006.

Schmidt: For most of his life, David Cesear lived in a shack - a scrap metal shelter with no running water. But eight years ago, he pushed open the door to his new home, a pastel green house at number 34 Chevelle Street in Port Elizabeth.

Cesear: "I was so happy, I say thank you Lord because it was a long time that I waiting for a house. And when I moved in some things have changed my life, like I've got water in my house and my toilet was inside my house. That was changing my life."

Schmidt: Cesear was one of the first residents of the Missionvale Housing Project in Port Elizabeth. Port Elizabeth is a gritty industrial city on the Indian Ocean, and the hub of auto manufacturing in South Africa. General Motors has a plant here and it was the non-profit GM Foundation that spurred the building of Missionvale.

Matlock: "We wanted to do something different."

Schmidt: Roger Matlock is the head of the GM foundation and a longtime South African housing advocate. Matlock says for decades, the South African government's idea of public housing was the so-called “matchbox” house - a four-room concrete block structure. Matchbox house settlements exist on the fringes of most South African cities. Like much of the world's public housing, they're bleak outposts far removed from city life. Matlock says when he conceived Missionvale, his goal was clear: design a new model for public housing and one that was easy to replicate.

Matlock: “If we can get the government to see a good idea that works in practice, the government have the resources to do it on a large scale.”

Schmidt: The Missionvale Housing Project was, in many ways, revolutionary.

Del Monte: “Hello, Joel.”

Schmidt: Urban Planner Lance Del Monte designed Missionvale. On a sunny weekday morning, he walks me through the project. Some kids tag along.

Del Monte: “Are you all on school holiday now? Are you enjoying your school holiday?”

Schmidt: Missionvale is a complex of 493 row houses. Most are two stories tall. This layout is unusual for South Africa. Almost all public housing units here are freestanding single-story structures. Del Monte says he worked to design a community that was dense but didn't feel dense. He points to a line of houses that wind their way up the hill.

Del Monte: “We tried to certainly create a sense of place, these rows up this road here and sort of staggered a little bit, there is a kind of I suppose a charm in having it do that.”

Schmidt: The idea behind Missionvale was to build not just attractive housing but a self-sustaining community. Missionvale was built near Port Elizabeth's manufacturing district, a likely source of jobs. It's close to bus lines, schools and hospitals. Many of the residents received job training as plumbers, carpenters and bricklayers. Residents were encouraged to volunteer for committees to oversee community policing, civic planning, even AIDS education. And at Missionvale, residents received title to their homes. They weren't squatters or renters, but owners. That was expected to instill a sense of responsibility. Homeowner David Cesear remembers the euphoria he and other new residents felt. It wasn't just the houses they were happy about; it was the plans for a thriving community.

Cesear: “Every week we had meetings, everyone was excited.”

Schmidt: That was eight years ago. These days this once praised project is in many ways just another slum. There's little left of the original optimism. The houses feel worn out. Jagged cracks scar the fronts of many of them. Plywood boards have replaced glass windows. Mangy dogs and ragged children roam the streets.

David Cesear says the community is a mess. Around the corner from his house, the road is blocked by a large pool of fetid garbage.

Cesear: “The people, they don't want to, uh, clean up the place here, see that is our main problem that we are facing, throwing the water in the streets, papers, rubbish, everything.”

Schmidt: And there are many problems beyond the physical state of this place. Men, young and old, sit listlessly in their yards. Some say they don't have the bus fare to look for work. They complain about cracked walls and leaks but lack the cash or energy to make repairs. Many of the original owners are gone. Some have died of AIDS, others have sold their homes for badly needed cash and returned to the squatter settlements. Back in his office, Missionvale designer Lance Del Monte gives a weary shrug.

Del Monte: “I think it became a bit of a nightmare, to be honest.”

Schmidt: When asked what went wrong, Del Monte answers, “We made a lot of mistakes.” But the bottom line, he says, is he and the others who designed Missionvale chose the wrong people to live there.

Del Monte: “We chose the most impoverished, and the most under-resourced, and the people with the largest families to live in Missionvale because we thought that was the right thing to do, we needed to address those who were in the most need. And that was a mistake.”

Schmidt: Missionvale's residents are the poorest of the poor. Most are unemployed, eeking out an existence on less than $100 a month. Many are also sick from tuberculosis, alcoholism and HIV. Melanie Acoline manages a church-supported assistance center that helps feed Missionvale's impoverished residents. She says the people picked to live in Missionvale couldn't afford the luxury of home ownership.

Acoline: “They went into homes not being prepared, with no income, now they are expected to buy electricity, they have to pay for water, if a window gets broken, it's fixed with plank.”

Schmidt: What's more, Missionvale's plans relied on these impoverished people to work together to keep the community running. That, too, was a mistake says Del Monte.

Del Monte: "We underestimated the, um, whole idea of volunteerism, that people would volunteer, you know, without payment."

Schmidt: Del Monte says he's learned some hard lessons. He no longer believes in subsidized housing projects exclusively for the poorest of the poor. He says the destitute might be better off in projects owned and run by the government, or selectively placed in mixed-income housing projects. Del Monte says simply transporting the indigent from shacks to houses is a recipe for failure.

Del Monte: "You cannot view housing in isolation. It is not a product that is going to solve some social problem. It is not."

Schmidt: For all its failures, Missionvale can boast some successes. Architecturally, it is still considered an innovative model, and it has been replicated. The community-run daycare center is thriving. One man has become a successful plumber and put an addition onto his row house. And then there's David Cesear.

Cesear: "Yes, this is my original house."

Schmidt: His home at number 34 Chevelle Street has deep cracks in it. The window frames are rotting. Upstairs, there's no ceiling. Mattresses lie on bare floorboards. Still, Cesear says it's his house, and he's content.

Cesear: "It's enough for me."

Schmidt: For The World, I'm Jennifer Schmidt, Port Elizabeth, South Africa.

Chapter 1 reviewed the influence of poverty on the poor. Chapter 2 reviewed the many ways, direct and indirect, that the quality of housing can affect the wellbeing of those who live there. The present study intends to integrate these two major dynamics by investigating the status quo in selected government sponsored low-cost housing settlements in the City of Cape Town. These settlements have low-cost houses with a very high proportion of informal shacks in the backyard, creating a juxtaposition of the two housing types.

2.10 References

1. WHO European Centre for Environment and Health. World Health Organization approach to housing and health. [online] 2004 [cited on 28 April 2009]. Available from: http://test.cp.euro.who.int/document/NOH/laresrpt.pdf.
2. WHO. Health Principles of Housing. [online] 1989 [cited on 25 March 2009]. Available from: http://whqlibdoc.who.int/publications/1989/9241561270_eng.pdf.
3. Brown VJ. Give me Shelter: the global housing crisis. Environmental Health Perspectives. 2003;111:A92-A99.
4. Breysse P, Farr N, Galke W, Lanphear B, Morley R, Bergofsky L. The Relationship between Housing and Health: Children at Risk. Environmental Health Perspectives. 2004;112:1583-1588.
5. Xavier RB, Braubach M, Moissonnier B, Monolbaev K, Robbel N. Housing and Health in Europe: Preliminary results of a Pan-European study. American Journal of Public Health. 2003;93:1559-1563.
6. Gauldie E. Cruel habitations: a history of working class housing, 1780-1918. London: Allen and Unwin; 1974. pp. 363.
7. Thomson H, Petticrew M, Morrison D. Health effects of housing improvement: systematic review of intervention studies. British Medical Journal. 2001;323:187-190.
8. Crankshaw O, Gilbert AG, Morris A. Backyard Soweto. International Journal of Urban and Regional Research 2000;24:841-857.
9. UN Human Settlement Programme (UN-HABITAT). The Challenge of Slums. Global Report on Human Settlements. [online] 2003 [cited on 23 March 2010]. Available from: www.unhabitat.org/downloads/docs/GRHS.2003.0.pdf.
10. Erguden S. Low-cost housing: policies and constraints in developing countries. Proceedings from the International Conference on Spatial Information for Sustainable Development; 2-5 October 2001; Nairobi, Kenya. 2001.
11. Peat JK, Dickerson J, Li J. Effects of damp and mould in the home on respiratory health: a review of literature. Allergy. 1998;53:120-128.
12. Marsh BT. Housing and health: the role of the Environmental Health Practitioner. Journal of Environmental Health. 1982;45:123-128.
13. Pollack C, Egerter S, Sadegh-Nobari T, Dekker M, Braveman P. Where we live matters for our health: the links between housing and health. [online] 2008 [cited on 31 April 2009]. Available from: http://www.rwjf.org/files/research/commissionhousing102008.pdf
14. Foster HD. Health, Disease and the Environment. London: Belhaven Press; 1992. p. 439-478.

15. Krieger J, Higgins DI. Housing and Health: time again for public health action. American Journal of Public Health. 2002:92:758-768.

16. Raffestin C, Lawrence R. An ecological perspective on housing, health and well-being. Journal of Sociology and Social Welfare. 1990;17:143-160.

17. Fullilove MT. Promoting social cohesion to improve health. Journal of the American Medical Women's Association. 1998;53:72-76.

18. Goebel A. Sustainable urban development? Low-cost housing challenges in South Africa. Habitat International. 2007;31:291-302.

19. WHO European Centre for Environment and Health. Report of the WHO Technical Meeting on Quantifying Disease from Inadequate Housing. [online] 2006 [cited on 6 March 2010]. Available from: http://www.euro.who.int/Document/HOH/EBD_Bonn_Report.pdf.

20. Geronimus AT. To mitigate, resist, or undo: addressing structural influences on the health of urban populations. American Journal of Public Health. 2000;90:867-872.

21. Greenberg MF, Popper F, West B, Krueckeberg D. Linking city planning and public health in the United States. Journal of Planning Literature. 1994;8:235-239.

22. Freudenberg N. Time for a national agenda to improve the health of urban populations. American Journal of Public Health. 2000;90:837-840.

23. Hancock T. Planning and creating healthy and sustainable cities: the challenge for the 21st century. [online] 2002 [cited on 5 November 2009]. Available from: http://www.who.dk/healthy-cities/hcppub.htm#Our_Cities.

24. Bashir SA. Home is where the harm is: housing as a health crisis. American Journal of Public Health. 2002;92:733-738.

25. WHO. Health and the Millennium Development Goals. [online] 2005 [cited on 20 January 2010]. Available from: http://www.who.int/hdp/publications/mdg_en.pdf.

26. Nicholson J. Bringing health closer to people: Local Government and the District Health System. [online] 2001 [cited on 14 February 2009]. Available from: http://www.hst.org.za/uploads/files/lg_dhs.pdf.

27. McCarthy DT, Mitchell VG, Deletic A, Diaper C. *Escherichia coli* levels in urban storm water. Proceedings from the WSUD & UDM Conference; April 2006. [online] 2006 [cited on 28 March 2009]. Available from: http://iswr.eng.monash.edu.au/research/projects/stormwater/papers.

28. Dunn JR, Hayes VR. Social inequality, population health, and housing: a study of two Vancouver neighbourhoods. Social Science and Medicine. 2000;51:563-587.

29. Cross B. World Population Day highlights an increasing global issue. [online] 2010 [cited on 1 July 2010]. Available from: http://worlddevelopment.suite101.com/article.cfm/world-population-day-highlights-an-increasing-global-issue.

30. UN Department of Economic and Social Affairs, Population Division. World Urbanization Prospects: The 1996 Revision. [online] 1998 [cited on 29 May 2009]. Available from: http://books.google.co.za/books?id=oxOAckK2stYC&dq=UN+Department+of+Economic+and+Social+Affairs,+Population+Division.+World+Urbanization+Prospects&printsec=frontcover&source=bn&hl=en&ei=ba01TJCVLMj9sQbGp5DUAQ&sa=X&oi=book_result&ct=result&resnum=4&ved=0CCEQ6AEwAw#v=onepage&q&f=false

31. Satterthwaite D. Will most people live in cities? British Medical Journal. 2000;321:1143-1145.

32. Mutume G. Rough road to sustainable development. Africa Renewal. 2004;8:19.

33. Graham JP, Corella-Barus V, Avitia-Diaz R, Gurian P. The in-home environment and household health: A cross-sectional study of informal urban settlements in Northern Mexico. International Journal of Environmental Research and Public Health. 2005;2:394-402.

34. UN. Resolution adopted by the general assembly 55/2: United Nations millennium declaration. [online] 2000 [cited on 15 June 2009]. Available from: http://www.un.org/millenium/declaration/ares552e.pdf.

35. Asian Development Bank. Resident Mission in the People's Republic of China, Low-income housing policies: lessons from international experience. [online] 2009. [cited on 6 January 2010]. Available from: http://www.adb.org/Documents/PRCM/Low-Income-Housing.pdf.

36. UN Office of the High Commissioner for Human Rights. The right to adequate housing. [online] 1991 [cited on 8 December 2009]. Available from: http://www.unhchr.ch/tbs/doc.nsf/0/469f4d91a9378221c12563ed0053547e?Opendocument

37. Kilian D, Fiehn H, Ball J, Howells M. National state of the environment project, Human Settlements. [Online] 2005 [cited on 13 November 2009]. Available from: http://soer.deat.gov.za/dm_documents/Introduction_572IF.pdf.

38. South African Institute of Race Relations. From bare fields to the back of private properties: The shifting pattern of informal dwelling erections. [online] 2008 [cited on 26 July 2009. Available from: http://www.sairr.org.za/press-office/archive/press_release_-_living_conditions_24_nov_2008.pdf.

39. Statistics South Africa. South African Census 2001 Atlas. [online] 2003 [cited on 22 August 2009]. Available from: http://www.statssa.gov.za/census2001/digiAtlas/index.html.

40. Mammon N, Ewing K. Moving towards a design approach to low-income housing in urban Cape Town: the case of Joe Slovo Park. Proceedings from the World Congress on Housing, Transforming Housing Environments through Design; 27-30 September 2005. [online] 2005 [cited on 2 November 2009]. Available from: http://www.nmassociates.co.za/research/02JoeSlovoPark.pdf.

41. Bell JE, Rubin V. Why Place Matters: Building a movement for healthy communities. [online] 2007 [25 September 2009]. Available from: http://www.rwjf.org/files/research/commissionhousing102008.pdf.

42. Morange M. Backyard shacks: The relative success of this housing option in Port Elizabeth. Urban Forum. 2002;13:3-25.

43. Republic of South Africa. White Paper: A new Housing Policy and Strategy for South Africa, Department of Housing, Government Gazette No 16178, 23 December 1994, Pretoria. [online] 1994 [cited on 15 May 2009]. Available from: http://www.info.gov.za/gazette/whitepaper/1994/16085.pdf.

44. Republic of South Africa. Constitution of the Government of South Africa. Act No. 108 of 1996 as amended. Adopted 8 May 1996. Pretoria: Government Printer. ISBN 0-620-20214-9.

45. Gilbert AG. Helping the poor through housing subsidies: lessons from Chile, Colombia and South Africa. Habitat International. 2004;28:13-40.

46. Huchzermeyer M. Housing for the poor? Negotiated housing policy in South Africa. Habitat International. 2001;25:303-331.

47. City of Cape Town Department of Housing. Breaking New Ground Comprehensive plan for housing delivery. [online] 2004 [cited on 3 February 2009]. Available from: http://web.wits.ac.za/NR/rdonlyres/CF05F3D4-DFDC-49DD-9776D924A89AB9D7/0/BreakingNewGroundHousingPlanCabinetapprovedversion.pdf.

48. Construction Industry Development Board. South Africa construction industry: Status report, 2004. [online] 2004 [cited on 20 July 2009]. Available from: http://www.cidb.org.za/Resource/report.pdf.

49. Seekings J. Introduction: Urban studies in South Africa after apartheid. International Journal of Urban and Regional Research. 2000:24:832-840.

50. Baumann T, Bolnick J, Mitlin D. The age of cities and organization of the urban poor: The work of the South African Homeless People's Federation. In D. Mitlin & D. Satterthwaite (eds.), Empowering squatter citizens: Local government, civil society and urban poverty reduction. London: Earthscan; 2004. pp. 313.

51. Biermann S. The sustainable location of low income housing development in South African urban areas. [online] 2004 [cited on 15 May 2009] Proceedings of a paper presented at the third International conference on urban regeneration and sustainability; 16-18 June 2004; Siena, Italy. Available from http://www.oldnet.co.za/akani/2004/nov/10.html/.

52. Barry MB. Secure Land Tenure for Informal Settlement Communities: The Effectiveness of the Cadastral System in the City of Cape Town. In Barry, M. (Ed) Proceedings of the International Conference on Land Tenure in the Developing World with a Focus on Southern Africa; 27-28 January 1998; University of Cape Town. [online] 1998 [cited on 1 November 2009]. Available from: http://www.fig.net/pub/athens/papers/ts21/TS21_1_Muzondo_et_al.pdf.

53. Barker FS. South African labour market policies. South African Journal of Economics. 1999;67:1-33.

54. Pillay A, Naude WA. Financing low-income housing in South Africa: Borrower experiences and perceptions of banks. Habitat International. 2006;30:872-885.

55. Tomlinson MR. South Africa's housing policy: lessons from four years of the new housing subsidy scheme. Third World Planning Review. 1999;21:283-296.

56. Lemanski C. Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies. Habitat International 2009;33:472-484.

57. Robins S. Planning 'suburban bliss' in Joe Slovo Park, Cape Town. Journal of the International African Institute. 2002;72:511-548.

58. Lizarralde G, Root D. Ready-made shacks: Learning from the informal sector to meet housing needs in South Africa. Proceedings of the CIB congress, Cape Town, South Africa. [online] 2007 [cited on 15 April 2009]. Available from: http://cibworld.xs4all.nl/dl/publications/CIB313.pdf.

59. Republic of South Africa Department of Housing. Department of Housing. [online] 2006 [cited on 26 June 2010. Available from: http://www.housing.gov.za/.

60. Barry M, Ruther H. Data collection techniques for informal settlement upgrades in Cape Town, South Africa. URISA Journal, 2005;17:43-52.

61. Cole E, Hawkley M, Rubino J, McCue K, Crookston B, Dixon J. Comprehensive family hygiene promotion in peri-urban Cape Town: Gastrointestinal and skin disease reduction in children under five. 13th International Society for Infectious Diseases. 2008;12:e435.

62. Cole E, Crookston B, Rubino J, McCue K, Hawkley M, Dixon J. Comprehensive family hygiene promotion in peri-urban Cape Town: Reduction of respiratory illness in children under five. 13th International Society for Infectious Diseases. 2008;12:e435.

63. University of Cape Town, Children's Institute. Adequate Housing. [online] 2008 [cited on 9 June 2009]. Available from: http://www.childrencount.ci.org.za/content.asp?PageID=58.

64. Millstein M, Oldfield S, Stokke K. uTshani BuyaKhuluma – the grass speaks: The political space and capacity of the South African Homeless People's Federation. Geoforum. 2003;34:457-468.

65. Gilbert AG. Slums, tenants and homeownership: on blindness to the obvious. International Development Planning Review. 2008;30:i-x.

66. South African Institute of Race Relations. Race relations survey 1993/1994. Johannesburg: South African Institute of Race Relations; 1994. pp 674.

67. Barry MB, Dewar D, Whittal JF, Muzondo IF. Land Conflicts in Informal Settlements: Wallacedene in Cape Town, South Africa. Urban Forum. 2007;18:171-189.

68. Western J. A divided city: Cape Town. Political Geography. 2002;21:711-716.

69. Wilkinson P. City profile: Cape Town. Cities. 2000;17:195-205.

70. Lizarralde G, Massyn M. Unexpected negative outcomes of community participation in low-cost housing projects in South Africa. Habitat International. 2008;32:1-14.

71. Chaudhuri N. Interventions to improve children's health by improving the housing environment. Reviews on Environmental Health. 2004;19:197-222.

72. Bradshaw D, Groenewald P, Laubscher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M. Initial Burden of Disease Estimates for South Africa, 2000. [online] 2003 [cited on 24 August 2009]. Available from: http://www.mrc.ac.za/bod/initialbodestimates.pdf.

73. Rauh VA, Chew GI, Garfinkel RS. Deteriorated housing contributes to high cockroach allergen levels in inner-city households. Environmental Health Perspectives. 2002;110:323-327.

74. Lehmann I, Thoelke A, Weiss M, Schlink U, Schulz R, Diez U, Sierig G, Emmrich F, Jacob B, Belcredi P, Bolte G, Heinrich J, Herbath O, Wichmann HE, Borte M. T cell reactivity in neonates from an East and West German city – results of the LISA study. Allergy. 2002;57:129-136.

75. Sharfstein J, Sandel M, Kahn R, Bauchner H. Is child health at risk while families wait for housing vouchers? American Journal of Public Health. 2001;91:1191-1192.

76. Cummins SK, Jackson RJ. The built environment and children's health. Pediatric Clinics of North America. 2001;48:1241-1252.

77. Mbiba B, Huchzermeyer M. Contentious development: Peri-urban studies in sub-Saharan Africa. Progress in Development Studies. 2002;2:113-131.

78. Durand-Lasserve A, Royston L. (eds.). Holding their ground. Secure land tenure for the urban poor in developing countries. London: Earthscan; 2002. pp. 264.

79. Clarke CG, Ward PM. Estancamiento en el 'ambito de la vivienda precaria: perspectivas a partir Mexico y del Caribe. Ediciones SIAP-CLACSO, Mexico City; 1978.

80. Fass S. Housing the ultra-poor: theory and practice in Haiti. Journal of the American Planning Association. 1987;53:193-205.

81. Potter RB. Urbanisation and development in the Caribbean. Geography. 1995;80:334-341.

82. Ward PM. The squatter settlement as slum or housing solution: evidence from Mexico City. Land Economics. 1976;52:330-346.

83. Dietz HA. Poverty and problem-solving under military rule: the urban poor in Lima, Peru. Austen: University of Texas Press; 1981. p 79-85.

84. Roy D. The supply of land for the slums in Calcutta. In Angel, S., Archer, R.W., Tanphiphat, S. & Wegelin, E.A. (eds.), Land for Housing the poor. Singapore: Select Books, Singapore; 1983. pp. 251.

85. Angel S, Pornchokchai S. Bangkok slum lands. Cities. 1989;6:136-146.

86. UN Centre for Human Settlements (Habitat) Low-income rental land and housing in Bangkok: an overview. In, Rental Housing: Proceedings of an expert group meeting; (eds.) Yap KS, de Wandeler K. Nairobi; 1990. pp. 251.

87. Palmer Development Group. Palmer Development Group, Backyard Living in Inner City Townships: a Survey of On-site Access to Water and Waste Services. Draft Report for the Water Research Commission. Cape Town: Water Research Commission; 1993.

88. Watson V. Housing policy, subletting and the urban poor, evidence from Cape Town. Urban Forum. 1994;5:27-43.

89. Hall K. Children's access to housing. South African Child Gauge. [online] 2008 [cited on 17 June 2009]. Available from: http://www.ci.org.za/depts/ci/pubs/pdf/general/gauge2007/part_three/housing.pdf.

90. Bank L. The rhythms of the yards: urbanism, backyards and housing policy in South Africa. Journal of Contemporary African studies. 2007;25:205-228.

91. Saphire H. Politics and protest in shack settlements of the Pretoria – Witwatersrand – Vereeniging Region, South Africa, 1980 – 1990. Journal of Southern African Studies. 1992;18:670-697.

92. Beall J, Crankshaw O, Parnell S. Uniting a divided city: governance and social exclusion in Johannesburg, London, Earthscan; 2002. pp. 237.

93. Crankshaw O. Squatting, apartheid and urbanisation on the southern Witwatersrand. African Affairs. 1993;92:31-51.

94. Beall J, Crankshaw O, Parnell S. Local government, poverty reduction and inequality in Johannesburg. Environment and Urbanisation. 2000;12:107-122.

95. Huchzermeyer M, Karam A. The continuing challenge of informal settlements: An introduction. In, Huchzermeyer, M. and Karam, A. (eds.) *Informal Settlements – A Perpetual Challenge?* Cape Town: Juta/University of Cape Town Press; 2006. pp. 318.

96. Shisaka Development Management Services. Township residential property markets: Final report, findings, conclusions and implications. Rosebank: Shisaki; 2004. p. 5.

97. Statistics South Africa. General household survey July 2005. [online] 2006 [cited on 22 November 2009]. Available from: http://www.statssa.gov.za/publications/P0318/P0318July2005.pdf.

98. Sanders D, Chopra M. Key challenges to achieving Health for all in an inequitable society: the case of South Africa. American Journal of Public Health. 2006;96:73-78.

99. Beck RB. The history of South Africa. Westport: Greenwood Press; 2000. pp. 248.

100. Smith L, Hanson S. Access to water for the urban poor in Cape Town: Where equity meets cost recovery. Urban Studies. 2003;8:1517-1548.

101. Haskins C. Household numbers in Cape Town. Discussion document. City of Cape Town: Information and Knowledge Management Department. [online] 2006 [cited on 16 March 2010]. Available from: http://web.capetown.gov.za/eDocuments/Household_Numbers_in_Cape_Town_16200694915_359.pdf.

102. Armstrong P, Lekezwa B, Sieberts K. Poverty in South Africa: A profile based on recent household surveys. Stellenbosch Economic Working papers: 04/08. [online] 2008 [cited on 10 January 2010]. Available from: http://ideas.repec.org/p/sza/wpaper/wpapers52.html.

103. City of Cape Town. 5 year plan for Cape Town, Integrated Development Plan (IDP) 2007/8 – 2011/12. [online] 2009 [cited on 30 February 2010]. Available from: http://www.capetown.gov.za/en/IDP/Documents/IDP_review_elephant_Jun_08_web.pdf.

104. Schmidt J. Cities of the Poor II: Housing and Poverty (South Africa). [online] 2006 [cited on 25 May 2010]. Available from: http://www.pri.org/theworld/?q=node/6709.

CHAPTER 3

AIM AND OBJECTIVES OF THE STUDY

3.1 Background

The approach of this study was not the traditional one of contrasting areas of extended 'shackland' (as it is called in South Africa) to more formal housing areas (i.e. suburbia), but rather to determine the sanitation and health status of these two groups of persons (formally vs. informally housed) living side-by-side on the same plots and sharing the same urban space in the low-cost housing communities of Cape Town. In this study there are mostly two types of dwellings on one plot that was originally designed for only the formal house, resulting in increased densification and pressure on the municipal service infrastructure.

The health profile of poor people living in low-cost housing settlements is of particular importance since large proportions of the urban poor of South Africa live under these circumstances. Some of the obvious benefits of better, more formal housing are improved shelter from the elements, better sanitation facilities, including the provision of potable water and toilets.

While the basic tenets of the South African Reconstruction Development Programme (RDP) policy remain relevant and sound, a new plan was implemented by the government to redirect and enhance existing mechanisms to achieve more effective delivery. The Breaking New Ground (BNG) initiative that replaced the RDP programme has as some of its central principles the improvement of quality of life for the poor, as well as using housing as an instrument for the development of sustainable human settlements. Both the RDP and BNG initiatives are aimed at assisting the country to reach its Millennium Development Goals by improving the living conditions of the urban poor and consequently their health and poverty status. In reality, the sustainable service delivery, quality, maintenance and management of low-cost housing to underprivileged people has been problematic and dogged by political dissent, financial constraints, corruption, poor planning, tender theft and the inferior quality of building materials used in the construction of these houses.

Escalating rates of urbanization, industrialization and population growth has resulted in an increase in the number of backyard shacks within low-cost housing communities across South Africa. In most low-cost housing estates the new owners rent out space in their backyards for the erection of 'backyard dwellings' - usually of the shack type - as a source of income. The backyard dwellings have no proper sanitation, no formal water supply and no proper provision for solid

waste. The increase in the number of dwellings exceeds the urban planning specifications for sewerage, storm water and solid waste and due to the increased roof space; there is a drastic increase in storm water run-off. All these effects have the potential to greatly increase infectious disease pressure and environmental pollution which negates the intended improvement in living standards of those families fortunate enough to receive an RDP/BNG house.

While population growth and in-migrants cause over-exploitation of land use, the present situation in low-cost housing settlements has posed a significant strain on the environment as well as the healthcare system and ultimately the economy of the City of Cape Town. The juxtaposition of the formal, low-cost housing adjacent to the informal shack dwelling in the backyard of the same plot provides an opportunity to study the health status and functioning of hygiene and sanitation between the two types of housing as well as the impact on the environment, notably environmental water pollution, from such settlements.

There are also lessons to be learnt from the large-scale provision of state-controlled low-cost housing in order to improve the process to the benefit of all. The actual health status of the recipients of new houses needs to be assessed as well as the problems experienced by the inhabitants of these houses to maintain the infrastructure, and especially the sanitation infrastructure, as well as the hygiene behaviour of the inhabitants. The impact on the environment and the nearby water sources are crucial in order to assess the risk of water pollution.

The following aims and objectives are presented in the next section as they were registered by the Faculty of Health Sciences at Stellenbosch University when ethical clearance was granted by the Committee for Human Research.

3.2 Aims and objectives of the present study

Overall aim:

To determine the health and sanitation status of specific low cost housing communities in the City of Cape Town, South Africa as contrasted with those occupying backyard dwellings on the same plot.

The sub-studies together with their objectives are as follows:

Aim for substudy 1

To determine the basic epidemiological characteristics of the exposed population of low-cost housing and 'the shack in the backyard' inhabitants.

Objectives:

1.1 To ascertain the demographic information of inhabitants (e.g. age, gender, number of inhabitants of each dwelling).
1.2 To estimate the socio-economic status (e.g. ownership, job status of adults, income category, school status of children).
1.3 To investigate the affordability of housing (running costs, who pays for repairs, who pays for municipal services, what is the contribution of the backyard dwelling).

Aim for substudy 2

To determine the physical living conditions with an emphasis on water and sanitation of the sampled dwellings in the selected low-cost housing communities.

Objectives:

2.1 To undertake a qualitative physical inspection of living conditions of dwelling with emphasis on sanitation and water (e.g. condition of toilets, taps, drains).
2.2 To undertake a physical inspection of obvious structural conditions (e.g. broken windows, doors, cracked walls, etc) as well as problems reported by the occupants.
2.3 To carry out a qualitative investigation of the quality of municipal services (e.g. rubbish removal, repairs of water pipes, unblocking of drains, etc).

Aim for substudy 3

To identify the health status, health risks and sanitation behaviour affecting the inhabitants of low-cost housing and 'the shack in the backyard.'

Objectives:

3.1 To establish a health status and disease profile (e.g. recent illnesses of inhabitants, chronic illnesses, food supply, malnutrition, access to health care).

3.2 To explore the sanitation behaviour (e.g. personal hygiene habits, food handling, washing dishes and clothes, availability of cleaning materials and towels, re-use of grey water and for what purposes).

Aim for substudy 4

To investigate the microbiological pollution of surface run-off water encountered in the low-cost housing settlements as an indication of environmental health hazards faced by the inhabitants of low cost housing and 'the shack in the backyard' communities.

Objective:

4.1 To investigate the faecal pollution levels of samples of some of the surface run-off water in the ditches and streets of each low-cost housing settlement to estimate the general environmental pollution in the settlement. Analysis will include total coliforms and *E. coli*.

3.3 Ethical aspects of the study

This study was approved by the Committee for Human Research of Stellenbosch University and conducted according to the ethical guidelines and principles of the International Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Ethical Guidelines for Research of the South African Medical Research Council (SA MRC). The random selection of the housing sites was done according to the WHO requirements for sample selection.

The various studies contributing to the research data presented in Chapter 4 and 5 were registered and approved by the Ethics Committee of the Faculty of Health Sciences at the University of Stellenbosch. The substudies were registered under the following project numbers: N09/08/214, N09/08/215, N09/08/216. Financial support for the study was obtained from the Harry Crossley Foundation, the German Academic Exchange Service (DAAD), the National Research Foundation and Stellenbosch University. No conflicts of interest were declared for the present study.

All structured interviews and surveys carried out by fieldworkers in the low-cost housing communities were done anonymously. A consent form (refer to Appendix D) in the inhabitant's home language was completed by all participants in the study and a copy was handed to all participants. Consent was also obtained from inhabitants for the photographing of their dwelling units (refer to Appendix E for some of the photographs taken at the study areas). The completed answer sheets were posted in a sealed box and only opened at the end of the study in order to preserve anonymity. The information obtained from the questionnaires is reported in grouped data form and no individual or dwelling can be identified from the journal papers in Chapter 5 or the database.

3.4 Notes regarding the reporting of findings of the study

The above aims and objectives were as registered by the University of Stellenbosch for this study. The prevailing requirements at the time of writing up this dissertation included that all papers presented in this dissertation had to be published prior to examination. The above objectives were covered in the database collected for the study. However the distribution of data under each paper was influenced by the requirements of the reviewers and editors of the various journals. By their request certain crucial information had to be repeated in some of the papers presented in Chapter 5.

The formulation of the aims and objectives of the study do not correlate on a one-to-one basis with the aims of the various topics in the papers. The objectives set for the four sub-studies are related to the themes covered in this study, namely: inhabitants, housing, sanitation, etc. On the other hand, the papers report on a mixture of these themes and therefore have aims of their own. In addition, the methods sections in the four papers closely resemble one another since the data reflected in each paper were gathered under the same research protocol. The referencing style and format in each paper appears as required by the respective journals. Since journal papers have restrictions on length, some General Information on Study Design, Procedures and Findings are provided in Chapter 4, followed by the published papers in Chapter 5.

CHAPTER 4

GENERAL INFORMATION ON STUDY DESIGN, PROCEDURES AND FINDINGS

4.1 Background to the study area

The study took place in October 2009 in four low-cost housing communities identified within the City of Cape Town Metropole. The inhabitants of these low-cost housing communities were classified as the study population for this cross-sectional study. The following low-cost housing settlements in the metropolitan area of Cape Town formed part of the study: Masipumelela in Kommetjie, Greenfields in Strand, Tafelsig in Mitchells Plain and Driftsands in Sikhumbule.

In order to qualify for a government sponsored house, the applicant had to be a South African citizen, unemployed and earn an income below R1000 per month.[1] Most of the inhabitants that that took part in this study were rehoused from an informal settlement either within the Western Cape Province or other provinces in South Africa. Very few of the families rehoused in these low-cost housing schemes managed to find stable employment and are therefore still poverty stricken. In this study 30% of adult inhabitants that are able to work are unemployed; in addition 45.8% of households (33.9% of main houses and 11.9% of shacks) are living below the South African poverty line.

The total living space in each low-cost house for three of the communities in the present study was approximately 7 metres by 4 metres. And only in Tafelsig was the living space, 8 metres by 5.5 metres. The house can be described as an oblong box structure with no sub-dividing rooms and with only one door. In Masipumelela, Greenfields and Driftsands there is no main kitchen. The kitchen in the house only consists of a basin and a tap. The only sub-division in the houses in Tafelsig and Greenfields was the toilet in a separate room. And in Driftsands and Masipumelela the toilets were outside the house near the only door in the house. The main houses were built on small plots with outer walls of the houses approximately 3 metres apart. It is in these very small spaces that the additional dwellings (called ‘backyard shacks’) were erected. These shacks are constructed in a lean-to fashion attached to the main house.[1] In some cases these backyard shacks permanently enclosed the window of the main house. The shacks were constructed of flimsy building materials, such as: pieces of cardboard, corrugated iron sheets, wood and plastic sheeting.[1] The shacks have no durable floors. Some shacks had carpet or vinyl flooring material laid on top of the soil. This served as the only protection against wet soil when it rains.

The conditions of most of these houses were observed to be very poor. In the present study, 48% of the main houses had at least 3 visible structural problems (defined below). The walls are crumbly and very cracked and roofs are leaking. Cape Town has a Mediterranean climate with wet winters and hot, dry summers. In the wet winters the porous wall absorbs moisture and moisture also leaks through the walls and cracks, leaving these houses damp and wet. Due to the flimsy construction, this is also a problem in the backyard shacks.[1]

4.2 Design of the study

The research strategy employed in this study was a cross-sectional survey with both quantitative and qualitative elements, carried out by means of interviews and site inspections. Survey methodology is a "widely used research approach in public health and government health studies."[2,3,4] The construction of the aims and objectives, sampling strategy and analysis of data were designed to comply with generally accepted principles of survey methodology.

A major strength of cross-sectional studies is that it is suited to the determination of the extent or the size of problems on a community level.[3,4,5] All the objectives of the present study were aimed at assessing the extent to which the improved low-cost housing programme with its attendant densification by means of shacks in the backyard could satisfy the basic living conditions envisaged by the government housing programme at its inception. In the process, an evaluation of the present condition of the housing as well as the needs of the inhabitants of these settlements could also be carried out. In this way the housing policies of the government can be amended to prevent problems in future housing projects.

4.3 Sampling strategy

Sample sites

In selecting the sites for the present study, officials from the City of Cape Town Department of Human Settlements were consulted to identify low-cost housing settlements that best represented the geographical spread of such settlements in the Cape Town Metropole. The Department of Human Settlements informed the investigator that low-cost housing settlements have been built in a ratio of two Black settlements for every one so-called Coloured settlement. Agreement was therefore reached between the investigator and the Department of Human Settlements that, the most representative selection of settlements for the study would be: Driftsand and Masipumelela as the two predominantly Black settlements, while Tafelsig was selected as the so-called Coloured settlement, and Greenfields represented a 'mixed' community where both population

groups lived together. Two settlements were chosen as pilot sites to test the research tools. They were Westbank and Blue Downs. The pilot survey was done two days before the main study and did not show up any problems with the research tools. Exactly the same structured interviews and data capture were carried out at these two sites and the two sites closely resembled those in the main study. Therefore the data obtained from the two pilot sites were pooled with the other four. This is routinely done in community surveys when no changes are needed to the research tools.[3,4] The sites selected for both the pilot and present study met the following criteria:

- Low-cost housing communities within the Cape Metropole (regardless of the policy under which the housing was developed, namely RDP, BNG)
- Settlements that are predominantly populated by: (a) the African community - (b) the Coloured community - (c) community with a mixed population with both cultural groupings.
- Low-cost housing communities that have the 'shack in the back yard' dynamic
- Discrete settlements with clear boundaries that do not 'blend' into shacklands or 'squatter' settlements, or have such settlements nearby

Sample sizes

No *a priori* comparative hypotheses were constructed (that was not the intention of the community survey) and therefore no formal calculations of minimum sample sizes were needed as is the case for inferential statistics where the usual requirements of sufficient accuracy and statistical power are demanded. The goals in survey methodology are first and foremost to obtain a sufficiently representative and unbiased sample to provide reliable findings and secondly, to obtain information from enough sampling units to permit inclusion of the less common instances of the variables under investigation.[1] In this study, sampling was approached in the same way as employed in empirical research to utilize the largest possible but realistic sample size, given the constraints of time and money.[1,3] Sampling in such study designs intends to obtain as true a picture of the conditions to be studied as possible without the necessity of obtaining data from an entire population, for reasons of practicality and cost-effectiveness.[3,4,5]

In this study a systematic sampling strategy was used with random starting points. Systematic sampling is a probability sampling selection method in which the sampling units are acquired by "selecting every *kth* element of the population where *k* is an integer greater than 1. The first number of the sample must be selected randomly from within the first *k* elements."[6] Probability sampling allowed statistical analysis of the results obtained from the survey. Systematic sampling is a popular method of selection where the sampling units are too numerous to list on an individual basis.[3,4] In the case of the present study, the precise numbers of plots in each housing

area were not known, but the plots were geographically ordered in urban streets, permitting the selection of a systematic sample.

The sampling strategy for the present study was a two-stage one. In the first stage of the sampling, the four study sites (the housing settlements) were selected to be as representative of the low-cost housing settlements in the city as possible (as described above). Note that the representivity was that of the *settlements*, not the racial groups living in the city. The second stage of sampling was the selection of plots within the different settlements by means of a systematic sampling strategy with k=10. After selecting every 10^{th} plot until a street was completed, a die was cast to determine whether the investigator should turn right or left. A random starting point ≤10 was again selected and then every 10^{th} house from that point on. Seven plots were selected in this manner in the two pilot sites and then 41 plots from Driftsands, 42 plots from Tafelsig, 42 plots from Greenfields and 40 plots from Masipumelele (173 plots in total containing 336 dwellings). There were 20 low-cost houses without shacks in the backyard, while there were nine with more than one backyard shack. The maximum number of shacks in the backyard was four.

Interviews were carried out by the candidate as main interviewer, assisted by the nurse during the gathering of the health data. The nurse was also selected to help with the questioning as she spoke the indigenous language and was a trained paediatric nurse. As a valued member of the community she was also thought to reduce the suspicion to a health questionnaire that may arise in these marginalised communities. All the persons present in the dwelling participated in the interview and information about those who habitually live in the home but who were absent at the time of the interview (a minority of the participants) was obtained from the head of the household or the most senior person present. There is substantial unemployment in these areas and in the vast majority of interviews the head of the household was present during the interview. The head of the household was identified by those present and not designated by the interviewer. A household was regarded as all those persons who habitually live in the dwelling, regardless of family ties as identified by the head of the household. Transient guests present during the time of the interview were excluded from the survey.

In a survey there is no intention to construct certain groups meeting inclusion and exclusion criteria such as employed on designs to test hypotheses by means of statistical inference. That is why the distribution of e.g. ages, genders in the survey data are not equal or in any way predictable. The survey simply registers the situation encountered on the day of the data gathering. That is the reason why the data contains a small number of plots with no shack in the backyard. Note that the units of analysis differ somewhat from the units of sampling. On each

plot all the dwellings were included in the survey, making the plot selection a cluster sample of dwellings and their inhabitants. In cases where the selected plot did not have all the main householders at home, the plot immediately adjacent was selected and the systematic sampling restarted from there.

The first unit of analysis was a subdivision of the cluster into main houses and backyard shacks (the two different housing types occurring on the same plot). The second unit of analysis was the inhabitants of the dwellings and their characteristics.

In the instances where the study looked at the health of the people, the unit of analysis was the total number of persons in the sample. In the instance where the focus was on the sanitation situation, the unit of analysis was the dwellings, since there was only one toilet on each plot.

There are sampling size calculations for surveys designed to provide the data from which statistical estimates can be inferred with predetermined accuracy and confidence intervals, especially surveys for the prediction of national and household censuses.[3,4,6] There are however no sampling size calculations available to determine optimal sampling sizes for once-off cross-sectional surveys providing information on the existence and extent of characteristics such as health-related conditions or sanitation status.

4.4 Research Tools

The use of questionnaires is an indispensable tool in community health research.[3,4,7] Findings in community health studies are often based partly or completely on data obtained by means of questionnaires or structured interviews (so-called 'verbal questionnaires') with data captured on data capture forms (Appendix A, B, C). Information on outcomes, exposures and confounding variables are collected in this way.[4,8]

The following tools were used in the survey:

- A questionnaire was administered by the investigator with the aid of a professional research-trained nurse to obtain the biographical details of the inhabitants living in both the house and shack to estimate the demographical details of the participants.

- A qualitative and quantitative housing inspection (refer to Appendix B and C) was conducted by the investigator to obtain the living conditions and the present structural and sanitation problems in both the house and any backyard shacks. The investigator is a

trained environmental health practitioner and has experience in carrying out public health risk assessments.

- A health survey (refer to Appendix A) was conducted by a professional nurse to assess the health status of the inhabitants living in both the house and shacks to determine the health profile as reported by the inhabitants and explore the hygiene behavior of the inhabitants living in the house and backyard dwelling(s).

- Water samples were taken from six different locations in each low-cost housing community on the same days as the structured interviews at each settlement. The samples were all collected from water running down the street in front of the houses as indication of communal water pollution spreading through the community. These water samples were analysed microbiologically for faecal contamination at a Water Analysis laboratory at the Department of Food Science at the University of Stellenbosch. The water samples were done to gain an overall impression of the faecal contamination of free-running water in the environment of the sampled plots, i.e. the role of environmental water as pathways of infection.[9]

Many municipalities in South Africa do only very rudimentary water sampling and then report only on total coliforms (Barnes JM. 2011. University of Stellenbosch. Personal communication). While total coliforms are not a very accurate indication of environmental risk (hence the determination of *E. coli* in the present study), the results of the total coliforms were reported for those organizations who only have that measure at their disposal. Total coliforms can contain many non-pathogenic organisms and as such is not a very accurate indicator of risk, but it still is better than no indication at all.

The questionnaires were developed and designed in collaboration with the study leaders, who is trained in the construction of community health research questionnaires. The questionnaires were piloted in two communities meeting the study inclusion criteria and no ambiguity, misunderstandings or other problems were encountered among the participants.

The questionnaires were administered and the structured interviews were conducted in any of three official languages prevalent in the area, namely isiXhosa, Afrikaans and English, depending on the home language of the respondent.

A large amount of qualitative data had been gathered during the interviews and noted on the data capture sheet for each respondent. This qualitative data included the inhabitants' opinions and

attitudes about a variety of subjects, such as: their health and the health services at their disposal, any problems with their house, difficulty in repairing the home and sanitation aspects. It also included their opinions on who should be made responsible on the upkeep of the houses. For shack dwellers, the qualitative data included their attempts to try an obtain a government sponsored house, their sentiments regarding the ability of the government to live up to promises made, the hardship of their daily living: always having to ask for the use of the toilet, always having to ask and pay for water and electricity. In addition, 350 photographs were taken during the data capture period to support the qualitative observations made in the present study.

Data were captured into a Microsoft Excel spreadsheet and transferred by a statistician at the Centre for Statistical Analysis at the University of Stellenbosch into Statistica version 9.0 (StaSoft Inc. 2009, USA) for further analyses. Data integrity was monitored by the study supervisors and the statistician during the analysis and reporting of the data.

Definition of some concepts used in the research tools

Diarrhoea: The definition of the WHO was used in this study namely, "the passing of three or more liquid stools per day or more frequently than is normal for the individual."[10] In some cases, the female caregivers said that diarrhoea was so common amongst the children that they only took note of severe attacks, thereby probably undercounting the occurrence of diarrhoea. The research nurse was trained in paediatrics amongst others and probed each report of diarrhoea to ascertain whether the symptoms were severe enough to warrant data capture.

Structural damage to main houses: The investigator (the candidate) measured the dimensions of the all the dwellings to calculate an approximate roof area for each. The design of the houses in the present study varied, but all the houses were very small in relation to the number of occupants ($27m^2$ to $42m^2$ in total). The investigator inspected the entire structure for visible and serious damage of the following nature:

- Cracks in the walls of such an extent that the rainwater could freely penetrate to the inside surface. The inhabitants repaired these cracks with softened green bar soap, which sent white streaks of soap lather running down the wall at the next rain episode, only to be filled with soap again. These white streaks were easily identifiable.
- Broken windows with glass missing
- Outer doors not fitting into the doorframes to the extent that dust and rainwater could penetrate

- Leaking roofs to the extent that rainwater ran down the inner walls or evidence of such leaks that were unrepaired. The same repair technique employing bar soap was used in these cases as described above for cracks in the walls.
- Unpainted (unsealed) outside walls on the rain side which allowed rainwater to penetrate. All the main houses were constructed of cement bricks with a high proportion of sand to cement and were very porous (personal observation). These walls leaked large amounts of water during any rain spell, causing excessive damp and cold conditions inside the home. The walls were also very brittle and crumbled easily.
- Non-operational toilets (all were conventional flush toilets) - not being able to flush or exhibiting serious leaks with pools of water visible on the floor to the point of not being functional to use.
- Leaking taps - consistent dripping or running water with taps being unable to be closed any further.
- Dirty or blocked drains - drains that were visibly blocked or leaking, with dirty water flowing onto the surrounding ground.

Poor sanitary conditions were noted as poor, fair and good as follows:

- The degree to which toilet bowls was dirty was classified qualitatively with poor being a high degree of soiling with faeces or visible brown streaking coupled with unmistakable smell of faeces and urine.
- The kitchen (usually only a sink/basin) was classified qualitatively as dirty when there was visible food rests clinging to the basin or wall and decomposing food was lying around.
- The degree to which the surrounding yard was dirty was classified qualitatively as poor when there was a substantial amount of litter lying around; broken glass on the ground, the outside waste bin was overflowing or attracting large numbers of flies.

Refer to Appendix E at the end of the dissertation for photographs of examples of such structural damage.

The reasons why disposing of dirty water from the kitchen by flushing it down the toilet is detrimental are twofold:

- *Wasting water* - Cape Town has a serious problem providing water for all its inhabitants and the demand is set to overtop the available supplies around 2015 to 2025, depending on the degree of climate change.[11] When clean potable water is used to dispose of dirty water on this large scale by so many inhabitants, the time when the water supplies run out will be

reached so much faster. In addition, the existing sewerage treatment works in the City are seriously overburdened and the additional volume of water used to flush away sullage is putting a serious burden on the services (City of Cape Town Water Supply and Sanitation Division. 2010. Personal Communication).

- *Blockages* from peels, food rests such as fats and vegetable matter, bones, etc. - The kitchen wastewater disposed via the toilet is contaminated with solid matter and the residents particularly resort to toilet disposal as an alternative when the kitchen sink is already blocked or half-blocked. The habit of disposing of kitchen waste by flushing it down the toilet is causing significant blockages of the sewer lines to the street connections (City of Cape Town Water Supply and Sanitation Division. 2010. Personal Communication), resulting in sewage water flowing over the yards and down into the street gutter, from where the storm water system takes it to the nearest river. The rivers surrounding these areas are severely polluted and that causes an even greater loss of potential water sources in times of drought.

4.5 Data analysis

The data were analysed by the Centre for Statistical Services at the University of Stellenbosch. The data was cross tabulated and Chi-squared analysis was carried out as first order non-parametrical analyses. Odds ratios were determined in the few instances. For ordinal variables Mann-Whitney U-Test calculations were carried out.

In some instances persons were used as the basis for comparison. When looking at the housing assessment the toilet was taken to be the primary focus of analysis. There are different ways of approaching such a comparison; however there are complex factors at work that need to be kept in mind. The survey showed that 58% of the toilets were non-functional on the day of the survey. In these communities the prevailing custom is for both main house inhabitants and shack dwellers to use a neighbouring toilet under these circumstances. That means that, firstly almost all the toilets in these low-cost housing areas act like communal toilets and not as a facility for a single dwelling. Under such circumstances the age and gender composition of the users of these toilets are not easy to predict. However, it cannot necessarily be deducted that because the families living in the main house have more children, that more children use the toilet in the main house, because the age composition of the possible visiting users is unknown. There is therefore not necessarily a clear-cut relationship between inhabitants and users. We therefore left the analysis of the relationship between the diarrhoea and the dwelling type at the rudimentary level of a simple comparison. The number of children present can be seen as a confounding factor for those diseases or health condition that affect different age groups unequally. It was not possible

to control for such confounding, due to the complexity of the relationship and the ages of the people sporadically or habitually using the toilet.

4.6 Advantages and Limitations of the Study Design

Cross-sectional designs inherently provide a 'snapshot' of the conditions prevailing in a particular population being studied as they exist at a particular point in time or a short time span.[2,3,4] Cross-sectional designs are particularly suited for gathering the information needed to plan health care, preventative programmes, etc.[3,4] Data on many variables can be gathered at the same time from large samples[2] of geographically dispersed subjects. Information on attitudes and behaviours can be included and the extent of certain community-based problems can be assessed.[4]

On the other hand, the costs of including many participants will increase the cost and time needed to carry out the study.[3,5] Cross-sectional designs can only give an indication of changes over time if the study is repeated, making it less suited to monitor change.[4] In the analysis of a cross-sectional design, associations must be interpreted with caution, since additional information over time (or provided by experience) should be involved before such associations can be declared 'causal'.[5] Thus the temporal sequence needed to prove cause-and-effect cannot be established in a cross-sectional design.[4,5] Lastly, in a cross-sectional design, it is not always possible to distinguish between rival explanations for the phenomena that are observed.[4,5]

Obtaining research information from study participants by means of structured interviews also have advantages and limitations. Structured interviews are less sensitive to low education levels (e.g. functional illiteracy) than self-completed questionnaires.[4] With structured interviews, especially coupled to home visits by means of systematic sampling, the researcher can replace any homes selected on a predetermined basis where inhabitants are absent or unwilling to participate and so obtain a very high participancy rate. In the present study, no inhabitants of homes selected in the sampling strategy refused to participate, thereby yielding a 100% response rate for the study. Structured interviews also enable the researcher to make sure that the respondents are those who were intended to participate in the survey, which cannot be ensured in self-completed postal surveys.[4,5]

The personal attributes of the interviewer (appearance, accent, temperament, etc.) can influence the interview process, either positively or negatively.[5] When interviewing participants, unwillingness to provide socially unacceptable or embarrassing answers as well as fears about the use made of information provided will influence the communication process.[3,5] Memory is furthermore a complex and selective procedure and people seldom remember all or nothing when

asked to recall certain information.[3] Recall can be distorted or incomplete.[4] Anonymity is lost at interviews or in group situations, but gains in information should be balanced against the disadvantages due to bias and repression/inhibition.[4]

A particular limitation of the study among this study environment is the high under-reporting of sensitive conditions such as tobacco, alcohol and substance use (legal or illegal), HIV status and TB positivity. Asking participants about illegal or harmful lifestyle activities has to be done in a sensitive manner. Even so, the accuracy of the answers is unpredictable. More reliable answers can be obtained by restricting questions to the existence of such habits, and not the extent of use. That is why it is best to ask about the use of these substances in the household, because that is more likely to elicit answers. To complicate any investigation into the extent of use, the poor in these areas do not only smoke cigarettes, but also pipes and cigarettes manufactured from pipe tobacco (sometimes mixed with other substances) rolled in newspaper. Similarly, when commercially available alcoholic drinks cannot be afforded, homebrewed drinks are manufactured - also with some harmful substances added. Trying to determine the extent of exposure under these circumstances leads to inaccurate conclusions.

It has been estimated by Medicins Sans Frontieres in 2010 that “5.7 million people are living with HIV in South Africa, which makes up approximately 17% of the world’s HIV population.”[12] In the 2009 Antenatal Survey reported an HIV prevalence of 16.8% (16.0 – 17.7% 95% confidence interval) for the Western Cape, while in the City of Cape Town the HIV prevalence was 18.2% (17.0 – 19.3% 95% confidence interval).[13] As examples of the possible positivity rates in our study sites, the HIV, AIDS and TB Plan for Cape Town for 2010/2011 cited the HIV positivity prevalence in Khayelitsha (a black township) as 30.1% and for Mitchells Plain (a so-called Coloured community) as 13.9%.[12] The HIV prevalence rates are not available for smaller geographical divisions such as the sites in the present study, but these figures serve as an indication that the self-reported HIV positivity is very far below the expected rate. Some of the factors fuelling HIV/AIDs in Cape Town are the “social norms which accept or encourages high numbers of sexual partners, poverty and unemployment, informal settlements with inadequate services, stigma and low status of women.”[13]

Cape Town has an exceedingly high TB prevalence. In 2009, 28 956 cases were reported with an incidence of 877 per 100 000 population.[13] The national figure for South Africa is approximately 500 per 100 000.[12] Several factors augmenting TB in Cape Town are “poverty, urbanization with resultant overcrowding, damp and poorly ventilated houses or shacks, substance abuse, smoking, poor treatment outcomes due to treatment interruption.”[13]

It is enshrined in the South African constitution that the participant has the right of not disclosing his or her status and therefore we only asked the head of the household if he or she was aware of anyone living in the home being HIV or TB positive. Information on HIV and TB status was elicited in the survey because the absence of such enquiries would leave the survey open to criticism. It was however expected that the data obtained by direct interviews would be a serious undercount. This actually materialised and it was clear that a significant under reporting of both HIV/AIDS and TB occurred when viewed against the official figures cited above. This is the reason that these data were not analysed in any depth but merely reported.

4.7 Declaration of participation of study leaders

The leaders of this study did not participate in any way in the examination of this dissertation. As per the regulations of the University of Stellenbosch Faculty of Health Sciences, they are thus permitted to be co-authors of the papers following in Chapter 5.

4.8 References

1. Huchzermeyer M, Karam A. The continuing challenge of informal settlements: An introduction. In, Huchzermeyer, M. and Karam, A. (eds.) *Informal Settlements – A Perpetual Challenge?* Cape Town: Juta/University of Cape Town Press; 2006. pp. 318.
2. Timmreck TC. An Introduction to Epidemiology. 3rd Edition. Sudbury: Jones & Bartlett, 2002. pp.505.
3. Bless C., Higson-Smith C. Fundamentals of Social Research Methods, An African Perspective. 2nd Edition. Kenwyn: Juta & Co Ltd, 1995. pp. 164.
4. Neuman WL. Social Research Methods Qualitative and Quantitative Approaches. 3rd Edition. Needham Heights: Allyn & Bacon, 1997. pp. 560.
5. Katzenellenbogen JM., Joubert G., Abdool Karim SS. Epidemiology A Manual for South Africa. Cape Town: Oxford University Press South Africa, 1999. pp. 295.
6. United Nations Department of Economic and Social Affairs. Designing household survey samples: Practical Guidelines. Studies in Methods, 2005. ST/ESA/STAT/SER.F/98.
7. Valanis B. Epidemiology in Nursing and Health Care. 2nd Edition. Norwalk: Appleton & Lange, 1992. pp. 444.
8. The International Epidemiological Association European Group. Epidemiology Deserves Better Questionnaires. [online] undated [cited on 20 July 2011]. Available from: http://www.iea-europe.org/download/Questionnaires.pdf.
9. Veldhuis ten JAE, Clemens FHLR, Sterk G, Berends BR. Microbial risks associated with exposure to pathgens in contaminated urban flood water. Water Research. 2010; 9:2910-2918.
10. WHO. Health Topics Diarrhoea. [online] 2011 [cited on 19 July 2011]. Available from: http://www.who.int/topics/diarrhoea/en/.
11. Mukheibir P., Ziervogel G. Framework for Adaptation to Climate Change in the City of Cape Town (FAC4T). [online] 2006 [cited on 20 July 2011]. Available from: http://www.erc.uct.ac.za/Research/publications/06Mukheibir-Ziervoge%20-%20Adaptation%20to%20CC%20in%20Cape%20Town.pdf .
12. Medecins Sans Frontieres. International Activity Report 2010. [online] 2011 [cited on 20 July 2011]. Available from: http://www.doctorswithoutborders.org/publications/ar/report.cfm?id=5376.

13. City of Cape Town. HIV, AIDS and TB Plan 2010/2011. [online] undated [cited on 19 July 2011]. Available from: http://www.capetown.gov.za/en/IDP/Statutory%20plans%202011%20%202012/AnnexureH_City_Health_HIV_AIDS_TB_Plan_2010_2011.pdf.

CHAPTER 5

RESEARCH PAPERS

5.1 Research Paper 1

The following paper has been published as **"Govender T, Barnes JM, Pieper CH. Living in low-cost housing settlements in Cape town, South Africa - the epidemiological characteristics associated with increased health vulnerability. *J Urban Health*. 2010; 87(6):899-911".** By the prevailing rule of the Faculty, this dissertation was examined after the publication of the paper. Some amendments have been made to reflect the requests and comments of the examiners.

Living in low-cost housing settlements in Cape Town, South Africa - The epidemiological characteristics associated with increased health vulnerability

Thashlin Govender [1,*], Jo M. Barnes [1] and Clarissa H. Pieper [2]

1 Division of Community Health Medicine, Faculty of Health Sciences, Stellenbosch University, Tygerberg, Cape Town, South Africa
2 Division of Neonatal Medicine, School of Child and Adolescent Health, University of Cape Town and Groote Schuur Hospital, Observatory, Cape Town, South Africa
E-Mails: 15217116@sun.ac.za; jb4@sun.ac.za; clarissa.pieper@uct.ac.za
* Author to whom correspondence should be addressed; Tel.: +27-83-730-2846; Fax: +27-021-938-9166

Abstract

The aim of this study was to assess the epidemiological characteristics of a representative sample of subsidized low-cost housing communities in the City of Cape Town in relation to their living conditions and their health status. Four subsidized low-cost housing communities were selected within the City of Cape Town in this cross-sectional survey. Structured interviews were administered in 336 dwellings on 173 plots. Data was obtained from 1080 persons with a response rate of 100%. Almost all of the state-subsidised houses had one or more shacks in the back yard, increasing the occupation density and putting the municipal sanitation infrastructure under pressure. In 40% of main houses one or more cases of diarrhoea were reported during the

two weeks preceding the survey, in contrast to 23% of shacks ($p<0.0007$). Of the total group 1.7% willingly disclosed that they were HIV positive, while 3.5% reported being TB positive. One of them reported having Multiple Drug Resistant TB. None of the HIV positive or TB positive persons were on any treatment. A reported 6.3% of the families admitted regularly eating only one meal per day whereas 18.5% reported having only two meals per day. The shack dwellers had significantly higher education and employment status ($p<0.01$), since they had to pay rent. Improvements in health intended by the rehousing process did not materialise for the recipients of low-cost housing in this study. The health vulnerability of individuals in these communities have considerable implications for the curative health services. Sanitation failures, infectious disease pressure and environmental pollution in these communities represent a serious public health risk. The densification caused by backyard shacks in addition have municipal service implications and needs to be better managed. Urgent intervention is needed to allow the state-funded housing schemes to deliver the improved health that was envisaged at its inception.

Keywords: Low-cost housing; Backyard dwelling; Health vulnerability; Community health; Cape Town

---

Introduction

Adequate shelter with access to safe water and sanitation are essential elements of community health.[1] However, in developing countries, suitable and affordable housing is often in short supply.[2] Urbanization, in the form of the rural-urban drift, has affected South Africa[3] contributing to the housing backlog and posing major challenges in aspects of economics, education, housing and public health.[4]

The South African government responded to the demand for low-cost housing with large-scale housing initiatives, such as the Breaking New Ground (BNG) initiative, previously known as the Reconstruction and Development Programme (RDP). These mass state-sponsored housing schemes are partially funded by the central government, but the actual provision of the houses as well as the building and upkeep of utilities and services rest with the local municipalities.

In South Africa the recipients of low cost housing are usually selected from the ranks of those who occupy the many informal settlements surrounding our cities and towns. Unfortunately ownership of a subsidised house was in most cases not accompanied by an improvement in income. The owners of low cost houses soon exploited one of the few resources they had, i.e. space, by allowing others to build informal structures (called “shacks” by the inhabitants) in the back yard, which are rented out for income.

The importance of adequate housing for the maintenance of health is one of the basic tenets of public health, yet the association between them remain difficult to quantify.[5] It is still not known whether re-housing previously disadvantaged groups will improve their health. Although many studies found an improvement, most studies did not adjust for potential confounding factors.[6] This lack of evidence of what appears to be self-evident can be attributed to the multi-factorial and complex nature of low-cost housing, the accompanying poverty and environmental degradation.[6]

The almost universal presence of informal structures in the backyards of low-cost housing in Cape Town presented an opportunity to investigate yet another factor in this complex causal chain. This scenario comprised two groups of disadvantaged people (those living in formal housing and those living in shacks) on the same premises. This survey analysed the characteristics of a representative sample of low-cost housing communities in the City of Cape Town, where almost all state-sponsored houses had backyard dwellings, in order to assess the relationship between their living conditions and their health vulnerability.

Methods

This study was approved by the Committee for Human Research at the Faculty of Health Sciences of Stellenbosch University and was conducted according to the ethical guidelines and principles of the International Declaration of Helsinki,[7] the South African Guidelines for Good Clinical Practice and the Ethical Guidelines for Research of the Medical Research Council of South Africa.[8] All respondents were informed of the objective of the study in one of three languages (English, Afrikaans or isiXhosa) of their choice and signed informed consent. A copy of the informed consent was provided to all participating households. The survey was conducted anonymously. All participants could inspect the completed questionnaire answer sheet for anonymity. They then posted the form into a sealed box with a postal slot. The box was only unsealed at the end of the study.

Characterization of Housing Type

Four subsidized housing communities were selected within the City of Cape Town Metropole (CCTM) to participate in this cross-sectional survey. The low-cost housing communities identified as study sites were: Driftsand, Greenfields, Masipumelela and Tafelsig. These sites were selected to represent the best geographic spread of all the subsidized housing settlements within the city. The settlements were selected regardless of the local or central authority under whose jurisdiction the housing schemes were originally erected. They had to be older than three years. This was important because in some of the newer settlements structural wear and tear of the houses had not yet become evident to the same extent as in the older settlements. The

settlements selected had to have distinct boundaries that did not blend into informal settlement areas (so-called squatter settlements) in order to avoid garbage and water pollution introduced from neighbouring areas. All four settlements had numerous low-cost houses (hereafter referred to as main houses) with informal dwellings made of temporary building materials in the back yard (hereafter referred to as shacks). A legacy of the previous spatial disparities in the City resulted in communities with predominantly only one ethnic group. There were three settlements with predominantly black inhabitants and one settlement with predominantly coloured (mixed ancestry) inhabitants in the survey. This selection was representative of the overall demographic profile of the settlements in the city.

Structured Interview Questionnaires

Data were collected by means of structured interview questionnaires during home visits to all selected dwellings by the senior author, assisted by a registered nurse who spoke all three languages prevalent in the area. All dwellings on a selected plot (main house and shack/s in the back yard) were included but recorded separately. Overall, 321 dwellings on 165 plots were selected for participation in the study. A systematic random sampling procedure was used to select the plots in the four study sites. Data were obtained from 1020 persons in total with a response rate of 100%.

The questionnaires were piloted in two different settlements (predominantly coloured and predominantly black) in the CCTM. The pilot study sites were situated in Mfuleni and Westbank. The survey was administered to 15 dwellings with data obtained from 60 persons. The results from the pilot sites met the same criteria as the study sites. No problems or confusing questions were encountered and these interviews were carried out under the same conditions as the main study. The data from the dwellings in these pilot sites were therefore included in the total group, i.e. 1080 participants living in 336 dwellings (173 main houses and 163 shacks).

The questionnaire was designed to record data from all dwellings on a plot. These questionnaires were administered in the language of preference during an on-site interview with the head of the household. The questionnaire comprised sections on demographics, health and home ownership as well as a section to note the condition of the sanitation infrastructure (tap, toilet, waste disposal, etc.) as well as the condition of the dwelling and its surrounding yard. All toilets were inspected and noted as non-functional if the toilet was blocked, could not flush or showed serious leaks or had a badly cracked cistern or bowl. Home ownership included questions formulated specifically for the main house and the shack.

Characterization of Demographic and Housing-Related Factors

Demographic and socio-economic variables included age, gender, physical handicaps, educational attainment, citizenship, social grant recipients, employment status and household monthly income. No questions or annotations on race were included in the questionnaire. The household monthly income was arrived at by the interviewed persons adding the income of all employed members of their dwellings. Health variables included HIV and TB status (voluntary), as well as ailments suffered in the two weeks preceding the survey. Home attainment and ownership in the main houses and backyard shacks, rental paid, and operational costs incurred by these previously disadvantaged inhabitants were explored.

Statistical analysis

Data were recorded in a database created in Statistica version 9.0 (StatSoft Inc. 2009, USA). Descriptive statistics mainly means and standard deviations for continuous variables and frequency distributions for categorical variables were computed. Bivariate analysis testing for differences in proportions of main houses and backyard shacks were performed using the test for probability values.

Results

The age distribution (Figure 1) of household members indicated a young population (43% younger than 20 years) with a mean age of 25 years. The age of inhabitants of the main houses did not differ significantly from the occupants of the shacks (Mann-Whitney U test, p=0,69).

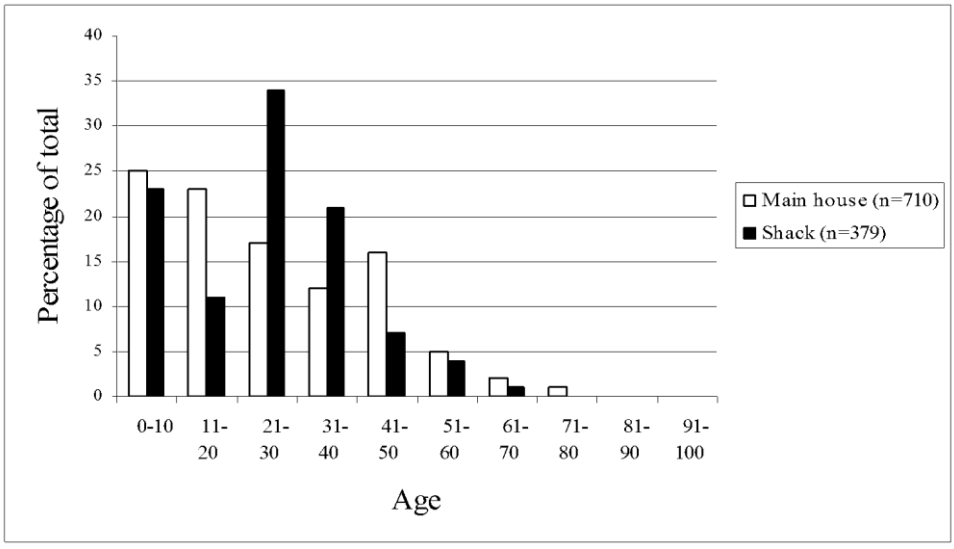

Figure 1: Comparison age frequency distribution of inhabitants in main house (mean age 25.02 ± 17.33years) and shack (mean age 24.5 ± 14.28 years)

The occupancy of people living in a main house ranged between one and 12 persons per dwelling and in shacks between one and 13 persons per dwelling (means reported in Table 1), giving a significantly greater occupancy rate in the main houses (Mann-Whitney test, $p<0.01$). According to the number of occupants per square metre however, the backyard shacks were significantly more densely occupied (Table 1).

Table 1: Sociodemographic characteristics of the study population

Characteristic	**Main house**	**%***	**Shack**	**%***	**Total group**	**%***	**p-value**
Study population	710	65.7	370	34.3	1080	100	-
Gender							
Male	322	45.3	184	49.7	506	46.8	0.17
Female	388	54.6	186	50.2	574	53.1	
Female-headed households	92	12.9	11	2.97	103	9.53	<0.01
Disabled individuals	18	2.5	2	0.54	20	1.85	<0.01
Nationality							
South Africans	695	97.5	329	88.9	1024	94.8	<0.01
Non-South Africans	18	2.5	38	10.2	56	5.2	
Highest education level							
No schooling	103	14.5	73	19.7	176	16.3	<0.01
Grade 0-4	152	21.4	32	8.6	184	17.1	
Grade 5-7	154	21.6	65	17.5	219	20.3	
Grade 8-10	138	19.4	90	24.3	228	21.1	
Grade 9-12	158	22.2	100	27.0	258	23.9	
Tertiary level	5	0.70	10	2.7	15	1.4	
Mean occupancy (persons per dwelling)	4.1	-	2.3	-	3.2	-	<0.01
Density - mean number of persons per 10m^2	1.1	-	2	-	1.95	-	<0.01
Employment status							
Full time	122	17.1	76	20.5	198	18.3	<0.01
Part time	8	1.1	33	8.9	41	4.8	
Irregular	50	7.0	32	8.64	82	7.6	
Unemployed	210	29.5	112	30.2	322	29.8	
Pensioner	14	1.9	13	3.5	27	2.5	
Child at home	104	14.6	66	17.8	170	15.7	
Scholar	202	28.4	38	10.2	240	22.2	

*All percentages calculated from the total group (n=1080).

The possession of a main house by any person other than a South African citizen is not in accordance with the regulations, yet 4 main houses were occupied by non-South Africans. According to Table 1, the number of non-South African citizens occupying shacks was significantly higher than those occupying main houses. The shack rental market fulfils this housing need among non-South Africans.

When analysing the total distribution of education categories as included in the survey, the educational level attained by the inhabitants of the main houses were significantly lower than those of the shack dwellers (Table 1). Of all the adults in the total group, 8% were illiterate or functionally illiterate (defined as schooling up to Grade 4), and 22% have only a primary school education (defined as schooling up to and including Grade 7).

The high level of unemployment is reflected in the low percentage of respondents in the survey who were employed full-time (Table 2). When analysed over all categories of employment status and income, the occupants of the shacks reported a significantly higher income than those living in main houses.

Table 2: Aspects of economic status of the study population per dwelling type

Characteristic	**Main house (n=173 dwellings)**	**%**	**Shack (n=163 dwellings)**	**%**	**Total group (n=336 dwellings)**	**%**	**p-value**
Household monthly income							
<R600	25	14.4	27	16.5	52	15.4	<0.01
R600-R1200	29	16.7	59	36.1	88	26.1	
R1200-R2500	58	33.5	52	31.9	110	32.7	
>R2500	23	13.2	60	36.8	83	24.7	
Unsure	1	0.5	2	1.22	3	0.8	
Households living below South African poverty line (R322 per month)	114	65.8	40	24.5	154	45.8	<0.01
Households receiving a social grant	93	53.7	66	40.4	159	47.3	<0.01

The modal income group was R1200 to R2500 per household (US$160 to US$333) with almost half of the total group having a monthly household income that is below the official South African poverty line of R322 (US$43) per person per month.[9] The survey only included a question on the total household income and no information was available on individual income. Again in keeping

with the finding that the shack dwellers had a higher mean income than the inhabitants of the main houses, the number of main house families receiving an income grant was significantly higher than those in the shacks (Table 2).

Almost 49% of the main houses had a toilet inside the house and all toilets were water-borne. The rest of the houses had a toilet adjacent to the building. No shacks had toilets or taps inside. During the data gathering it was observed that 59% of the toilets were not in working order. Blocked or overflowing drains were commonly observed (64% of dwellings had pools of drain water outside the house) while the state of the yard was noted as poor and rubbish-strewn in 49% of cases. The number of persons per toilet ranged from two persons to 18 persons.

Diarrhoea occurring in the preceding two weeks was reported by 153 persons in the total survey, living in 70 main houses (40.5% of main houses) and 38 shacks (23.3% of shacks). There was a significant difference (Chi-square test, p value <0.01) between the number of diarrhoeal cases of participants living in the main houses and shacks, but not a significant difference between the two housing types when comparing the number of cases (Table 3).

Table 3: Reported health aspects of participants separated into dwelling types

Health condition	Main house (n= 710)	%	Shack (n=370)	%	Total group (n=1080)	%	Odds ratio (95% CI)
Diarrhoea*	96	13.5	57	15.4	153	14.2	**1.16 (0.82-1.66)**
Diarrhoea in females†	54	7.6	25	6.75	79	7.3	**1.04 (0.63-1.73)**
Diarrhoea in children <10 years†	31	4.3	19	5.1	50	4.6	**1.73 (0.95-3.13)**
TB positive persons*	24	3.4	14	3.8	38	3.5	**1.12 (0.57-2.20)**
HIV positive persons*	8	1.1	10	2.7	18	1.7	**3.45 (1.51-7.89)**

* Calculated from the total group (n=1080)

†Calculated from total number of diarrhoea cases per dwelling type

Significantly more cases (38 cases) of self-reported TB occurred in main houses than in shacks (Table 3) with 21 being female. One of the TB cases reported being diagnosed as Multi-Drug Resistant (MDR) TB. Of the 18 cases reporting being HIV positive, 11 were female. There were 12 cases reporting being both HIV and TB positive, of which 8 were female. All medication in the household was inspected by the survey nurse and no TB or antiretroviral medication in the entire survey was found amongst them.

There was no significant difference in the number of main households reporting eating only one meal a day when compared to the shack dwellers (odds ratio 1.96 95% confidence interval 0.78 to 4.92). There was no significant difference in the numbers of main and shack households reporting one or more members using drugs (Table 4, odds ratio 1.24, 95% confidence interval 0.64 to 2.38). Half of the households in the total group had one or more smokers living there, while almost two-thirds of the total group had one or more members consuming alcohol. All other diagnoses of illnesses (16 symptoms) were reported in low numbers. This does not imply that the participants in the survey suffered from very few illnesses, but merely very few had their illnesses diagnosed at their local clinic.

Table 4: Meal frequency and substance usage per dwelling type

	Main house (n=173)	**%**	**Shack (n=163)**	**%***	**Total group (n=336)**	**%***	**Odds ratio (95% CI)**
1 meal per day	14	8.1	7	4.2	21	6.3	1.96 (0.78-4.92)
2 meals per day	36	20.8	26	15.9	62	18.4	1.38 (0.79-2.41)
Substance use							
Smoke cigarettes	89	51.4	80	49.0	169	50.2	1.10 (0.72-1.69)
Consume alcohol	106	61.2	110	67.4	216	64.2	1.31 (0.84-2.05)
Had a member using drugs*	23	13.2	18	11.0	41	12.2	1.24 (0.64-2.38)

* The nature of the drugs were not explored

Some qualitative results noted during the data gathering included participants' responses to problems in keeping their homes clean and repaired, as well as an inspection of sanitation facilities (tap, toilet, waste disposal, etc.) in all homes. The lack of education among adults in the study contributed to the homeowners' lack of knowledge on how to keep up their new home. This lack of knowing how to keep their homes clean and how to fix broken infrastructure were strongly verbally communicated by the respondents. In addition, their acquisition of an improved home was not accompanied by an improvement in employment status and that resulted in many being unable to afford the repairs or the cleaning materials required to keep the home clean. Within a short space of time, the sanitation facilities in their new home fell into a state of disrepair and were left uncleaned because of lack of both awareness and resources.

Discussion

Very few studies have described the phenomenon of informal housing (so-called shack in the backyard) interspersed within low cost housing settlements, particularly with a focus on health. The participants in the present survey living in state-sponsored housing schemes reflect an epidemiologically young population. There is a virtual absence of aged persons in the survey. There is consequently a lack of role models in these urban environments contributing to the disintegration of the social fabric of these communities. McMichael (2000) argues that "urbanism, increased mobility and relaxation of traditional cultural norms yield new patterns of human behaviour, which includes changes in sexual behaviour and the use of illicit drugs."[10]

The high unemployment in these communities prevents the inhabitants from fulfilling their potential. These communities are impoverished and there is significant employment insecurity. The average household income of both the main house and shack reflects this economic reality. There were a large number of families with only one female breadwinner. One consequence of this adverse economic situation is that many families are living below the poverty line. This is compounded by the 25% of families who reported eating fewer than three meals a day. "Poor socio-economic status is linked to deficiencies in prenatal and early nutrition as malnourished children develop differently, have lower educational achievement and are more likely to live a poorer quality of life compared with children who received proper nutrition."[11] The lack of nutrition adds significantly to the vulnerability of this population to infectious disease pressure which is worsened by their dirty environment. A study undertaken by Bomela (2007) confirmed that "stunting or chronic malnutrition is the most prevalent amongst children under five years of age in South Africa (25%), much fewer though when compared to other developing countries such as Mozambique (41%), Angola (45%) and Lesotho (46%)."[12]

The low level of education and lack of basic hygiene practiced by the inhabitants of government subsidized housing will have to be taken into account when future housing schemes are designed. Education campaigns designed to improve the cleanliness of their homes and surroundings should reflect these realities faced by low income inhabitants of government subsidized housing.

There were a high proportion of households reporting alcohol, tobacco or drug use. Use of these substances would have impacted negatively on the already constrained household income. The "crowding out effect" of such expenditure on the already scant household budget in poor areas had also been reported by Thomson *et al*. (2002).[13]

The survey revealed crowding, more so in the case of the backyard shacks, which were of necessity much smaller. Crowded living conditions have been associated with increased infectious disease transmission, spread by the respiratory route, such as tuberculosis, rheumatic fever[14] and meningococcal disease.[15] The majority of self-reported TB cases in this survey were female, while the majority of persons who reported having both TB and HIV were also female. The occurrence of at least one MDR-TB case is of special concern, given the poverty, crowding and poor nutrition prevailing in these communities.

All the inhabitants on a particular plot had to use the only toilet on the property which was in or just outside the main house. This high rate of usage and resultant broken infrastructure and blocked or overflowing drains explains the poor state of sanitation encountered in this survey. This increased the health risks to individuals in these communities due to infectious disease pressure and environmental pollution. This partly counteracted the supposed increase in living standards of those families fortunate enough to receive a low cost house.

The number of persons who reported one or more attacks of diarrhoea over the two weeks preceding the survey comprised 14%, while 4.6% were children less than ten years of age. Diarrhoea affected more than a third of the total dwellings. We observed that diarrhoea occurred more frequently in the main house (where the toilet is located) when compared to the shacks. In a survey carried out during 2001 in an informal settlement in Kayamandi outside the nearby town of Stellenbosch, the number of cases of diarrhoea during the month preceding the survey was reported to be 13.1%. The diarrhoea prevalence found in the present study was also comparable to that reported by D'Souza (1997) where in the two week period before a cross-sectional study in Karachi, prevalence of diarrhoea was 14.4%.[17] These results indicate that children under ten years are at additional risk because of poor environmental conditions.[17]

People living in poor areas often lack preventative health care or the means to manage chronic diseases.[18] All of the respondents who admitted having HIV or TB were diagnosed at a health care facility. During an inspection of the medication in each dwelling, no antiretroviral drugs or TB medication was encountered. While some of the persons diagnosed with TB may have been enrolled in a directly observed treatment strategy (DOTS) programme at their nearest clinic, none of these cases reported visiting a clinic in the past two weeks. This has serious implications for the management of the disease which introduced additional risks to other inhabitants sharing the house. In the present study one case of MDR-TB was reported from a study population of 1080 persons. Should this proportion prevail in the rest of these low-cost housing communities, that would translate into 93 cases per 100 000 people living in such communities in the City of Cape Town. The risk of MDR-TB (a communicable disease that is difficult to control)[19] spreading in low-

cost housing communities should be addressed by much more active community intervention than is the case at present.

The escalation in number of shacks within low-cost housing communities resulted in a huge increase in population density (1.95 persons per 10 m^2 living space), which was above the numbers used during the planning of these housing schemes. This placed municipal infrastructure under significant strain. The resultant breakdown in infrastructure (blocked drains, dispersal of sewage and contaminated storm water, flooding, etc.) caused widespread environmental damage and increased infection risk. These home owners do not have the finances to maintain their homes, placing them under a greater risk for disease, as lack of income and poverty is the most consistent predictor of disease and premature death.[10,19]

Comparisons on various indicators of health between inhabitants of the main houses and the shacks in the back yard yielded very few significant differences. The income of the shack dwellers was significantly higher, but that could be explained by the fact that they had to rent their shacks while the main house owners acquired their houses for free. Although there were more persons aged between 21 and 40 years of age living in shacks, the overall age distributions did not differ significantly. This lack of difference in important health characteristics implies that the acquisition of an improved dwelling with more space and supposed better sanitation did not translate into improved health for the inhabitants of those houses when compared to the shack dwellers in the back yard. Degrading the aims of low-cost housing programmes by allowing backyard overcrowding is an important factor to keep in mind when assessing the health improvements associated with re-housing of the urban poor. There is a dearth of studies investigating this dynamic and the present study aimed to illustrate that the supposed improvements in health brought about by improved housing did not materialise under these conditions.

The reality of large numbers of persons housed in informal dwellings side-by-side with the state-subsidised low-cost houses cannot be legislated away at this late stage since the problem is so widespread. The laws of the country place the onus on any municipality who evicts these inhabitants to find alternative accommodation for them - an impossible task. The planning of urban design and service delivery in these settlements however need to be far more cognisant of the particular challenges and needs arising from these communities. Attention is at present focussed solely on the population who are not yet rehoused, but the inhabitants housed in these low-cost settlements are not by any means properly catered for regarding sanitation, health and living conditions. These communities ought not to be written off as “taken care of” by the authorities.

Low-cost housing programmes in South Africa has been highly cost-inefficient and the present policies driving these initiatives are giving rise to significant numbers of low income strata of the population experiencing threats to their health. Thus the underlying assumption that improved housing will result in improved health has been subverted by allowing the new recipients of improved housing to bring slum conditions with them - quite literally in their own back yards.

Acknowledgements

We thank the Harry Crossley Foundation, the German Academic Exchange Service (DAAD), the National Research Foundation and Stellenbosch University for the funding of this project, Sister N. Lethuka for help in administering the survey and Professor M. Kidd from the Centre for Statistical Consultation at Stellenbosch University for statistical support.

Conflicts of interest: None.

References

1. United Nations Human Settlement Programme (UN-HABITAT). *The Challenge of Slums. Global Report on Human Settlements*. London: Earthscan Publications Limited; 2003. www.unhabitat.org/downloads/docs/GRHS.2003.0.pdf (accessed 4 June 2009).

2. Erguden S. Low-cost housing: policies and constraints in developing countries. *Proceedings of the 2001 International Conference on Spatial Information for Sustainable Development*, Nairobi, 2-5 October 2001. Kenya.

3. Ndegwa D, Horner D, Easu F. The Links between Migration, Poverty and Health: Evidence from Khayelitsha and Mitchell's Plain. Soc Indic Res. 2006;81:223-224.

4. Satterthwaite D. Will most people live in cities? *BMJ*. 2000;321:1143-1145.

5. Rauh VA, Landrigan PJ, Claudio L. Housing and Health: Intersection of Poverty and Environmental Exposures. *Ann. N.Y. Acad. Sci.* 2008;1136:276-288.

6. Thomson H, Pettigrew M, Morrison D. Health effects of housing improvement: systematic review of intervention studies. *BMJ*. 2001;323:187-190.

7. World Medical Association. *Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects*. Geneva: World Medical Association; 2000. http://www.fda.gov/ohrms/dockets/dockets/06p0147/06p-0147-c000001-02-vol1.pdf (accessed 24 January 2009).

8. Department of Health. *Guidelines for Good Clinical Practice in the Conduct of Clinical Trials in Human Participants in South Africa***.** Pretoria, South Africa: Department of Health, 2000. http://www.doh.gov.za/docs/policy/trials/trials_01.html (accessed 3 October 2009).

9. Statistics South Africa. *Statistics South Africa Income and Expenditure of households 2005/06 - Analysis of results*. Report no. 01-00-01. Pretoria, South Africa: Statistics South Africa, 2008. http://www.statssa.gov.za/Publications/Report-01-00-01/Report-01-00-012005.pdf (accessed 13 November 2009).

10. McMichael AJ. The urban environment and health in a world of increasing globalization: issues for developing countries. *Bull World Health Organ*. 2000;78:1117-1126.

11. Mechanic D, Tanner J. Vulnerable people, groups and populations: societal view. *Health Aff (Millwood)* 2007;26:1220-1230.

12. Bomela N. Child nutritional status and household patterns in South Africa. *AJFAND*. 2007;16:1-18. http://www.ajfand.net/Issue16/PDFs/Bomela_2140.pdf (accessed 15 March 2010).

13. Thomson GW, Wilson NA, O'Dea D, Reid PJ, Howden-Chapman P. Tobacco spending and children in low income households. *Tobacco Control* 2002;11:372-375.

14. Perry CB, Roberts JAF. Study of the variability and incidence of rheumatic heart disease within the city of Bristol. *BMJ.* 1937;2:154-158.

15. Baker M, McNicholas A, Garrett N, Jones N, Stewart J, Koberstein V, Lennon D. Household crowding a major risk factor for epidemic meningococcal disease in Auckland children. *Pediatr Infect Dis J.* 2000;19:983-990.

16. Barnes JM. The impact of water pollution from formal and informal urban development's along the Plankenbrug River on water quality and health risk. PhD thesis. Western Cape, University of Stellenbosch. 2003.

17. D'Souza RM. Housing and environmental factors and their effects on the health of children in the slums of Karachi, Pakistan. *J Biosoc Sci*. 1997;29:271-281.

18. Kawachi I, Wamala S. *Globalization and Health*. New York: Oxford University Press; 2007. p. 122-137.

19. Connolly MA, Gayer M, Ryan MJ, Salama P, Spiegel P, Heymann DL. Communicable diseases in complex emergencies: impact and challenges. *Lancet.* 2004;364:1974-1983.

5.2 Research Paper 2

The following paper has been published as **""Govender T, Barnes JM, Pieper CH. Housing conditions, sanitation status and associated health risks in selected subsidized low-cost housing settlements in Cape Town, South Africa. *Habitat Int*. 2011;35(2):335-342"**. By the prevailing rule of the Faculty, this thesis was examined after the publication of the paper. Some amendments have been made to reflect the requests and comments of the examiners.

Housing conditions, sanitation status and associated health risks in selected subsidized low-cost housing settlements in Cape Town, South Africa

Thashlin Govender [1,*], Jo M Barnes [1] and Clarissa H Pieper [2]

1 Division of Community Health, Faculty of Health Sciences, Stellenbosch University, Tygerberg, Cape Town, South Africa

2 Division of Neonatal Medicine, School of Child and Adolescent Health, University of Cape Town and Groote Schuur Hospital, Observatory, Cape Town, South Africa

E-Mails: 15217116@sun.ac.za; jb4@sun.ac.za; clarissa.pieper@uct.ac.za)

* Author to whom correspondence should be addressed; Tel.: +27-83-730-2846; Fax: +27-021-938-9166

Abstract

This paper provides an assessment on the structural living conditions of selected government-subsidised low cost housing settlements in the City of Cape Town and the associated health conditions of the inhabitants. Almost all of these houses have one or more informal dwellings in the back yard. Four subsidized housing communities were selected within the City of Cape Town in this cross sectional survey. Structured interviews were administered in 336 dwellings on 173 plots. Data was obtained from 1080 persons with a response rate of 100%. The vast majority of the main houses had two (38%) or three (48%) structural problems and 99% of the home owners could not afford repairs to the home. The integrity of the walls of the dwelling structure was problematic, showing large visible cracks. None of the walls were plastered causing rainwater to penetrate during rainstorms. During an inspection of the sanitation facilities in the home, 58% of toilets were non-operational, 66% of the bathrooms did not have toilet paper but had a supply of old newspaper instead, while 82% of the bathrooms did not have soap available to wash hands. At present the design of these low cost housing schemes contribute to an increased risk of communicable diseases, rather than an improvement. The recipients of these houses were

previously disadvantaged and their sanitation behaviour is inter alia shaped by the amenities at their disposal. The designers of low-cost houses should take serious note of the pathways of disease created by the provision and layout of sanitation-associated structures. The design of low cost housing should not force the inhabitants of such houses into unsafe habits because of poor provision or poor layout of basic amenities.

Keywords: Low-cost housing; Backyard dwelling; Structural conditions; Sanitation behavior; Health risks; Cape Town

Introduction

Housing is meant to provide shelter and security and is considered a fundamental development process, in which the built environment is created, used and maintained for the physical, social and economic well-being and quality of life of individuals and households.[1] Populations with less disposable income have fewer choices and are liable to end up in poor housing.[2] Less income is available for maintenance and repair, medicines and other necessary items such as food, which can have a direct impact on health status.[3]

Insecure occupancy of housing and limited prospects of secure employment make living conditions difficult for the underprivileged worldwide. Such living conditions include poorly constructed housing from inferior quality building materials and limited building skills; the location of housing on contaminated or disaster prone sites; limited basic services like clean water, garbage collection and sewage treatment.[3] Prolonged poor maintenance of houses leads to dilapidated buildings – leaking pipes, peeling paint or cracks and holes in ceilings. Buildings is such conditions create the risk of poorly or non-functioning toilets and taps and damp conditions that can act as stressors that affects the human immune system.[4,5] Housing disrepair among the poor exposes them disproportionately to lead, pests, air pollutants, contaminants and greater social risks.[4,6]

In South Africa the RDP (Reconstruction and Development Programme) engaged in working with government to end the issues associated with the apartheid regime and build a better life for its citizens through the improvement of social rights, such as health, housing, as well as opportunities for gainful employment.[7] Recently, the RDP was replaced by the Breaking New Ground (BNG) programme.[8] The new human settlements plan has as some of its central principles the improvement of quality of life for the poor, as well as using housing as an instrument for the development of sustainable human settlements. This paper investigates the

design aspects of examples of such government sponsored low cost housing settlements and the resultant health profile of inhabitants of those communities.

Numerous technical, urban, social and economic factors have been associated with service delivery of low-cost housing projects in South Africa.[9] With the rising need for adequate housing and the availability of space in the back yards of new housing settlements, back yard dwellings (informal housing) sprung up across all the new improved housing settlements.[10] These informal dwellings referred to as shacks by the inhabitants are viewed as a ready source of income by the owners of the new low-cost houses. Prior to 1996, housing policies overlooked backyard dwellers and most national surveys captured them in the informal settlement bracket, though their circumstances and challenges are dissimilar.[11] According to the South African Institute of Race Relations (SAIRR), 590 000 households (approximately one-third of all households living in informal housing settlements), reside in backyard shacks,[12] representing 5.7% of all South African households.[13] The SAIRR have indicated that the proportion of households living in backyard dwellings is increasing more rapidly than the proportion in truly informal (squatter) settlements, indicative of the growing popularity of this housing type in the context of massive housing shortages.[12] The aim of this is paper is to provide an assessment on the structural living conditions of selected government-subsidised low cost housing settlements in the City of Cape Town and the associated health conditions of the inhabitants.

Methods

This study was approved by the Committee for Human Research at the Faculty of Health Sciences of Stellenbosch University and was conducted according to the ethical guidelines and principles of the International Declaration of Helsinki,[14] the South African Guidelines for Good Clinical Practice and the Ethical Guidelines for Research of the Medical Research Council of South Africa.[15] All respondents were informed of the objective of the study in their home language (English, Afrikaans or isiXhosa) and signed informed consent. A copy of the informed consent was provided to all participating households. The survey was conducted anonymously. All participants could inspect the completed questionnaire answer sheet for anonymity. They then posted the form into a sealed box with a postal slot. The box was only unsealed at the end of the study.

Four subsidized housing communities were selected within the City of Cape Town Metropole (CCTM) to participate in this cross sectional survey. The government subsidized low-cost housing communities identified as study sites were: Driftsand, Greenfield, Masipumelela and Tafelsig. These sites were selected to represent the best geographic spread of all the subsidized housing settlements within the city. The settlements were selected regardless of the local or central

authority under whose jurisdiction the housing schemes were originally erected. They had to be older than three years. This was important because in some of the newer settlements structural wear and tear of the houses had not yet become evident to the same extent as in the older settlements. The settlements selected had to have distinct boundaries that did not blend into informal settlement areas (so-called squatter settlements) in order to avoid garbage and water pollution introduced from neighbouring areas. All four settlements had numerous low-cost houses (referred to as 'main house' from this point forward) with informal dwellings (called "shacks" by the inhabitants) made of temporary building materials in the back yard (referred to as 'shack' from this point forward). There were three settlements with predominantly black inhabitants and one settlement with predominantly coloured (mixed ancestry) inhabitants. This selection was representative of the overall demographic profile of the settlements in the city. No questions or annotations on race were included in the questionnaire.

Data were collected by means of structured interviews during home visits to all selected dwellings by the senior author, assisted by a qualified registered nurse who spoke all three languages prevalent in the area. All dwellings on a selected plot (formal house and informal dwellings in the back yard) were included but recorded separately. Overall, 322 dwellings on 165 plots were selected for participation in the study. A systematic randomised sampling procedure was used to select the plots in the four study sites. Data were obtained from 1080 persons in total with a response rate of 100%.

The questionnaires were piloted in two different settlements (either predominantly Coloured or predominantly black) in the CCTM. The pilot study sites were situated in Mfuleni and Westbank. The results from the pilot sites met the same criteria as the study sites. No problems or confusing questions were encountered and these interviews were carried out under the same conditions as the main study. The data from the dwellings on eight plots in these pilot sites were therefore included in the total group.

The questionnaire was designed to record data from all dwellings on a plot. These questionnaires were available in all three languages and administered in the language of preference during an on-site interview with the head of the household. The questionnaire comprised sections on demographics, health and home ownership as well as a section to note the condition of the dwelling and its surrounding yard. Health variables included HIV and Tuberculosis (TB) status, as well as ailments suffered in the preceding two weeks of the survey. Respondents were given an option of disclosing their HIV and TB status.

Data were recorded in a database created in Statistica (data analysis software system), version 9.0. Descriptive statistics, mainly means and standard deviations for continuous variables and frequency distributions for categorical variables were computed. Bivariate analysis testing for differences in proportions of low-cost housing and backyard shacks were performed using the test for probability values.

Results

Housing acquisition

The recipients of state-funded houses were mainly drawn from the inhabitants of informal settlements in the Cape Town metropolitan area but some were relocated from outside the borders of the Province (Table 1). Purchase of state-subsidized houses is illegal, but 12 owners acquired their houses by this method, one being a foreign national (Table l). The present owners of illegally purchased houses described the original owners as “desperate for money.” These new owners of the main houses paid between R35 000 to R60 000 (about US$4 666 to US$8 000).

Table 1: Housing type and inhabitants in all four settlements in the study

	Number	**%**
Dwelling type		
Main house	173	51
Backyard shack	163	49
Citizenship of occupants		
South African	1024	95
Non-South African	56	5
Families’ place of origin		
Western Cape Province	210	62
Eastern Cape Province	100	30
Northern Cape Province	10	3
Other African countries*	16	5
Ownership		
Main houses owned by original allocation	150	87
Main houses purchased from original owner	12	7
Total main houses rented	11	6

Application for houses		
Mean years waited for house obtained (SD)	6.03 (3.44)	not applicable
Application made to government for a house	65	40
Mean years still waiting for house (SD)	7.07 (4.01)	not applicable
Family requiring house but no application made	98	60

*Zimbabwe, Botswana, Mozambique, Namibia, Tanzania and Zambia.

Renting out a low-cost house is also illegal. None of the 11 houses that were rented out had the original owner living on the premises (Table 1). The monthly rental paid for a state-funded house was between R600 to R1 200 (US$80 to US$160), excluding the charge the landlord imposed for use of on-site water and electricity. In this study, all shacks found in the backyard of main houses were rented out by the owner of the main house in the front. The median rent paid monthly by the shack owner was R150 with a standard deviation of R126.47 (about US$20 with a SD of US$16.80). Main houses had 1.1 person per 10 m^2 and 2.0 persons per 10 m^2 in backyard shacks (Chi-square test, p value <0.01).

Design of low-cost houses

In three of the four settlements the low-cost houses comprised one large room (sometimes informally subdivided by the owners) with a waterborne toilet and a basin and tap forming an open-plan ‘kitchen area’ (Table 2). All main houses were constructed of cement blocks and were unplastered.

Table 2: Sites and design of low-cost houses in the study (*n*=173).

Site	Toilet	Access to municipal drain	Tap/s	Bathroom facilities
Masipumelela	Toilet outside house	No	1	No bath or washbasin
Tafelsig	Toilet inside house	Yes	3	Bath and washbasin
Driftsands	Toilet outside house	No	2	No bath and washbasin
Greenfields	Toilet inside house	No	1	No bath and washbasin

All settlements were situated in areas with formal potable water, sewerage and storm water systems and with formal tarred roads. All main houses were connected to the main electricity grid, but no shacks had formal approved electrical connections. Illegal, informal connections were provided by the main house owner to the shacks. Shacks were charged a flat fee by the landlord for water; electricity was obtained by prepaid meter cards. No shacks had toilets or taps and none had formal facilities to dispose of household wastewater. Shacks had to fetch water from the main house. The shack owners also used the solid waste bins supplied by the City Council to main house owners, resulting in too much solid waste for the disposal system to contain between collection days.

Evaluation of structural conditions

The construction and design of these houses were found to vary between sites (Table 2). A large proportion of the study participants reported that their houses were not structurally complete upon occupancy. The vast majority of the main houses had two (38%) or three (48%) structural problems. The integrity of the walls of the dwelling structure was problematic, showing large visible cracks (Table 3). None of the walls were plastered causing rainwater to penetrate during rainstorms. Damp was visible on the walls in many dwellings. Home owners commonly using softened bar soap to fill up holes in leaking roofs which washed out at the next rain episode, causing white streaks down the inner walls.

Table 3: Housing quality indices of main houses

Independent variable	**Number (*n=173*)**	**%**
Outside walls not painted	82	47
Inside walls not painted	88	51
Cracked walls	117	68
Door not well fitted	103	60
Broken windows	60	35
Toilet not operational	101	58
Toilet leaking	69	40
Tap leaking	63	36
Roof leaking	136	79
Structural damage	11	6

Ninety-nine percent of the home owners in the survey reported that they could not afford repairs to their home. Various households had reported problems to the City Council but noted that they eventually “fixed the problems themselves or learn to live with it.”

Sanitation knowledge and behaviour

Backyard dwellers were allowed to use the only toilet on the property. The mean number of persons per toilet on a plot varied between one and 13 (mean 6.24). However, for toilets inside the home when no one was at home, the neighbours’ toilet was used. Alternatively these persons resorted to using a receptacle as a chamber pot or defecated in the open. During the survey 83% of the respondents reported that the toilet often broke or was blocked.

An overwhelming proportion of participants were sufficiently aware of the importance of proper sanitation - 99% of them knew that using a dirty toilet or living in an unclean home can make you ill while 79% of the respondents knew that one can get ill from not washing one's hands after using the toilet. In contrast, 97% of the bathrooms did not have material for drying hands (clean towel, paper towels or toilet paper). During an inspection of the sanitation facilities in the home, 66% of the bathrooms did not have toilet paper but had a supply of old newspaper instead, while 82% of the bathrooms did not have soap available to wash hands.

Almost all respondents (92%) admitted of their own accord that “they found it difficult to keep their home clean” and 99% found purchasing cleaning materials expensive. Of the occupants of main houses, only 26% reported that they cleaned the toilet daily. A reported 34% of the respondents living in main houses cleaned their toilet once a week. The largest number (63%) of main house participants reported cleaning the toilet by hand with soap and a cloth.

Waste disposal practices

Since shack dwellers had no toilets or taps in their homes or access to any kind of drain, the disposal of household wastewater was problematic - 72% of shack dwellers disposed of grey water into the only toilet on the premises, while 61% of main house dwellers reported the same habit. Only one community (Tafelsig) had a drain on the property while all the others had no access to a drain except via the toilet or the only household basin in the kitchen. During on-site inspection, 92% of the drains in Tafelsig were in a poor state (blocked, leaking, dirty, or spilling wastewater). In 68% of cases there was no waste bin inside any of the dwellings. Almost 8.1% of main house dwellers reported disposing of their excreta and soiled nappies on the street while 17.8% of shack dwellers disposed of such refuse into the storm water drain.

Health profile of inhabitants

Over the two weeks preceding the survey 153 (living in 40% of main houses and 23% of shacks) persons reported suffering from one or more attacks of diarrhoea (Figure 1).

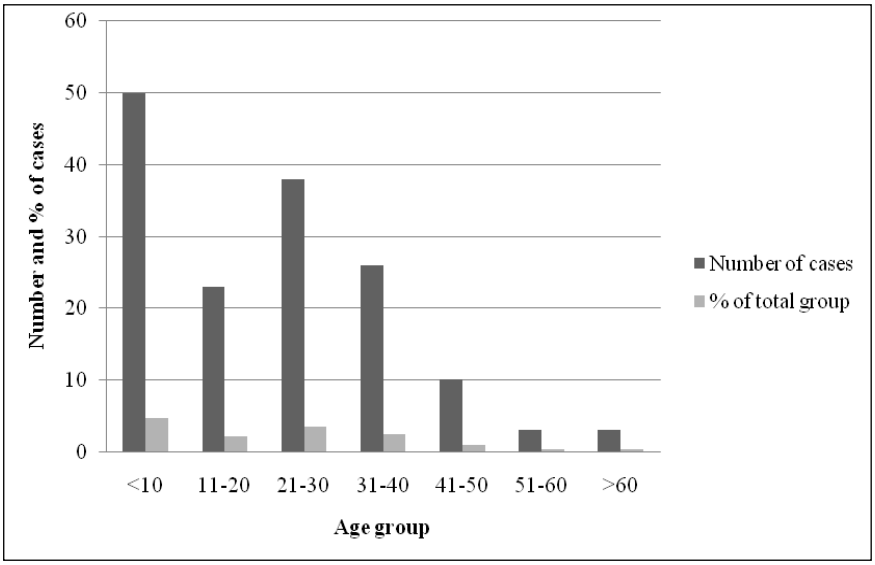

Figure 1: Diarrhoeal cases classified into age groups

Many of the persons represented in this survey were under-nourished - 24.8% of families reported eating only one or two meals a day. In the two months preceding the study, 38 inhabitants were diagnosed with TB after a visit to their local clinic (Table 4).

Table 4: Health aspects of households in survey

Dwellings affected	Main house	%	Shack	%	Total group	%	p-value	Odds ratio (95% CI)
Diarrhoea*	70	40.0	38	23	108	32	0.0071	2.24 (1.40-3.57)
TB	24	3.3	14	3.7	38	3.5	0.7341	1.12 (0.57-2.20)
HIV positive	8	1.1	10	3.7	18	1.6	0.0458	3.45 (1.51-7.89)

*Cases calculated out of the number of dwellings relative to the toilet per plot

One person reported having multiple drug resistant (MDR) TB. All other diagnoses of illnesses were reported in very low numbers (16 cases). This does not imply that the participants in the survey suffered from very few illnesses, but merely very few had their illnesses diagnosed at a clinic or their nearest health care facility.

Discussion

The recipients of the state-funded houses are drawn from housing lists containing the names of impoverished families unable to afford housing and who applied for state assistance. Even while taking ownership of a new formal house was certainly an improvement in living conditions, usually the new ownership was not accompanied by an improvement in income for the recipients in these resettlement programmes. Owners of low cost houses soon exploited one of the few resources they had, namely space, by allowing others to build informal structures (called shacks by the inhabitants) in the back yard, which are rented out for income.[16] This escalation in the number of shacks within low-cost housing communities resulted in a huge increase in population density, placing the infrastructure designed for fewer people under significant strain.

Many backyard dwellers participating in the present study were not on the housing list, because they are unaware of the application procedure, were ignorant of some aspect of the procedure or had no confidence in the ability of the authorities to provide a house. This pessimism about their chances of improving their lives has profound effects on their outlook regarding their attitude towards their housing future.[17] Some of the recipients of state-funded houses illegally sold their houses, mainly because of severe financial hardship. They will not be able to access another house in future. This is yet another category of persons who are forced to fall back on living in informal shacks.

The results of this survey revealed that the infrastructure of the dwellings in these low cost settlements is in a poor state of repair. This poses significant health risks to the inhabitants as housing disrepair among the poor exposes them disproportionately to lead, pests, air pollutants, contaminants and greater social risks.[4,6] The owners of the low cost houses reported having difficulty making repairs to their houses as well as being able to afford the repairs. Some reported the faults to the City Council, but the Council is not the owner of these structures and cannot be expected to maintain them.

This survey showed that the number of people making use of the sanitation infrastructure in the main house exceeded the number of inhabitants that these houses were designed for by a large margin due to the added inhabitants from the informal dwelling(s) in the backyard. The added pressure on the sanitation facilities in these low-cost houses due to the high number of users would make the upkeep of the infrastructure more expensive.

Since the main house was sponsored, the previously disadvantaged new owners considered the government (in whatever guise) to be responsible for maintenance - a situation that is untenable. Furthermore, these ‘cash poor’ communities do not have the financial resources and knowledge

to repair their houses. Chaudhuri (2004) found a strong relationship between social disadvantage and living in poor quality housing.[3] Cash poor populations have fewer choices in housing and are liable to end up in poor housing.[2] These homes tend to have exorbitant housing expenditures, which worsens their incidence of poverty after housing costs were subtracted.[18] Less income is available for maintenance and repair, medicines and other necessary items such as food, which can have a direct impact on health status.[3] Poor maintenance of houses leads to dilapidated structures over time and that can create unhealthy conditions resulting in stressor that can affect the human immune system.[4,5]

The increase in infection pressure created by the poor housing conditions in the present study is manifested inter alia in the high number of diarrhoea cases reported. This high prevalence of diarrhoea also has secondary effects on the financial situation of affected families as well as casting a significant burden on the economy of the area.[19] Research undertaken by Goebel (2007) suggest that "low-cost housing projects must understand and prioritize health and livelihoods issues for the poor. In terms of health, basic needs for sanitation and affordable services still remain, with solutions to be found in both the technical and political realms."[20]

Lewin *et al.* (2007) reported in 2000 that an estimated 13 368 deaths were attributable to unsafe water, sanitation and hygiene, accounting for 2.6% of all deaths in South Africa.[21] The high incidence of non-functional toilets together with the reported high prevalence of diarrhoea in low-cost housing communities in this study suggest that there is a serious lack of control over the spread of common sanitation-associated diseases, hence the high diarrhoea prevalence. Results from the study indicate good hygiene knowledge among the inhabitants - however their actions reveal a large gap between knowledge and practice. Ablution facilities were cleaned infrequently and inappropriate methods were used, posing a significant strain on the control of spread of infection within the household.

The design of these houses also contributed to unsafe hygiene practices. In two of the four settlements in the present study there were no taps near the toilets. The only tap in the house was in the kitchen area, forcing those who did wash their hands after a visit to the toilet to use the same tap where food was prepared. This constitutes a clear pathway of transferring pathogens onto food. The single tap in the house was also used for bathing, washing clothes and all other water-related activities. Furthermore, the occupants of the shack in the backyard used the toilet in the main house. These informal structures have no taps or toilets, so that their use of these already dirty facilities in the main house contributed to the contamination and spread of pathogens to the outside structures. The collection of water in the main house for storage in the shacks also created the chance of water contamination spreading disease in these settings.[22]

The main houses in these communities showed poor structural integrity and damp interiors. Together with overcrowded conditions, this is conducive to the spread of TB. The association between the overcrowding of dwellings and the spread of TB is well known.[23,24] In excess of 400 000 cases of TB require treatment annually in South Africa with cure rates hardly reaching 50% and mortality rates at an all-time high.[25] Patients with MDR-TB have been identified throughout South Africa's nine provinces with an incidence of 10 000 cases per year - the largest MDR-TB burden in Africa and representing a failure of TB control.[26] In South Africa at least 60% of TB patients are estimated to be infected with HIV.[25] The self-reported HIV positivity of the inhabitants in this study constitutes an added health vulnerability in these exposed communities. It can safely be assumed that this percentage constitutes an under-count.

The disposal of household waste and wastewater by these inhabitants add yet more risks of disease to these communities. The lack of access to a drain connected to the sewer system in these dwellings contributed to the undesirable practice of disposal via the flush toilet. Using a waterborne toilet to flush away dirty water is a practice severely wasteful of potable water. The available water sources available to the City of Cape Town are threatened by over-exploitation and the City is rapidly reaching the capacity of current water resources.[27] This wasteful practice on such a large scale contributes significantly to water shortages.

The persistent degradation of dwelling infrastructure within these housing communities creates an additional cost for the owners. The overcrowding and poor sanitation behaviour result in frequent breakdown of municipal infrastructures such as sewerage systems incurring even more burdens on the wider economy. Flooding caused by increased storm water adds to the upkeep and thus the costs. All these costs should be added to the nominal cost of the initial construction of these settlements. In addition, local municipalities in South Africa are faced with a severe shortage of capacity and resources and increased levels of corruption.[28]

Promulgating more laws to prohibit shacks in the back yard will not address the already huge problem existing in these communities in the City as indeed in such low-cost housing communities across South Africa. Creative approaches to address the increased demand on sanitation services and storm water systems during the planning phase are urgently needed. Retrofitting infrastructure with bigger capacity is costly and not practical. This is an unmet need on a level above the community. Governmental planning ought to be adjusted to take health and safety of the inhabitants of these houses into consideration and not just the delivery of the largest number of poorly planned houses in the shortest possible time.

The low cost housing programmes in South Africa have as one of their aims the improvement of the living conditions and the consequent better health of the recipients. At present the design of these low cost housing schemes unfortunately contribute to an increased risk of communicable diseases, rather than an improvement. The recipients of these houses come from the ranks of the previously disadvantaged and their sanitation behaviour is shaped by the amenities at their disposal. Allowing backyard structures as a means of income to the recipients of these low-cost houses creates a serious degradation of the living conditions of the inhabitants with improved housing. Therefore this form of unregulated rental housing requires policy support, something that is lacking in the backyard dwelling dynamic.[11] The designers of low cost houses should take serious note of the pathways of disease created by the provision and layout of sanitation-associated structures such as the toilet, taps and disposal facilities.[29] The design of low cost housing should not force the inhabitants of such houses into unsafe habits because of poor provision or poor layout of basic amenities.

Acknowledgements

We thank the Harry Crossley Foundation, the German Academic Exchange Service (DAAD), the National Research Foundation and Stellenbosch University for the funding of this project. Sister N. Lethuka is thanked for assisting in administering the survey and Professor M. Kidd from the Centre for Statistical Consultation at Stellenbosch University for statistical support.

References

1. RJ. Lawrence, Housing and health: from interdisciplinary principles to transdisciplinary research and practice, Futures 36 (2004) 487-502.
2. PL. Howden-Chapmen, N. Isaacs, J. Crane, R. Chapman, Housing and health: the relationship between research and policy, International Journal of Environmental Health Research 6 (1996) 173-186.
3. N. Chaudhuri, Interventions to improve children's health by improving the housing environment, Reviews on Environmental Health 19 (2004) 197-222.
4. VA. Rauh, GI. Chew, RS. Garfinkel, Deteriorated housing contributes to high cockroach allergen levels in inner-city households, Environmental Health Perspectives 110 (2002) 323-327.
5. I. Lehmann, A. Thoelke, M. Weiss, U. Schlink, R. Schulz, U. Diez, G. Sierig, F. Emmrich, B. Jacob, P. Belcredi, G. Bolte, J. Heinrich, O. Herbath, HE. Wichmann, M. Borte, T cell

reactivity in neonates from an East and West German city – results of the LISA study, Allergy 57 (2002) 129-136.

6. J. Sharfstein, M. Sandel, R. Kahn, H. Bauchner, Is child health at risk while families wait for housing vouchers? American Journal of Public Health 91 (2001) 1191-1192.
7. D. Hemson, Beating the backlog: meeting targets and providing free basic services. Position Paper. [online] 2004 [cited on 6 July 2010]. Available from: http://www.hsrc.ac.za/Document-470.phtml
8. City of Cape Town, Department of Housing. Breaking New Ground, Comprehensive plan for housing delivery. [online] 2004 [cited on 3 July 2010]. Available from: http://web.wits.ac.za/NR/rdonlyres/CF05F3D4-DFDC-49DD-9776D924A89AB9D7/0/BreakingNewGroundHousingPlanCabinetapprovedversion.pdf
9. G. Lizarralde, M. Massyn, Unexpected negative outcomes of community participation in low-cost housing projects in South Africa, Habitat International 32 (2008) 1-14.
10. O. Crankshaw, AG. Gilbert, A. Morris. Backyard Soweto, International Journal of Urban and Regional Research 24 (2000) 841-857.
11. C. Lemanski, Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies, Habitat International 33 (2009) 472-484.
12. South African Institute of Race Relations. From bare fields to the back of private properties: The shifting pattern of informal dwelling erections. [online] 2008 [cited on 2 July 2010. Available from: http://www.sairr.org.za/press-office/archive/press_release_-_living_conditions_24_nov_2008.pdf.
13. Statistics South Africa. General household survey July 2005. [online] 2006 [cited on 22 June 2010]. Available from: http://www.statssa.gov.za/publications/P0318/P0318July2005.pdf.
14. World Medical Association. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. [online] 2000 [cited on 2 May 2010] Available from: http://www4.ensp.fiocruz.br/etica/docs/artigos/Helsing.pdf.
15. Republic of South Africa, Department of Health. Guidelines for Good Clinical Practice in the Conduct of Clinical Trials in Human Participants in South Africa. [online] 2000 [cited on 4 June 2010]. Available from: http://www.doh.gov.za/docs/policy/trials/trials_01.html.
16. V. Watson, Housing policy, subletting and the urban poor, Urban Forum 5 (2009) 27-43.
17. FM. Carp, Impact of improved housing on morale and life satisfaction, The Gerontologist 15 (1975) 511-515.

18. B. Stephen, The impact of housing expenditure on the incidence and severity of poverty. GSBGM Working paper series 11/94. Wellington: Public Policy group, 1994.

19. DO. Abegunde, CD. Mathers, T. Adam, M. Ortegon, K. Strong, The burden and costs of chronic diseases in low-income and middle income countries, Lancet 370 (2007) 1929-1938.

20. A. Goebel, Sustainable urban development? Low-cost housing challenges in South Africa, Habitat International 31 (2007) 291-302.

21. S. Lewin, R. Norman, N. Nannan, E. Thomas, D. Bradshaw, Estimating the burden of disease attributable to unsafe water and lack of sanitation and hygiene in South Africa in 2000, South African Medical Journal 97 (2007) 755-762.

22. KJ. Nath, Home hygiene and environmental sanitation: a country situation analysis for India, International Journal of Environmental Health 13 (2003) S19-S28.

23. JH. Darbyshire, Tuberculosis: old reasons for a new increase? British Medical Journal 310 (1995) 954-955.

24. JA. Singh, R. Upshur, N. Padayatchi, XDR-TB in South Africa: Not time for denial or complacency, PLoS Medicine 4 (2007) 19-25.

25. WHO. Global Tuberculosis control: surveillance, planning, financing. [online] 2006 [cited on 11 June 2010]. Available from: http://books.google.co.za/books?id=GOnK4Zq0X7UC&dq=Global+Tuberculosis+control:+surveillance,+planning,+financing&printsec=frontcover&source=bn&hl=en&ei=WMA1TNaiMtaTsQaD8sW5AQ&sa=X&oi=book_result&ct=result&resnum=4&ved=0CCIQ6AEwAw#v=onepage&q&f=false.

26. M. Zignol, MS. Hosseini, A. Wright, CL. Weezenbeek, P. Nunn, CJ. Watt, BG. Williams, C. Dye, Global incidence of multidrug-resistant tuberculosis, Journal of Infectious Disease 194 (2006) 479-85.

27. A. Joubert, TJ. Stewart, R. Eberhard, Evaluation of water supply augmentation and water demand management options for the City of Cape Town, Journal of Multi-criteria decision analysis 12 (2003) 17-25.

28. D. Kilian, H. Fiehn, J. Ball, M. Howells. National state of the environment project, Human Settlements. [Online] 2005 [cited on 13 June 2010]. Available from: http://soer.deat.gov.za/dm_documents/Introduction_572IF.pdf.

29. AL. Dannenberg, RJ. Jackson, H. Frumkin, RA. Schieber, M. Pratt, C. Kochtitzky, HH. Tilson, The impact of community design and land-use choices on public health: a scientific research agenda, American Journal of Public Health 93 (2003) 1500-1508.

5.3 Research Paper 3

The following paper has been published as **"Govender T, Barnes JM, Pieper CH. Contribution of water pollution from inadequate sanitation and housing quality to diarrheal disease in low-cost housing settlements of Cape Town, South Africa. *Am J Public Health*. 2011 Jul;101(7):e4-9"**. By the prevailing rule of the Faculty, this thesis was examined after the publication of the paper. Some amendments have been made to reflect the requests and comments of the examiners.

Contribution of water pollution from inadequate sanitation and housing quality from Diarrhoeal disease in low-cost housing settlements of Cape Town, South Africa

Thashlin Govender [1]*, Jo M Barnes[1] and Clarissa H Pieper[2]

1. Division of Community Health, Department of Interdisciplinary Health Sciences, Faculty of Health Sciences, Stellenbosch University, Tygerberg, Cape Town, South Africa

2. Division of Neonatal Medicine, School of Child and Adolescent Health, University of Cape Town and Groote Schuur Hospital, Observatory, Cape Town, South Africa

E-Mails: 15217116@sun.ac.za; jb4@sun.ac.za; clarissa.pieper@uct.ac.za)

* Author to whom correspondence should be addressed; Tel.: +27-83-730-2846; Fax: +27-021-938-9166

Abstract

Purpose: To investigate the effects of failing sanitation and poor housing conditions on the health of inhabitants, along with faecal pollution levels in run-off environmental water.

Methods: Four subsidized low-cost housing communities were selected in this cross sectional survey. Structured interviews were administered in 336 dwellings. Data was obtained from 1080 persons. The Colilert® DST technique was used to detect and enumerate the *E. coli* levels of run-off water samples taken from the study communities.

Results: Almost 15% of households dispose of soiled products into the storm water drain and 6% in the street. Only 26% of the dwellings wash their toilets once a day. Approximately 59% of dwellings do not have a tap nearby to wash their hands after using the toilet. A reported 14% of participants suffered one or more attacks of diarrhoea. *E.coli* counts of run-off environmental water samples ranged between 750-1 580 000 000 per 100ml.

Conclusion: With a reported 21% of households admitting the incorrect disposal of human excreta and the counts of *E.coli* observed in the environmental water samples; these communities are faced with a public health hazard.

Keywords: Low-cost housing; Backyard dwelling; Environmental water pollution; *E. coli* enumeration, Diarrhoeal disease

Introduction

Shelter, access to adequate potable water and sanitation are basic human needs that pose serious challenges to developing countries.[1] In South Africa, these challenges are greatly heightened by the fast rate of urbanization mainly by low-income rural dwellers and the rapid expansion of unplanned urban informal settlements.[2]

South Africa is facing a low-income housing crisis, with the current backlog estimated at over three million units.[3] The South African housing policy is mainly based on the promotion of state-funded home-ownership for the poor.[4] One of the six principles of the South African government's low-cost housing scheme, now called the Breaking New Ground initiative (formerly Reconstruction and Development Programme) is to improve the living conditions and therefore the health of the recipients of the new houses.[5]

Low cost housing units are usually allocated to persons who occupy makeshift dwellings in one of the many informal settlements surrounding cities and towns. Unfortunately ownership of a new formal house was not accompanied by an improvement in income in these resettlement programmes. The owners of low cost houses soon exploited one of the few resources they had, namely space, by allowing others to build informal structures (called shacks by the inhabitants) in the back yard, which are rented out for income. This escalation in the number of shacks within low-cost housing communities resulted in a huge increase in population density, placing the infrastructure designed for fewer people under significant strain.[6]

The inter-related effects of the quality of water supplies, excreta disposal and health status, especially via the faecal-oral route, are well established.[7,8] The benefits of improved water and sanitation include both health and non-health effects.[9] The direct health benefits are related in two contrasting roles of water, that of disease vector when it carries pathogens and that of health mediator through its use in personal and domestic hygiene. Indirect effects related to health include, for example, improved quality of life and decreased expenditure on medical expenses.[8]

Diarrhoeal diseases are an important cause of morbidity and mortality in low and middle income countries, which resulted in the estimated death of 4.9 out of every 1000 children aged less than

5 years.[10,11] The WHO estimated that there are 0.75 cases of diarrhoea per person worldwide annually.[12] In South Africa diarrhoeal diseases account for 3.1% of total deaths – the eighth largest cause of death nationally.[13,14] In addition, diarrhoeal diseases are the third largest cause of death and the third greatest contributor to the burden of disease among children under 5 years of age, constituting 8.8% of all disability-adjusted life years (DALYs) in this age group.[14]

Problems of environmental pollution of living space and of domestic hygiene are almost always related to poverty of the population and the sanitation of settlements.[15] Pathogens, especially enteric pathogens, are transmitted at household level through a complex set of interdependent pathways.[16] These pathways include contaminated food and water, poor waste disposal contaminating the living spaces, as well as intricate household and community-level person-to-person routes.[16] This study aims to investigate the interplay of inadequate housing and poorly functioning sanitation on ill-health and environmental pollution in formal low cost housing settlements in Cape Town.

Methods

Housing and health survey

This study was approved by the Committee for Human Research at the Faculty of Health Sciences of Stellenbosch University and was conducted according to the ethical guidelines and principles of the International Declaration of Helsinki,[17] the South African Guidelines for Good Clinical Practice and the Ethical Guidelines for Research of the Medical Research Council of South Africa.[18] All respondents were informed of the objective of the study in their home language (English, Afrikaans or isiXhosa) and signed informed consent. A copy of the informed consent was provided to all participating households. The survey was conducted anonymously. All participants could inspect the completed questionnaire answer sheet for anonymity. They then posted the form into a sealed box with a postal slot. The box was only unsealed at the end of the study.

Four subsidized housing communities were selected within the City of Cape Town Metropole to participate in this cross-sectional survey. The state-funded low-cost housing communities identified as study sites were: Driftsand, Greenfields, Masipumelela and Tafelsig. These sites were selected to represent the best geographic spread of all the subsidized housing settlements within the city. The settlements were selected regardless of the local or central authority under whose jurisdiction the housing schemes were originally erected. They had to be older than three years. This was important because in some of the newer settlements structural wear and tear of

the houses had not yet become evident to the same extent as in the older settlements. The settlements selected had to have distinct boundaries that did not blend into informal settlement areas (so-called squatter settlements) in order to avoid garbage and water pollution introduced from neighbouring areas. All four settlements had numerous low-cost houses (referred to as main house from this point forward) with informal dwellings made of temporary building materials in the back yard (referred to as shack from this point forward).A legacy of the previous spatial disparities in the City resulted in communities with predominantly only one ethnic group. There were three settlements with predominantly black inhabitants and one settlement with predominantly coloured (mixed ancestry) inhabitants. This selection was representative of the overall demographic profile of the settlements in the city. No questions or annotations on race were included in the questionnaire.

Data were collected by means of structured interview questionnaires during home visits to all selected dwellings by the senior author, assisted by a qualified registered nurse who spoke all three languages prevalent in the area. All dwellings on a selected plot (formal house and informal dwellings in the back yard) were included but recorded separately. Overall, 321 dwellings on 165 plots were selected for participation in the study. A systematic randomised sampling procedure was used to select the plots in the four study sites. Data were obtained from 1020 persons in total with a response rate of 100%.

The questionnaires were piloted in two different settlements (predominantly coloured and predominantly black) in the Cape Town Metropole. The pilot study sites were situated in Mfuleni and Westbank and four plots were randomly selected from each of the sites. From these eight plots the survey was administered to 15 dwellings with data obtained from 60 persons. The results from the pilot sites met the same criteria as the study sites. No problems or confusing questions were encountered and these interviews were carried out under the same conditions as the main study. The data from the dwellings in these pilot sites were therefore included in the total group, i.e. 1080 participants living in 336 dwellings (173 main houses and 163 shacks).

The questionnaire was designed to record data from all dwellings on a plot. These questionnaires were available in all three languages and administered in the language of preference during an on-site interview with the head of the household. The questionnaire comprised sections on demographic, health and home ownership as well as a section to note the condition of the dwelling and its surrounding yard. Home ownership included questions formulated specifically for the main house and the shack. Home attainment and ownership in both the subsidized and backyard dwelling, rental paid, and operational costs incurred by these previously disadvantaged inhabitants was used to explore and set the scene of state-funded housing communities in the

CCTM. In addition, an attempt to gauge the safety of these settlements and the community needs were documented.

Colilert Defined Substrate Technologies

Assessment method for determining the presence and number of faecal bacteria and *Escherichia coli* (*E. coli*) used in this study was defined substrate technology Colilert DST (IDEXX, Westbrook, ME). Sampling of environmental water (six samples per study site, *n*=24) was done according to the guidelines set out by the South African Bureau of Standards that incorporates the standard methods set out by the American Public Health Association, American Water Works Association and the Water Environment Federation.[19,20,21] For the purpose of this study, environmental water samples can be described as run-off water from houses and shacks, water running alongside the street into the storm water drain and puddles of water in the streets. All samples were transported on ice and delivered to the analysing laboratory at the Department of Food Science Water Research Laboratory of the University of Stellenbosch within 90 minutes. For the analysis of faecal contamination, the Colilert Quanti-tray 2000 technique 8 serial dilutions (10^8) per 100ml of sample water was used.

Statistical analysis

Data from the survey were recorded in a database created in Statistica version 9.0 (StatSoft Inc. 2009, USA). Descriptive statistics mainly means and standard deviations for continuous variables and frequency distributions for categorical variables were computed. Chi square tests for analyses of statistical differences between frequencies were carried out.

Results

The living conditions in these low-cost housing settlements were found to pose a considerable risk to the health of the inhabitants. The 173 main houses surveyed were in a state of disrepair (Figure 1). The drains were dirty with sewage-laden water spilling in 92% of the houses, while the toilet area was deemed to be observably dirty in 72% of cases.

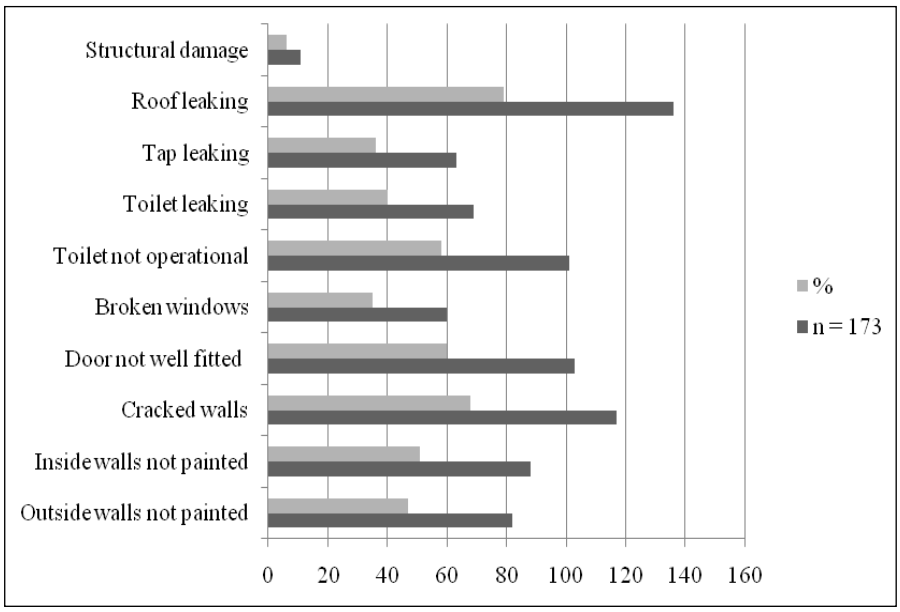

Figure 1: Distribution of housing quality indices in low-cost houses

The sanitation status of dwellings in these low cost housing communities was poor. In all four communities there was only one waterborne toilet on each plot - 51% were outside the main house and 49% inside the house. A summary of the findings of the inspection of the sanitation infrastructure is presented in Table 1.

Table 1: Results of inspection of sanitation infrastructure (only for main houses - shacks did not have these amenities)

Sanitation feature	Number reported to be poor/absent (n=173)	%
Bathroom condition poor	129	75
Toilet not working	102	59
Toilet leaking	71	41
Tap leaking	68	39
No toilet paper in bathroom	113	65
No soap available in bathroom	143	83
No clean towel to dry hands	165	95
Condition of drain poor	158	91

Ninety-nine percent of the respondents stated that one can get ill from using a dirty toilet. Only 26% of the toilets however were reported to be cleaned once a day and 34% of toilets were cleaned once a week, while 18% of respondents said that they carried out cleaning “sometimes.”

The method of toilet cleaning reported by most inhabitants (63%) of main houses was using soap and a cloth. Only 25% reported cleaning the toilet with a brush. When questioned, 79% of respondents answered that an individual can get sick from not washing their hands. Approximately 59% of dwellings did not have a tap nearby for washing of hands after using the toilet and these inhabitants were forced to use the kitchen tap for this purpose.

The disposal of household waste was also unsatisfactory (Figure 2). In 68% of cases there was no waste bin inside the dwelling. The cleanliness of the outside yard was poor in 76% of cases, while 49% of households had solid waste (much of this was broken glass) lying around outside the home. Tafelsig was the only community where main houses had an outside drain. Of these, 92% were in a poor state (blocked, dirty, or spilling wastewater). A reported 60% of the study population did not know who to contact if there was a drain blocked or overflowing and 15% responded that nothing will happen if rubbish is thrown into the toilet.

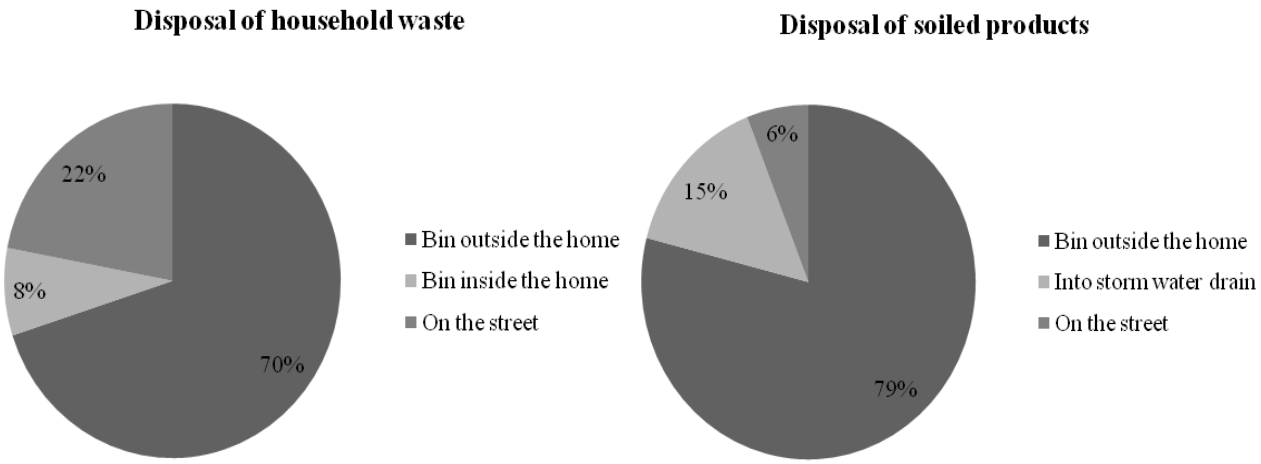

Figure 2: Disposal practices for two classes of household waste

Additional indictors of an unhygienic home environment were reported by the respondents from both types of dwellings. All of the respondents in the survey complained of disease-carrying household pests within their immediate home environment. The respondents from all four communities reported their single major pest problem was rats by 50%, cockroaches by 30%, fleas by 16% and flies by 4%.

In main houses one or more cases of diarrhoea were reported during the two weeks preceding the survey (Table 2).

Table 2: Diarrhoeal cases (*n*=153) as per age group, gender and educational status

Diarrhoeal cases	Diarrhoeal cases	Total in group	%
Age group			
<10	50	262	19.0
11-20	23	203	11.3
21-30	38	243	15.6
31-40	26	162	16.0
41-50	10	138	7.2
51-60	3	48	6.2
>60	3	24	12.5
Gender			
Male	74	506	14.6
Female	79	574	13.7
Educational status			
No schooling	31	176	21.0
Pre-primary to Grade 4	27	184	14.6
Grade 5 to Grade 7	30	219	13.6
Grade 8 to Grade 10	24	228	10.5
Grade 9 to Grade 12	39	258	15.1
Tertiary	2	15	13.3

The most frequently reported signs and symptoms are summarised in Table 3. Of those reporting symptoms, 80% still suffered from these ailments at the time of the survey.

Table 3: Frequent signs and symptoms reported by participants in the different dwelling types

Symptoms reported	Main houses (n=173)		Shack dwellings (n=163)		p-value (Chi-square test)
	Number	%	Number	%	
Diarrhoea	70	40	38	23	0.0007
Coughing for >1 week	34	20	19	12	0.0430
Vomiting	12	1.7	8	2.2	0.5850
Skin complaints (itchy skin, hand / body sores)	14	2	6	1.6	0.0646
Fever	11	1.5	6	1.6	0.9278

With the increase in the number of dwellings and inhabitants per plot; the volume of household wastewater generated from various household activities were also increased. These households

lacked accessible entry points to the sewerage system except for one sink and the single toilet. The inappropriate disposal of household wastewater reported by inhabitants of all dwellings are summarised in Table 4.

Table 4: Percentage of respondents from both types of dwelling (n=336) reporting inappropriate disposal of household wastewater

Wastewater source	Open land	Toilet	Storm-water drain
Bathing/washing	14.9	41.7	4.5
Kitchen*	23.2	20.2	2.7
Laundry	13.1	47.9	1.5

*Includes food preparation, dishes and cleaning

During the inspection of the premises, 64% of the dwellings had puddles of dirty water outside the home. A common occurrence in these communities was the presence of wastewater puddling outside or running along the road and entering storm water channels draining into the nearest river system. The storm water volume generated in built-up areas is related to the extent of the hardened surfaces in those areas. The total roof area covered by the formal houses in the four settlements was 5550 m^2 while the total roof area added by the shacks was 1587 m^2 - an increase of 29%.

The run-off environmental water samples taken from the yards or the street outside the properties, showed gross faecal pollution. The total coliform counts and *E. coli* counts are presented in Table 5.

Table 5: Environmental run-off water samples from six different sample points in each of the four study sites.

Settlement	Sample number					
	1	**2**	**3**	**4**	**5**	**6**
Masipumelela						
Total coliforms*	>21 420 000 000	410 000 000	3 100 000	200 000 000	850 000	1 580 000 000
*E. coli**	82 000 000	410 000	10 000	3 100 000	310 000	1 000 000
Greenfields						
Total coliforms*	1 090 000	1 000 000	24 890 000 000	4 040 000 000	1 000 000	3 270 000 000
*E. coli**	52 000	310 000	1 580 000 000	7 500 000	750	13 500 000
Tafelsig						
Total coliforms*	10 000 000	3 310 000000	41 000 000	10 000 000	10 000 000	310 000
*E. coli**	52 000	10 000 000	10 000 000	200 000	41 000	41 000
Driftsands						
Total coliforms*	2 000 000	4 100 000	940 000	4 100 000	740 000	1 000 000
*E. coli**	840	31 000	20 000	100 000	100 000	106 000

* per 100 ml water

Discussion

Housing provision plays a vital role in meeting basic needs.[22] Improved housing is intended to improve, inter alia, the health status of newly housed urban poor.[23] This is one of the basic tenets that most state-funded housing schemes are based on. Alternatively, inadequate and insufficient housing, especially for the urban poor, has an extensive history of problems associated with sanitation failures and ensuing environmental degradation.[15,16,24] In exploring the impact of the built environment on public health, research indicates that the burden of illness is greater among minorities and lower income communities.[25,26] The population of urban poor is increasing faster than service delivery due to urban migration and population increases.[2]

Informal dwellings in the back yards of low-income urban living areas occur across the world,[27,28] but the extent of this unplanned urban densification in South African communities is uncommon. The impact of backyard dwellings on this scale remains under-researched and the existing literature on the subject matter is minimal.[6] With the exception of a few studies[4,6,29,30,31] reference to backyard dwellings was virtually absent, with most of the attention focusing on other aspects of housing. No previous research conducted on the health status of backyard dwellers situated within low-cost housing settlements in South Africa could be found and this paper provides such information for a representative sample of settlements in the City of Cape Town.

Housing is an important mechanism for improving the health of vulnerable populations and re-housing such persons should reduce the burden on the government for supplying health services for theoretically preventable secondary infections.[32] Although all the main houses in this study were state-funded structures provided for free to inhabitants, who previously lived in informal urban slum areas with the intention of improving their living standards, the structural failures of the houses were such that this improvement did not materialise. The design and the present state of the sanitation infrastructure in actual fact predisposed the inhabitants to ill-health. This can be deduced from the large number of toilets that were non-functional, the poor state of the buildings (both the cracked walls and leaking roof tops in the formal houses and the flimsy nature of the shacks) and the general state of the sanitation facilities (Table 1).

In general, the health profile of the communities in the survey gave cause for concern. An unexpected result of this survey was the observation that inhabitants of shacks were significantly less affected regarding the prevalence of diarrhoea. The reasons were, inter alia, one of proximity of source of infection. The only toilet on the premises was situated inside the main house in two of the four study communities or next to the house in the other two. The inhabitants of the main house therefore lived closer to the source of highest infection pressure associated with the toilet area. Given the high rate of failure or disrepair and poor cleanliness of the toilet facilities, this

meant that the shack dwellers contributed to the use and subsequent poor condition of the toilet, but did not have to live in close proximity to the unhygienic conditions. As seen in Table 1, the provision of amenities to clean after using the toilet (toilet paper, soap, towel, etc.) was poor. In 83% of homes there was no soap available and in 95% of homes there was no clean towel to dry hands.

The high prevalence of diarrhoea in the main houses can be partly related to the poor state of sanitation in these houses. The persons living in the main houses lived in closer proximity to the dirty toilet than those living in the shacks. The non-availability of a tap near the toilet contributed to the spread of disease. All water used to wash or bathe the inhabitants of the house also had to be disposed of at the kitchen sink or down the toilet. Using the kitchen tap for hand washing as well as the disposal of all personal bathing and washing wastewater added to the risk of disease transmission. These inappropriate uses of a kitchen washing facility add significantly to the infection risks faced by the inhabitants of these houses. This reality should be taken into account by the planners and designers of low-cost housing.

The single tap at the kitchen sink used for all ablutions contributes to the possible transfer of diarrhoeal pathogens onto food. These increased risks were especially harmful for children under the age of 10 years, and in this study these children were one of the two age categories most affected by diarrhoea. Some of the other reported symptoms such as vomiting and fever may also be partly related to gastrointestinal illness and this supports the results from the environmental water samples that there is high infection pressure from gastrointestinal pathogens in this environment. This warrants the urgent need for education in basic home maintenance and household domestic hygiene in low-cost housing communities in order to reduce the risks of transmission of diarrhoeal disease.

Even though low-cost housing settlements creates the opportunity for backyard shack dwellers to access on-site water and toilet facilities, there were insufficient waste and wastewater disposal facilities for all the occupants of the plot. This resulted in direct dispersal of wastewater and untreated sewage into the immediate environment. With many households admitting to unsafe disposal of human excreta; this created the potential for the establishment of a reservoir of pathogens in the environment (both inside and outside houses) as wastewater and raw sewage were discarded into yards, sidewalks and streets. The cumulative impact of this pollution challenge can be seen from the *E. coli* counts of the water in the immediate surroundings (Table 4). This run-off water ultimately made its way into formal or informal storm water channels, subsequently polluting nearby rivers. This urban population lives in close proximity to those rivers, creating just one more infection pathway for them.

The lack of adequate and timely removal of solid waste in this study environment as well as the inappropriate discarding of contaminated waste in the immediate surroundings of the dwellings caused widespread pollution. Seepage from rubbish bins added to this burden. With 22% of households disposing solid waste on the street this also contributed to the environmental pollution. Rego (2005) found that exposure to garbage was the most important factor associated with diarrhoea in children living in an informal neighbourhood in Salvador, Brazil.[33] Moraes (2003) established that improvements in community sanitation can have an impact on the prevalence of diarrhoeal disease even without measures to promote hygiene behaviour.[34] Thus the improvement of waste disposal and sanitation infrastructure as a matter of priority would directly improve the disease profile of the studied communities.

Improper waste disposal at the household and community level further encouraged the occurrence of disease-carrying vectors such as rodents, flies and cockroaches. Apart from increased risk of direct disease transmission from these vectors, they also increase the risk of exposing inhabitants to allergens.[35,36]

According to studies by Carden *et al.* (2005) and Armitage (2009) the management of household wastewater has a low priority among inhabitants of urban sub-economic communities in South Africa.[37,38] This was borne out by the findings of the present study. The disposal of household wastewater (sullage) was inappropriate in 56% of all households in this survey (Figure 1). Inappropriate disposal of wastewater included disposal on open land, into the storm water drain or flushed down the toilet. The first two inappropriate disposal options directly contribute to environmental pollution in the city. Flushing away household wastewater was stated by 44% of households and represented additional management problems for the city authorities. Disposal of dirty household water by using potable water on such a large scale creates heavy pressure on the scarce water resources of the city as well as on the already overburdened wastewater purification infrastructure. This inappropriate behaviour is a direct consequence of poor hygiene habits and inadequate or inconvenient access to the formal sewerage system in these state-funded housing schemes.

The surface run-off water sampled in these low-cost housing communities was heavily polluted (Table 4). The health risks emanating from the water in the surroundings of the dwellings as well as the streets were considerable - the highest *E. coli* count per 100 ml of water was 1.58×10^9. Since the properties were so small and the backyards had no available open space due to the existence of backyard shacks, the small front yard as well as the street constituted the only open spaces for children to play. Persons or pet animals entering the dwellings had to walk through this polluted water. This pathway of pathogens in the immediate home environment provided a plausible explanation for the high prevalence of diarrhoea observed in this study.

Widespread occurrence of household wastewater in the environment found in the present study and the serious levels of faecal pollution measured in this water, create a host of environmental and health problems. It became clear that household wastewater could not be managed separately from the other waste streams namely sewerage, solid waste and storm water. These conditions favour the worsening of community health and environmental pollution (especially of water sources) and the subsequent deepening of poverty.

The incidence of diarrhoea points to the serious need for information regarding household and personal hygiene. A cost-effective initiative for addressing the health needs at community level would be to support community-recruited health assistants to visit families and give advice on basic health matters.[39] These persons could also liaise with the clinic and act as a link between the formal curative services and the community. It has been shown to be successful on a pilot scale however this needs to be co-ordinated in a systematic manner with the availability of primary health care services and supported by local government authorities.[39] Leaving the situation unaddressed will inevitably lead to an escalation of already objectionable living circumstances into a crisis that is unmanageable by the present services.

Eisenberg, Scott and Porco (2007) pointed out that much is known about the natural history of disease transmission, but that little is known about the interaction of different transmission pathways to determine the efficacy of any intervention.[16] Their research showed that the effect of intervening on one transmission pathway depends on the magnitude and interplay of the other transmission pathways. Specifically, when community sanitation is poor, water quality improvements may have minimal health impact, regardless of the amount of water contamination.[16] If each transmission pathway alone is sufficient to maintain diarrhoeal disease, single-pathway interventions will have minimal benefit, and ultimately an intervention will be successful only if all sufficient pathways are eliminated.[16] However, when one pathway is critical to maintaining the disease, public health efforts should focus on this critical pathway. “Under these conditions of high community transmission, community level sanitation must be considered a necessary intervention.”[16] It is clear from the present study that a holistic and integrated approach to the housing and sanitation failures in low cost housing is urgently needed in order to realise the public health benefits of improved housing for South African poor.

Acknowledgements

This work was funded in part by grants from the Harry Crossley Foundation, the German Academic Exchange Service (DAAD), the National Research Foundation and Stellenbosch University. We thank Amanda Brand from the Department of Food Sciences at Stellenbosch University for her assistance with the analyses of the water samples.

Conflicts of interest: None.

References

1. WHO (1978) Primary health care: report of the International Conference on Primary Health Care; Alma-Ata, USSR; 6-12 September 1978. Geneva: World Health Organization. http://www.who.int/hpr/NPH/docs/declaration_almaata.pdf.
2. Rogerson CM (1996) Urban Poverty and the informal economy of South Africa's economic heartland. Environment and Urbanization 8:167-179. doi:10.1177/095624789600800115.
3. Pillay A, Naude WA (2006) Financing low-income housing in South Africa: Borrower experiences and perceptions of banks. Habitat International 30:872-885. doi:10.1016/j.habitatint.2005.03.001
4. Morange M (2002) Backyard shacks: The relative success of this housing option in Port Elizabeth. Urban Forum 13:3-25. doi:10.1007/s12132-002-0011-4
5. City of Cape Town, Department of Housing (2004) Breaking New Ground, Comprehensive plan for housing delivery. http://web.wits.ac.za/NR/rdonlyres/CF05F3D4-DFDC-49DD-9776D924A89AB9D7/0/BreakingNewGroundHousingPlanCabinetapprovedversion.pdf
6. Lemanski C (2009) Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies. Habitat International 33:472-484. doi:10.1016/j.habitatint.2009.03.002
7. Curtis V, Cairncross S, Yonli R (2000) Review: domestic hygiene and diarrhoea – pinpointing the problem. Tropical Medicine and International Health 5:22-32. doi: 10.1046/j.1365-3156.2000.00512.x
8. Fewtrell L, Kaufmann RB, Kay D, Enanoria W, Haller N, Colford JM (2005) Water, sanitation and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. Lancet Infectious Diseases 5:42-52. doi:10.1016/S1473-3099(04)01253-8
9. Greenwood D, Slack R, Penthorer J (1997) Medical Microbiology - A guide to microbial infections, pathogenesis, immunity, laboratory diagnosis and control. 15th edition. Churchill Livingstone: New York.
10. Kosek M, Bern C, Guerrant RL (2003) The Global burden of diarrhoeal disease, as estimated from studies published between 1992 and 2000. Bulletin of the World Health Organisation 81:197-204.

11. Pruss A, Kay D, Fewtrell L, Bartram J (2002) Estimating the Burden of Disease from Water, Sanitation and Hygiene at a global level, Environmental Health Perspectives (2002) 110:537-542.

12. WHO (2009) More research needed into childhood diarrhoea, new priority areas for research identified. http://www.who.imt/mediacentre/news/releases/2009/diarrhoea_research_20090310/

13. Bradshaw D, Groenewald P, Laubscher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M (2003) Initial burden of Disease Estimates for South Africa, 2000. http://www.mrc.ac.za/bod/initialbodestimates.pdf

14. Norman R, Bradshaw D, Schneider M, Pieterse D, Groenewald P (2006) Revised Burden of Disease Estimates for the Comparative Risk Factor Assessment, South Africa, 2000. http://www.mrc.ac.za/bod/RevisedBurdenofDiseaseEstimates1.pdf.

15. Nath KJ (2003) Home hygiene and environmental sanitation: a country situation analysis for India, International Journal of Environmental Health 13:S19-28. doi:10.1080/0960312031000102778

16. Eisenberg JNS, Scott JC, Porco T (2007) Integrating public health control strategies: Balancing water sanitation and Hygiene Interventions to reduce diarrheal disease burden, American Journal of Public Health 97:1-7. doi: 10.2105/AJPH.2006.086207

17. World Medical Association (2000) Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. http://www4.ensp.fiocruz.br/etica/docs/artigos/Helsing.pdf.

18. Republic of South Africa, Department of Health (2000) Guidelines for Good Clinical Practice in the Conduct of Clinical Trials in Human Participants in South Africa. http://www.doh.gov.za/docs/policy/trials/trials_01.html.

19. American Society for Microbiology (1997) Clinical Microbiology Procedures Handbook. Vol. 1. Editor-in-chief: Isenberg H.D. ASM: Washington D.C. Loose-leaf format.

20. American Public Health Association, American Water Works Association, Water Environment Federation (1992) Joint publication. Standard Methods for the examination of water and wastewater, 18th edn. American Public Health Association/American Water Works Association/Water Environment Federation, Washington DC.

21. American Public Health Association, American Water Works Association, Water Environment Federation. Joint publication. (1996) Standard Methods for the examination of water and wastewater, 19th edn. American Public Health Association/American Water Works Association/Water Environment Federation, Washington DC.

22. Kleinman M (2005) Meeting housing needs through the market: An assessment of housing policies and the supply/demand balance in France and Britain, Housing studies 10:17-38. doi:10.1080/02673039508720807

23. Krieger J, Higgins DI (2002) Housing and Health: time again for public health action, American Journal of Public Health 92:758-768. doi: 10.2105/AJPH.2005.073817.

24. Larson E, Duarte CG (2001) Home hygiene practices and infectious disease symptoms among household members, Public Health Nursing 18:167-127. doi: 10.1046/j.1525-1446.2001.00116.x.

25. Fullilove MT (1998) Promoting social cohesion to improve health, Journal of the American Medical Women's Association 53:72-76.

26. Bashir SA (2002) Home is where the harm is: housing as a health crisis, American Journal of Public Health 92:733-738.

27. Roy D (1983) The supply of land for the slums in Calcutta. In Angel S, Archer RW, (eds.) Tanphiphat S, Wegelin EA. Land for Housing the poor. Select Books: Singapore, pp 251.

28. Potter RB (1995) Urbanisation in the Caribbean and trends of global convergence-divergence, Geographical Journal 159:1-21.

29. Crankshaw O, Gilbert AG, Morris A (2000) Backyard Soweto, International Journal of Urban and Regional Research 24:841-857. doi:10.1111/1468-2427.00282.

30. Bank L (2007) The rhythms of the yards: urbanism, backyards and housing policy in South Africa, Journal of Contemporary African studies 25:205-228. doi:10.1080/02589000701396298.

31. Morange M (2002) Backyard shacks: The relative success of this housing option in Port Elizabeth, Urban Forum 13:3-25. doi: 10.1007/s12132-002-0011-4.

32. Kidder DP, Wolitski RJ, Campsmith ML, Nakamura GV (2006) Health status, health care use, medication use, and medication adherence among homeless and housed people living with HIV/AIDS, American Journal of Public Health 97:2238-2245. doi:10.2105/AJPH.2006.090209

33. Rego RF, Moraes LRS, Dourado I (2005) Diarrhoea and garbage disposal in Salvador, Brazil, Transactions of the Royal Society of Tropical Medicine and Hygiene 99:48-54. doi: doi:10.1016/j.trstmh.2004.02.008

34. Moraes LRS, Cancio JA, Caincross S, Huttly S (2003) Impact of drainage and sewerage on diarrhoea in poor urban areas in Salvador, Brazil. Transactions of the Royal Society of Tropical Medicine and Hygiene, 97:153-158. doi: 10.1016/S0035-9203(03)00043-9

35. Rauh VA, Chew GR, Garfinkel RS (2002) Deteriorated housing contributes to high cockroach allergen levels in inner-city households, Environmental Health Perspectives 110:323-327.

36. Taylor PJ, Arntzen L, Hayter M, Iles M, Frean J, Belmain S (2008) Understanding and managing sanitary risks due to rodent zoonosis in an African city: beyond the Boston model, Integrative Zoology 3:38-50.

37. Carden K, Armitage N, Winter K, Sichone O, Rivett U (2008) The Management of greywater in the non-sewered areas of South Africa, Urban Water Journal 15:329-343. doi: 10.1080/15730620801972316

38. Armitage NP, Winter K, Spiegel A, Kruger E (2009) Community-focused greywater management in two informal settlements in South Africa, Water Science Technology 59:2341-2350. doi:10.2166/wst.2009.294

39. Barnes JM (2003) The impact of water pollution from formal and informal urban developments along the Plankenbrug River on water quality and health risk. [dissertation]. Stellenbosch: University of Stellenbosch, pp. 246.

5.4 Research Paper 4

The following paper was as "**Govender T, Barnes JM, Pieper CH. 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. *Environ Health Insights* 2011;5:23-52.**" By the prevailing rule of the Faculty, this thesis was examined after the publication of the paper. Some amendments have been made to reflect the requests and comments of the examiners.

The impact of densification from informal shacks in the back yards of low-cost housing settlements on municipal service delivery in Cape Town, South Africa

Thashlin Govender [1,*], Jo M Barnes [1] and Clarissa H Pieper [2]

1 Division of Community Health, Department of Interdisciplinary Health Sciences, Faculty of Health Sciences, Stellenbosch University, Tygerberg, Cape Town, South Africa

2 Division of Neonatal Medicine, School of Child and Adolescent Health, University of Cape Town and Groote Schuur Hospital, Observatory, Cape Town, South Africa

E-Mails: 15217116@sun.ac.za; jb4@sun.ac.za; clarissa.pieper@uct.ac.za

* Author to whom correspondence should be addressed; Tel.: +27-83-730-2846; Fax: +27-021-938-9166

Abstract:

This paper investigates state-sponsored low-cost housing provided to previously disadvantaged communities in Cape Town and the strain imposed on municipal services by the densification of unofficial backyard shacks. Houses were in a state of disrepair with significant lapses of structural defects and sanitation status (as a consequent 38% of dwellings reported one or more persons suffering from diarrhoea). Primary Health clinics were poorly utilised while none of the self-admitted HIV or TB positive persons were on treatment. The design of low-cost houses and phenomenon of backyard dwellings placed enormous pressure on the existing municipal infrastructure and the environment, thereby creating unintended public health risks.

Keywords: Densified low-cost housing settlements; Backyard shack dwellings; Municipal service delivery; Primary health care services; HIV; TB

Introduction

Housing and its relationship to health has long been one of the core areas of public health research (Shaw, 2004). Housing affects health through a range of factors, acting directly or indirectly at different levels (Shaw, 2004). The assumption that provision of improved housing to previously disadvantaged urban slum dwellers may improve their health is still being debated (Thomson, Petticrew, Morrison, 2001). This premise however forms one of the six principles of the state-funded low-cost housing scheme in South Africa, referred to as the Breaking New Ground initiative, formerly known as the Reconstruction and Development Programme (City of Cape Town, 2004).

The exact association between housing and the maintenance of health and well-being remain elusive (Rauh, Landrigan, Claudio, 2008). It is intuitively accepted that affordable and appropriate housing protects people from hazards and promotes good health and wellbeing (World Health Organization, 1989). Deficient housing on the other hand could compromise basic human needs such as water, sanitation, safe food preparation and storage as well as assisting in the rapid spread of communicable and food borne diseases (Brown, 2003). According to the World Health Organisation (WHO), the developing world records 98% of deaths resulting from unsafe water, sanitation and hygiene (World Health Organization, 2002). The WHO report identified infectious diarrhoea as the largest single contributor to ill health associated with water, hygiene and sanitation inadequacies (World Health Organization, 2002).

In South Africa the accelerated migration of indigent rural people into urban areas caused informal settlements to grow beyond the coping capacity of city infrastructure, resulting in the deterioration of living conditions and the surrounding environment (Graham, *et al*., 2005). In theory, living in urban areas potentially offers improved access to health care, education, better housing and improved economic opportunities (Graham, *et al*., 2005). In reality however, the growth of urban slum areas in developing countries brought about an increase in poverty as many poor, often illiterate and unskilled people leave rural areas to try and find employment in cities (Graham, *et al*., 2005).

A consequence of the housing backlog is that nearly one-fifth of households live in informal dwellings and in response to this need, there had been a large roll-out of government-sponsored low-cost housing in South Africa (Lemanski, 2009). The South African housing policy is based on the promotion of fully state-funded home-ownership for the poor and seeks to eradicate informal housing, including backyard shacks (Morange, 2002).

The South African housing policy is primarily based on the promotion of fully subsidized home-ownership for the poor and seeks to eradicate informal housing (Morange, 2002). The new owners of such subsidized houses acquired their houses for free, but the improvement in their living conditions in most cases was not accompanied by an improvement in their financial status. Most of these inhabitants remained unemployed or with insecure or intermittent employment.

The new home owners soon exploited one of the few resources at their disposal, namely space, by erecting informal or makeshift dwellings in their backyard which were constructed from inadequate building materials (e.g. corrugated iron sheets, wood and cardboard). Most of these informal dwellings are used for rental by other poorly housed families. Backyard dwellings in such formal housing communities caused the slum conditions of their former existence to follow them (Crankshaw, Gilbert, Morris, 2000; Bank, 2007). These informal dwellings (called shacks by the inhabitants) have no sanitation, water, electricity and waste disposal facilities. The subsequent overcrowding and failures of the existing sanitation infrastructure causes severe pressure on municipal services with accompanying environmental pollution. This paper investigates the facilities provided to previously disadvantages communities and the strain posed on municipal services by densified low cost housing communities in the City of Cape Town, thereby creating unintended public health risks.

Methods

This study was approved by the Committee for Human Research at the Faculty of Health Sciences of Stellenbosch University and was conducted according to the ethical guidelines and principles of the International Declaration of Helsinki (World Medical Association, 2000), the South African Guidelines for Good Clinical Practice and the Ethical Guidelines for Research of the Medical Research Council of South Africa (Republic of South Africa, Department of Health, 2000).

All respondents were informed of the objective of the study in their home language (English, Afrikaans or isiXhosa) and signed informed consent. A copy of the informed consent was provided to all participating households. The survey was conducted anonymously. All participants could inspect the completed questionnaire answer sheet for anonymity. They then posted the form into a sealed box with a postal slot. The box was only unsealed at the end of the study.

Four subsidized housing communities were selected within the City of Cape Town Metropole (CCTM) to participate in this cross-sectional survey. The government subsidized low-cost housing communities identified as study sites were: Driftsands, Greenfields, Masipumelela and Tafelsig. These sites were selected to represent the best geographic spread of all the subsidized housing settlements within the city. The settlements were selected regardless of the local or central

authority under whose jurisdiction the housing schemes were originally erected. They had to be older than three years. This was important because in some of the newer settlements structural wear and tear of the houses had not yet become evident to the same extent as in the older settlements. The settlements selected had to have distinct boundaries that did not blend into informal settlement areas (so-called squatter settlements) in order to avoid infection pressure in the form of garbage and water pollution introduced from neighbouring areas. All four settlements had numerous low-cost houses (referred to as main house from this point forward) with informal dwellings made of temporary building materials in the back yard (referred to as shacks by the inhabitants themselves and so called in this paper).

A legacy of the previous spatial disparities in the City resulted in communities with predominantly only one ethnic group. There were three settlements with predominantly black inhabitants and one settlement with predominantly coloured (mixed ancestry) inhabitants. This selection was representative of the overall demographic profile of the settlements in the city. No questions or annotations on race were included in the questionnaire.

Data were collected by means of structured interview questionnaires during home visits to all selected dwellings by the senior author, assisted by a qualified registered nurse who spoke all three languages prevalent in the area. All dwellings on a selected plot (main house and informal dwellings in the back yard) were included but recorded separately. Overall, 321 dwellings on 165 plots were selected for participation in the study. A systematic randomized sampling procedure was used to select the plots in the four study sites. Data were obtained from 1020 persons in total with a response rate of 100%.

The questionnaires were piloted in two different settlements (predominantly coloured and predominantly black) in the CCTM. The pilot study sites were situated in Mfuleni and Westbank and four plots were randomly selected from each of the sites. From these eight plots the survey was administered to 15 dwellings with data obtained from 60 persons. The results from the pilot sites met the same criteria as the study sites. No problems or confusing questions were encountered and these interviews were carried out under the same conditions as the main study. The data from the dwellings in these pilot sites were therefore included in the total group, i.e. 1080 participants living in 336 dwellings (173 main houses and 163 shacks).

The questionnaire was designed to record data from all dwellings on a plot. These questionnaires were available in all three languages and administered in the language of preference during an on-site interview with the head of the household. The questionnaire comprised sections on demographic, health and home ownership as well as a section to note the condition of the

dwelling and its surrounding yard. The inspection of the dwelling and yard concentrated on the sanitation infrastructure and condition of the premises.

The toilet was classified as non-operational when one of the following was noted: toilet blocked, could not flush, had serious leaks or had a severely cracked cistern or bowl. The sanitary condition of the yard was classified as poor when one or more of the following was noted: presence of broken glass, solid waste, excreta, puddles of dirty water, overflowing waste bins, overflowing or dirty drains.

Demographic and socio-economic variables included age, gender, physical challenges, educational attainment, citizenship, social grant recipients, employment status and household monthly income. The household monthly income was arrived at by adding the income of all employed members of the dwelling. Health variables included HIV and TB status, as well as ailments suffered in the preceding two weeks of the survey. Respondents were given an option of disclosing their HIV and TB status. All medication in the dwelling that was issued by the clinic was inspected and the reported diagnoses verified from that.

Data were recorded in a database created in Statistica version 9.0 (StatSoft Inc. 2009, USA). Descriptive statistics mainly means and standard deviations for continuous variables and frequency distributions for categorical variables were computed. Bivariate analysis testing for differences in proportions of low-cost housing and backyard shacks were performed using the test for probability values.

Results

Income and education status

Significantly more of the occupants of the shacks were employed than the occupants of the main houses (χ^2 test, p=<0.01). Almost 42% of households in the total group had a combined household income of less than R1200 (about US$160). The reported incomes of the inhabitants of the main houses were statistically significantly lower than those of the occupants of the shacks (Mann-Whitney U-test, p<0.01). Approximately 28% of main households and 20% backyard shack dwellers received a government social grant (Table 1). The occupants of the shacks had a significantly higher education status that the occupants of the main houses (Mann-Whitney U-test, p=0.01).

Table 1: Sociodemographic characteristics of the study population

Characteristic	Main house	%	Shack	%	Total group	%	p-value
Study population	710	65.7	370	34.3	1080	100	-
Gender							
Male	322	45.3	184	49.7	506	46.8	0.17
Female	388	54.6	186	50.2	574	53.1	
Female-headed households	92	12.9	11	2.97	103	9.53	<0.01
Disabled individuals	18	2.5	2	0.54	20	1.85	<0.01
Nationality							
South Africans	695	97.5	329	88.9	1024	94.8	<0.01
Non-South Africans	18	2.5	38	10.2	56	5.2	
Highest education level							
No schooling	103	14.5	73	19.7	176	16.3	<0.01
Grade 0-4	152	21.4	32	8.6	184	17.1	
Grade 5-7	154	21.6	65	17.5	219	20.3	
Grade 8-10	138	19.4	90	24.3	228	21.1	
Grade 9-12	158	22.2	100	27.0	258	23.9	
Tertiary level	5	0.70	10	2.7	15	1.4	
Employment status							
Full time	122	17.1	76	20.5	198	18.3	<0.01
Part time	8	1.1	33	8.9	41	4.8	
Irregular	50	7.0	32	8.64	82	7.6	
Unemployed	210	29.5	112	30.2	322	29.8	
Pensioner	14	1.9	13	3.5	27	2.5	
Child at home	104	14.6	66	17.8	170	15.7	
Scholar	202	28.4	38	10.2	240	22.2	
Household monthly income*							
<R600	25	14.4	27	16.5	52	15.4	<0.01
R600-R1200	29	16.7	59	36.1	88	26.1	
R1200-R2500	58	33.5	52	31.9	110	32.7	
>R2500	23	13.2	60	36.8	83	24.7	
Unsure	1	0.5	2	1.22	3	0.8	
Households receiving a social grant*	93	53.7	66	40.4	159	47.3	<0.01

*Percentages calculated from the total dwellings (n=1080).

Housing infrastructure

All of the main houses have been equipped with a flush toilet, either inside or outside the house. In all cases backyard dwellers were allowed to use the toilet on the property. If however the toilet inside the home was not available, then the neighbour's toilet may be used or any receptacle that could act as a chamber pot was used. The contents of such receptacles were often disposed of in the storm water drain. On the day of the home visit, 58% of toilets were found to be non-operational (Table 2).

Table 2: Distribution of observations of poor condition of low-cost (main) houses

Observation	**Number (n = 173)**	**%**
Outside walls not painted	82	47
Inside walls not painted	88	51
Cracked walls	117	68
Door not well fitted	103	60
Broken windows	60	35
Toilet not operational	101	58
Toilet leaking	69	40
Tap leaking	63	36
Roof leaking	136	79
Structural damage	11	6

The main houses were in a state of disrepair (Table 2). The majority of the houses had cracked walls and/or visibly leaking roofs (walls streaked with previous leak damage). About half of the houses had unpainted walls, allowing wind-driven rain to seep through. A common occurrence was the use of softened bar soap to fill holes in leaking roofs. Some households had reported the structural problems (Table 2) to the City Council, but stated that they eventually “fixed the problem themselves or learnt to live with it.” This was fruitless as Council do not own these structures and could not be expected to maintain them.

Electricity and water services

All of the main houses had an operational prepaid electricity connection. Backyard dwellings created illegal connections from the main house, and paid between R50 to R200 per month for electricity usage. Of the main houses interviewed in the survey, only seven (4%) of the 173

houses timeously paid the local municipality for water usage (approximately R500 paid in total by the seven houses for a month). A total of 66% of backyard dwellers pay the landlord between R20 and R100 per month for water, in spite of the City providing the first 6000 litres of water for free each month to all households. The 97 backyard shack dwellers paid R6080 (about US$811) in total per month to landlords who themselves did not pay for this water. Backyard inhabitants fetched water from the main house and stored the water in a bucket in the shack.

Waste disposal

The disposal of household waste was unsatisfactory. The sanitary state of the yard outside the dwelling was classified as poor in 76% of the premises inspected. In 68% of cases there was no waste bin inside the dwelling. Household disposal of sewage from chamber pots and soiled baby diapers was inappropriate in 21% of cases (mainly into the storm water drain and in the street). In addition, 22% of households disposed of their solid refuse on the street. Fifteen percent of respondents said that nothing will happen if rubbish is thrown into the toilet.

All of the respondents in the survey complained of pests carrying potential health risks within their immediate home environment. The respondents from all four communities reported their most prominent pest problem was rats by 50%, cockroaches by 30%, fleas by 16% and flies by 4%. Flies were observed in all homes, indicating the presence of flies were under-reported.

Only one of the four sites had access to a drain leading to the sewerage system for the disposal of grey water (Table 3). Storm water drains were mostly used by families who lived in close proximity to such an opening in the kerb, while others preferred to use the toilet or open ground as disposal points. The storm water volume generated in built-up areas is related to the extent of the hardened surfaces in those areas. The total roof area for main houses was 5550 m^2 while for backyard dwellings the total roof area was 1587 m^2 - an increase of 29%.

Table 3: The percentage of dwellings who dispose of household waste water inappropriately (n=336)

Wastewater source	Open land	Toilet	Storm-water drain
Bathing/washing	14.9	41.7	4.5
Kitchen*	23.2	20.2	2.7
Laundry	13.1	47.9	1.5

*Includes wastewater from food preparation, dishes and cleaning)

Health profile

Over the two weeks preceding the survey 38% of dwellings reported one or more persons suffering from diarrhoea (Table 4).

Table 4: Gender and age group of reported cases of diarrhoea

	Number of cases (n=153)	**%**
Dwelling type		
Main house	70	40
Shack	38	23
Gender		
Male	74	48
Female	79	52
Age		
<10	50	33
11-20	23	15
21-30	38	25
31-40	26	17
41-50	10	7
51-60	3	2
>60	3	2

Five percent of the participants willingly disclosed that they were HIV positive, while 11% reported that they were TB positive, one of whom reported being diagnosed with Multiple Drug Resistant (MDR) TB. None of those who reported suffering from TB or who were HIV positive had any medication for their condition in the dwelling. Furthermore, none of the TB or HIV infected individuals had visited the clinic in the preceding two months. The use of chronic medication was reported by 165 (15%) respondents. In many instances, respondents did not know what disease the medication was intended for. The five most common diseases diagnosed at the clinic and reported by the respondents are summarised in Table 5. Of the main houses, 51% had one or more inhabitants who smoked, while 49% of the shack dwellings had one or more smokers (Table 5).

Table 5: Five most frequent illnesses diagnosed at a clinic* and treated by medication as reported by participants, differentiated by housing type

Diagnoses reported	Main house occupants (n=710)		Shack dwellers (n=370)		p-value (Chi-square test)
	Number	%	Number	%	
Hypertension*	42	5.9	9	2.4	0.01
Asthma*	32	4.5	17	4.6	0.95
Diabetes*	28	3.9	7	1.9	0.07
Arthritis*	25	3.5	2	0.5	<0.01
Epilepsy*	7	1.0	4	1.1	0.88
Substance use					
Smoke cigarettes	106	49	110	51	0.23
Consume alcohol	23	56	18	44	0.03
Use drugs†	89	53	80	47	0.66

*These diagnoses were verified by inspecting the medication issued by the clinic in each home

†The nature of the drugs were not explored

Primary health care services

Three of the four low cost housing communities had access to a state clinic in their community. The Driftsands community used other healthcare facilities in neighbouring communities. Of the 400 signs and symptoms of illness reported by the participants, only 35% (140 symptoms) were treated by visiting the local clinic (Table 6).

Table 6: Reported ailments and treatment

	Main house		Shack		Total		p-value
	n	%	n	%	n	%	
Ailments reported	249	35	151	41	400	37	0.06
Participants suffering from ailment	198	28	117	32	315	29	0.20
Treatment of ailment							
Visited clinic	89	12	51	14	140	13	0.79
Home treatment	170	24	90	24	260	24	
Participants still suffering from ailment	158	22	96	82	254	24	0.62

Sixty percent of the participants walked to their primary health care clinic, while 39% used a 'communal taxi' and one percent utilized private transport. The amount paid for a return trip per person to a health care facility varied from R5.00 to R35.00 (about US$1-$5). This was a significant amount of the total household earnings as the mean reported total monthly income per household was R1353 (about US$180). The cost of transport mounted considerably for those on chronic medication who had to visit the clinic regularly. Thirty-five percent of the households reported that there had been one or more occasions during the preceding year when a family member needed to visit a clinic, but did not have money to pay for transport. A large percentage (71%) of the households were not satisfied with the services provided by the clinic and 86% thought that private health care facilities would offer better services than a state clinic.

Discussion

"Despite commendable efforts, the housing backlog for South Africa's urban poor has grown from 1.5 million units in 1994 to about 2.1 million in 2010, according to the Minister of Human Settlements. Taking into account the pace of delivery and the resources available, as well as continued economic and population growth and the rapid pace of urbanisation, it could take decades to beat the backlog".

Income and education status

The economic implications of the creation of shacks for subletting can be seen not only in the direct rent charged but also the water that was sold to backyard dwellers - water that the formal home owners should have paid for but did not. The amount of rent charged was not exorbitant and constituted a basic service rendered rather than an exploitative one. Contrary to common belief, the present survey found that backyard dwellers were better educated and had a higher employment rate and income when compared with the inhabitants of the main houses. Backyard dwellers have to seek employment and generate an income as they have to pay rent and water and electricity usage to the owner of the main house or otherwise face eviction. There is an inherent contradiction in this situation as the persons better able to pay (shack dwellers) are actually living in poorer housing conditions.

Housing infrastructure

The condition of the state-funded main houses in the present study was poor and a cause for concern. These houses are not 'owned' by the state or the local authority any longer and the present indigent owner does not have the financial ability or skills to maintain the house. This

situation has now deteriorated to the point that the failing sanitation infrastructure is impacting on municipal service delivery as well as causing huge pollution risks to the environment. This looming crisis will need huge financial and other resources to redress. The improvements in living standards envisaged by the low-cost housing schemes are fast being lost. There is an urgent need for education of these home owners to improve their ability to maintain the structure of their homes. In some cases small defects would have cost little to remedy at the time, but left untended, the cumulative cost for renovation in these settlements is by now very large.

Electricity and water services

All the formal and informal houses in this study had access to electricity. The shacks accessed electrical connections by means of illegal connections such as extension cords. When these electrical wires, many of which are of the wrong technical specifications for building to building connections, come into contact with corrugated metal roof material, sparks fly in windy conditions. The high number of smokers and illegal electrical connections in the presence of flimsy building materials of the shacks (wood, corrugated iron sheets and even cardboard) increased the risk of structural fires considerably.

An analysis of burn injuries in Cape Town showed that shack fire burns were the second most frequent reason for admission to a Burns Unit in a secondary hospital in Cape Town (Godwin, Hudson, Bloch, 1997). Thus the insecure nature of electricity supply to shacks in the backyard has implications for health care and fire services in the City. At present this is a challenge for the authorities.

Waste disposal

Managing waste services in developing countries is one of the most costly services as it takes up to 1% of the gross national product and typically absorbs between 20% and 40% of municipal revenues (Schertenleib, Meyer, 1992). Improved technology can only be a partial solution to this problem (Godfrey, 2008). Successful implementation of proper waste management strategies strongly depend on en enabling social and economic environment that supports the services rendered. In the present study both the infrastructure enabling the inhabitants of these communities to follow safe disposal practices and their level of knowledge of such practices fall far short of even the most lenient definition of user co-operation.

The consequences of this ‘disastrous’ lack of infrastructure and awareness can be seen from the worrisome results in this study. The levels of environmental pollution, the visible deterioration of the surroundings of these houses and the disease profiles of the inhabitants all indicate a looming

crisis. These settlements are creating favourable conditions for disease outbreaks because of the easy transmission of particularly oral-faecal, water or food related pathogens. The lack of adequate and timely removal of solid waste causes seepage from bins and bulk rubbish containers and inappropriate rubbish disposal contributes to the environmental pollution. Improper waste disposal at the household and community level led to problems such as fly and rodent infestation, as reported by all four communities in the present study. These aspects of the re-housing of urban poor should receive attention by disaster-risk planning authorities.

Even though low-cost housing settlements provided access to an onsite toilet and water facilities for backyard shack dwellers to use, there are insufficient waste disposal facilities in those settlements. Direct discharges of untreated sewage from such settlements into the environment - notably the urban rivers - greatly increased the risk of disease transmission and environmental degradation, adding to the pressures on the urban poor. With a reported 21% of households admitting to the unsafe disposal of human excreta; wastewater and raw sewage makes its way into yards, sidewalks and streets and into the storm water drains. The rationale behind the provision of free improved housing and free basic water allocation, namely increased hygiene and improved living conditions are thus negated by the lack of provision for adequate disposal of sewage, solid waste and wastewater. Armitage (2009) warned that in settlements the waste streams of storm water, sanitation and refuse removal cannot be considered separately as the contamination is so effectively intermingled under these circumstances (Armitage, *et al*., 2009).

Armitage (2009) found that grey water management had a low priority amongst inhabitants of settlements (Armitage, *et al*., 2009). Without adequate waterborne sanitation, the disposal of household wastewater becomes a problem (Carden, *et al*., 2008). Although the main houses in the present study had waterborne sanitation, the design of the facilities and the low level of proper sanitation behaviour of the inhabitants caused widespread disposal of wastewater in two inappropriate ways. The City of Cape Town faces periodic water shortages that are set to increase with the advancement of climate change. Using potable water on such a large scale to dispose of wastewater and other solid waste by flushing down the toilet is a wasteful habit that needs urgent educational remediation. Any community outreach to change this habit will ultimately fail, however, if user-friendly alternatives to this way of disposal are not provided. Unfortunately, retrofitting such user-friendly alternatives have cost and engineering implications for the City and this dilemma should be avoided by amending the planning in future housing settlements.

Storm water runoff in urban areas is increased by impermeable urban surfaces such roofs and as hard-topping of streets and driveways (Parkinson, 2003). Unfortunately settlements are often constructed with little consideration for storm water drainage (Parkinson, 2003). Even formal

storm water drains are 'passive' systems simply receiving any water and solid matter discarded in or near them and are thus vulnerable to misuse. Storm water systems in low-cost settlements are used for the disposal of unwanted wastewater, solid waste and even dead animals as was readily apparent in the present study areas. Apart from the risk of flooding because of blocked storm water systems, the other major impact of this unfortunate situation is the major contamination of rivers flowing past urban areas (Keraita, Drechsel, Philip, 2003; Palamuleni, 2002). The implications of this widespread pollution of surface water in the City for future water resources and environmental health should receive urgent attention by the City planners and engineers.

Primary health care services

The reported HIV positivity of 5% was almost certainly an undercount. The prevalence of HIV for the Cape Town metropolitan area for 2008 was reported by the National Department of Health (2008) as 16.1% [95% confidence interval 14.7% - 17.5%] (Republic of South Africa, Department of Health, 2008). The lack of any antiretroviral medication present in the dwellings was an equally worrisome finding. This indicates a need for better monitoring and evaluation along with a more incisive public health approach to support HIV positive persons. This unmet need has implications for the burgeoning HIV/AIDS epidemic in South Africa. Improved housing can theoretically improve the health of HIV positive persons (Kidder, *et al*., 2007), but under the present state of sanitation failures and polluted environments, these improvements will not materialize due to high infection pressure.

In spite of the reported TB and HIV positivity in this survey, no form of public health support or preventative programme regarding these diseases was visible in these communities. TB or HIV positive persons or those who are malnourished need clean living environments because of their lowered immunity. The present living conditions in this study add significant infection pressure to the already poor health suffered by these persons. This in turn added to the patient load at the already overburdened and underfunded local health clinics, as well as higher up the referral chain of health services.

The public health measures to tackle TB in these communities were wholly inadequate. The self-reported prevalence of TB was a source of great concern, notably the existence of a case of MDR-TB. The fact that none of these patients, including the case of MDR-TB, was on any TB medication has serious implications for the future management of this potentially preventable disease. None of the TB-positive persons visited the clinic in the preceding two months either, which indicated a serious lack of involvement of the primary health care services in the area.
If one in 1080 dwellers of these low-cost housing communities are already MDR-TB positive, then the City can expect a substantial increase in these difficult-to-treat cases, with a serious knock-on

effect on the already overburdened health care system. The development of MDR may be related to poor compliance with drug treatment, poor treatment drug choices, poor access to primary health care facilities along with patient factors such as poor absorption of drugs and general poor health (Singh, Upshur, Padayatchi, 2007). Many of these factors are at play in these communities and the meticulous execution of TB control programmes in such environments should be a high priority. This need is clearly unmet at present.

Moraes (2005) showed that in three poor communities in Salvador, Brazil the incidence of diarrhoea in children in neighbourhoods with drainage and sewerage was one-third of the incidence in neighbourhoods with neither service (Moraes, *et al*., 2003). They also found that improving community sanitation - even in the absence of hygiene-promoting behaviour - can have an impact on diarrhoeal disease. This is important in the context of the high reporting of diarrhoeal disease among the inhabitants of the low-cost communities in the present study. Thus the effort and money spent on improving the sanitation systems in these communities should improve the diarrhoeal morbidity experienced by these communities. Unfortunately, estimations of the possible impact of improvements seldom include the expected easing of disease burdens as well as the reduction in the patient loads of the primary health services.

This survey only recorded chronic conditions that were diagnosed formally at the clinic and for which the medication could be verified. A major factor influencing the accessibility of primary health care was the inability of some persons needing medical attention to procure transport to the clinic. The cost of using a communal taxi, especially for those with chronic conditions who had to visit the clinic repeatedly, made significant inroads into their household budget.

Many of the inhabitants of low-cost housing communities preferred to treat their ailments using home remedies or traditional medicines. South Africa has many tradition healers who dispense herbal medicines of various origins. Unfortunately the efficacy and safety of some of these medicines are unknown. At worst, such treatment may delay the diagnosis or treatment of serious transmissible conditions such as HIV and TB. This necessitates a need for traditional healers to work in synergy with Western medical treatment to improve the safety and health of inhabitants from low-income areas in South Africa.

Barriers to access to health information and support services include cost, geographic location, illiteracy, disability and capacity to utilize information effectively (Eng, *et al*., 1998; Barnett, 2001). All of these restraints are present in the communities in the present survey and effective ways of bridging these gaps are not in place at present. Delays in obtaining medications were reported to be one of the most common strategies among urban poor in Australia (Barnet, 2001). There are indications that this strategy was also prevalent among the participants in the present study since

most attempted home remedies first. Many of those who should have been on treatment (TB and HIV positive persons) were not. Although the local clinic is within reachable distance for many, cost of transport remains a significant factor for these communities. The barriers resulting in low utilization have not been addressed in these communities.

The low opinion of the perceived quality of care available at the clinics also contributed to the poor utilization of the primary health care available to these communities. Haddad (1998) studied the expectations and criteria that two rural communities in Guinea used to determine quality of service (Haddad, 1998). He found that the criteria depended inter alia on gender and the ability to access the services and that the communities placed considerable emphasis on outcomes of treatment, but little emphasis on preventative services (Haddad, 1998). With such low utilization as reported in the present study and so many barriers to effective primary health care, the local clinics cannot play any meaningful role in addressing the serious health needs of the urban poor in these four communities. Preventative actions by the local clinics that are so sorely needed in these communities with their high HIV and TB burdens as well as the added complications of poverty, substance abuse and hunger will be largely fruitless under the present circumstances and needs to be addressed urgently.

Conclusion

Given the design of these houses and the added pressure on the existing infrastructure by the inhabitants of unplanned housing in the backyard, these results send a powerful message that the existence of unplanned informal housing for the purposes of augmenting income can have a severe detrimental effect on the inhabitants of new low-cost housing schemes. A further negative aspect is the added pressures on the environment and the various services such as primary health care clinics and municipal water and sewerage systems. This informal densification needs to be better managed. Sensible policies to cope with this reality would allow the improved housing schemes to deliver the improved health that was promised at its inception.

The unfortunate separation of the fields of public health and urban planning has contributed to uncoordinated efforts to address the health of urban populations and a general failure to recognize the links between the built environment and health disparities facing low-income populations (Corburn, 2004). A reconnection of these two responsibilities is a prerequisite for successful improvement of the present unsafe and unhealthy conditions prevailing in low-cost housing areas in South Africa. The irony is that these resettlement programs were instituted to improve the living conditions of the urban poor and it is imperative that this improvement be realized.

Acknowledgements

We thank the Harry Crossley Foundation, the German Academic Exchange Service (DAAD), the National Research Foundation and Stellenbosch University for the funding of this project. We are grateful to Sister N. Lethuka for assisting in the administering of the survey and Professor M. Kidd from the Centre for Statistical Consultation at Stellenbosch University for statistical support.

References

Armitage, N.P., Winter, K., Spiegel, A., Kruger, E., 2009. Community-focused greywater management in two informal settlements in South Africa. Water Science Technology 59, 2341-2350.

Bank, L., 2007. The rhythms of the yards: urbanism, backyards and housing policy in South Africa. Journal of Contemporary African studies 25, 205-228.

Barnett, R., 2001. Coping with the costs of primary care? Household and locational variations in the survival strategies of the urban poor. Health and Place 7, 141-157.

Brown, V.J., 2003. Give me Shelter: the global housing crisis. Environmental Health Perspectives 111, A92-A99.

Carden, K., Armitage, N., Winter, K., Sichone, O., Rivett, U., 2008. The management of greywater in the non-sewered areas of South Africa. Urban Water Journal 5, 329-343.

City of Cape Town, Department of Housing. Breaking New Ground, Comprehensive plan for housing delivery. Available from: http://web.wits.ac.za/NR/rdonlyres/CF05F3D4-DFDC-49DD-9776D924A89AB9D7/0/BreakingNewGroundHousingPlanCabinetapprovedversion.pdf

Corburn, J., 2004. Confronting the challenges in reconnecting urban planning and public health. American Journal of Public Health 94, 541-546.

Crankshaw, O., Gilbert, A.G., Morris, A., 2000. Backyard Soweto. International Journal of Urban and Regional Research 24, 841-857.

Eng, T.R., Maxfield. A., Patrick, K., Deering, M.J., Ratzan, S.C., Gustadson, D.H., 1998. Access to health information and Support: A public highway or a private road? Journal of American Medical Association 280, 1371-1375.

Godfrey, L., 2008. Facilitating the improved management of waste in South Africa through a national waste information system. Waste Management 28, 1660-1671.

Godwin, Y., Hudson, D.A., Bloch, C.E., 1997. Shack fires: a consequence of urban migration. Burns 23, 151-153.

Graham, J.P., Corella-Barus, V., Avitia-Diaz, R., Gurian, P., 2005. The in-home environment and household health: A cross-sectional study of informal urban settlements in Northern Mexico. International Journal of Environmental Research and Public health 2, 394-402.

Haddad, S., Fournier, P., Machouf, N., Yatara, F., 1998. What does quality mean to lay people? Community perceptions of primary health care services in Guinea. Social Sciences and Medicine 47, 381-394.

Keraita, B., Drechsel, P., Philip, A., 2003. Influence of urban wastewater on stream water quality and agriculture in and around Kumasi, Ghana. Environment and Urbanization 15, 171-178.

Kidder, D.P., Wolitski, R.J., Campsmith, M.L., Nakamura, G.V., 2007. Health status, health care use, medication use and medication adherence among homeless and housed people living with HIV/AIDS. American Journal of Public Health 97, 2238-2245.

Lemanski, C., 2009. Augmented informality: South Africa's backyard dwellings as a by-product of formal housing policies. Habitat International 33, 472-484.

Moraes, L.R.S., Cancio, J.A., Caincross, S., Huttly, S., 2003. Impact of drainage and sewerage on diarrhoea in poor urban areas in Salvador, Brazil. Transactions of the Royal Society of Tropical Medicine and Hygiene 97, 153-158.

Morange M. Backyard shacks: The relative success of this housing option in Port Elizabeth. Urban Forum. 2002;13:3-25.

Palamuleni, L.G., 2002. Effect 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 27, 845-850.

Parkinson, J., 2003. Drainage and storm water management strategies for low-income urban communities. Environment and Urbanization 15, 115-126.

Rauh, V.A., Landrigan, P.J., Claudio, L., 2008. Housing and Health, Intersection of Poverty and Environmental Exposures. Annals of the New York Academy of Science 1136, 276-288.

Republic of South Africa, Department of Health, 2000. Guidelines for Good Clinical Practice in the Conduct of Clinical Trials in Human Participants in South Africa. Available from: http://www.doh.gov.za/docs/policy/trials/trials_01.html.

Republic of South Africa, Department of Health, 2008. The National HIV and Syphilis Prevalence survey South Africa 2007. Available from: http://www.doh.gov.za/docs/reports/2007/hiv/part1.pdf.

Schertenleib, R., Meyer, W., 1992. Municipal solid waste management in developing countries: problems and issues; need for future research. International Reference Centre for Waste Disposal News 2, 2-9.

Shaw, M., 2004. Housing and Public Health. Annual Review of Public Health 25, 397-418.

Singh, J.A., Upshur, R., Padayatchi, N., 2007. XDR-TB in South Africa: Not time for denial or complacency. PLoS Medicine 4, 19-25.

South African Press Association, 2010. Role-players to brainstorm housing crisis - Sexwale. Cape Times, 23 April 2010, p9.

Thomson, H., Petticrew, M., Morrison, D., 2001. Health effects of housing improvement: systematic review of intervention studies. British Medical Journal 323, 187-190.

World Health Organization, 1989. Health Principles of Housing. Available from: http://whqlibdoc.who.int/publications/1989/9241561270_eng.pdf.

World Medical Association, 2000. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. Available from: http://www4.ensp.fiocruz.br/etica/docs/artigos/Helsinq.pdf.

World Health Organization, 2002. Burden of disease in DALYs by cause, sex and mortality stratum in WHO regions. Available from: http://www.who.int/whr/2003/en/Annex3-en.pdf.

CHAPTER 6

OVERALL CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The studies described in Chapter 5 have generated uniquely novel and valuable information of urban poor communities in South Africa. Very few studies featuring dense low-cost housing settlements with backyard dwellings exist and most of these studies described and focused on the social impact of backyard dwellers in low-cost housing settlements. None of those studies investigated the health and sanitation status of such communities in any detail or generated information on the environmental impact of these inhabitants - which encompasses a large proportion of the urban poor in South Africa.

These communities investigated in the present study were inhabited by many people with unfavourable health status and who lived under conditions of poor hygiene behaviour, high infection pressure and polluted water which constituted a biological hazard to the community. The extent to which these issues were encountered in all four study communities provided a picture of what is in fact a national problem affecting almost all of the state funded housing communities in South Africa.

It is of further concern that these communities represented rehoused persons who have already benefited from governments housing programme and were supposed to have been adequately assisted to improve their living conditions. In actual fact, the present study illustrated that these persons have not to any real extent benefited from the acquisition of a subsidized low-cost house and that these communities remained disadvantaged, polluted and unhealthy. For that reason, the present state-subsidised housing programme may create an impression of improving the lives of previous shack dwellers in informal settlements; while in reality those improvements did not materialize in the areas studied.

South Africa is falling behind in its delivery of housing for the poor. According to figures released by the Minister of Human Settlements in April 2010, the housing backlog has grown from 1.5 million in 1994 to about 2.1 million at present.[1] This means that about 12 million South Africans need better shelter.[1] South Africa has only been able to reduce the housing backlog by about 10% per year over this time.[1] The slow pace of housing delivery as well as the poor living conditions in both the low-cost housing settlements and the informal settlements (shack land) resulted in countrywide civil unrest over the past few years, as inhabitants erupted in street

demonstrations with considerable damage to property and interpersonal violence to protest the lack of service delivery.[2] This precarious situation and risk of future civil unrest on an even larger scale, make it all the more important that the settlements that have been built should function much better than at present. The present conditions in these settlements not only affect those living there - they are seen as an indication of future success by those millions watching the development of housing delivery with increasing frustration.

The phenomenon of backyard shacks arose in response to a critical shortage of housing for the urban poor and as such was not originally prompted by opportunistic exploitation for the sake of rent income.[1,2] There is definitely a critical shortage of housing in urban areas as the extensive waiting lists and the long waiting periods for new houses indicate. The phenomenon of backyard shacks has expanded into an upsurge of informal dwellings occupying as many small spaces behind many urban buildings as can be found, not only in the backyard of low-cost houses. This overexploitation of space cannot be addressed by declaring the trend illegal or by applying existing municipal bylaws to remove them. A new outlook on this phenomenon is needed. These structures need to be viewed as ‘interim shelter’, occupying a halfway stage between urban squatting and the acquisition of a formal house by whatever means. This process however, requires far better planning, management and much better supervision so that the worst of the risks accompanying this informal augmentation of housing may be mitigated with less impact on municipal services.

There are several interlocking findings arising from the present study, all with serious consequences for the health and safety of these settlements and even the wider urban area beyond the borders of these specific communities. The inhabitants of these communities live for the most part in squalid, dirty and poorly maintained homes. Their overall health and poor socioeconomic status make them vulnerable to outbreaks of communicable diseases. The pollution resulting from wastewater and sewage dispersing into the immediate surroundings and consequently reaching the urban rivers in ever increasing loads cause infection pathways that will be hard to control should there be an outbreak of waterborne disease. Such outbreaks have the potential for irrevocable consequences for the whole city and beyond. This cycle of sanitation facilities in disrepair, poor hygiene behaviour and resultant spreading of contamination should be effectively broken as soon as possible. The present blame shifting of responsibilities need to be rechanneled into constructive action by a concerted effort of all stakeholders. Not finding a solution for the looming crisis of infection risk is not an option any longer.

6.2 Recommendations emanating from the study

The major long-term solutions reside in the field of urban planning, municipal infrastructure and even politics, since politics is the ultimate driving force behind budgeting.

6.2.1 Community health aspects

Various aspects addressed in this study are cross-cutting issues that have implications for various role-players and organizations. Some of these issues are therefore discussed under more than one set of recommendations.

6.2.1.1 Poverty-related issues

The present rapid rate of urbanisation, together with the inadequate pace of delivery and steady population growth, suggests that overcoming the present backlog of houses may take decades.[2] Large numbers of local rural people as well as immigrants from other African countries flock to South African cities and towns, with no clear strategy for survival once they arrive there.[2] This phenomenon should be better studied and documented. The City of Cape Town needs to know in more detail where these persons who arrive in the city to settle there come from, what made them uproot and relocate, and what their needs are. A holistic planning strategy for rehousing poorly housed persons needs much more extensive and reliable data in order to be effective. Such studies are therefore recommended.

The present study looked at the effect on one particular city as a 'net receiving destination' for in-migrants. It should be borne in mind however, that most of these in-migrants left a rural area behind where the population is steadily decreasing. Depopulation of rural areas has its own negative effects and is not in the interests of stability. Rural areas are mainly agrarian or agricultural regions and South Africa's food security rests in the hands of these rural inhabitants. Rural development, to retain a new generation of inhabitants engaged in agriculture (for instance) is urgently needed and should be taken into account by economic policies. But policy amendments are not enough. At present there are no effective or clear plans or actions to effectively drive the policies that already exist. This needs to be addressed as a matter of urgency.

With so many in-migrants flocking into the City, improved needs assessments are essential to establish who should be helped as a matter of priority. The present housing lists have been severely criticised for being open to dishonesty and fraud, and for being prone to favouritism. The

present study has found some evidence of this as 5% of owners of formal subsidised houses were from other African countries which are against the regulations of the BNG/RDP plan. Furthermore, those who obtained houses waited for a mean of 6 years, while inhabitants living in backyard shacks and who have not been able to obtain a house as yet, have already waited for a mean of 7.1 years. A further 60% of those living in backyard shacks have not even applied to join the housing list because they did not know how to or did not have faith that the government will be able to deliver a house for them. The system or process for obtaining a house needs to be overhauled and depoliticised as well as the lists purged of persons who do not meet the requirements.

At present the allocation of new houses to families on the housing list is supposed to be done in order of those waiting the longest. Such persons will have been living in one of a large number of shack-land communities spread across the city. These new owners of low-cost houses in any particular new settlement suddenly find themselves living side-by-side with 'strangers.' It takes a long time to build a sense of community and a sense of being partly responsible for the wellbeing of those who share their living space. Manifestations of alienation such as high rates of vandalism and asocial behaviour noted in these communities are among others related to this lack of social cohesion in the settlements. Consideration should be given to upgrading entire shack-land communities, rather than selecting persons from an arbitrary list. This is already attempted in some parts of the City, but should receive much more support from Government funding structures so that this pattern of development becomes the model of choice.

The City is faced with the results of the asocial behaviour of these inhabitants and urgently needs effective steps to prevent further degradation of the areas and its infrastructure. On the other hand, the inhabitants urgently need improved living conditions. Attempts on a much larger scale than at present should be made to mediate between the two sets of interest groups - at present they are divided between 'us' and 'them.' Negotiations between municipal structures and inhabitants are marked by considerable distrust, political interference and negotiations in 'bad faith'. This has resulted in many agreements being violated by one or both sides even before some of the initiatives could get off the ground. Vandalism, political suspicion-mongering and local power struggles can only be curbed in the long run when local authorities adopts an even-handed and patently transparent negotiation style, while consulting as widely as possible. Prompt communication of decisions and the reasons for those actions are essential. This has not always been the case in the past.

The slow pace of delivery of housing settlements contributes to the acute housing shortage.[2] New approaches are urgently required. Other models utilising alternative building styles, building materials other than cement bricks, models with more owner participation in the erection of the

house, and so forth, are all alternative initiatives that deserve more intensive investigations and funding support. There are not enough integrated drives to consider the best option for each piece of land earmarked for housing development and the funding models from central government do not present or allow much flexibility in this regard.

6.2.1.2 Issues affecting health status

Poverty is a powerful mediator of the quality of life of human beings. Poverty is simultaneously a cause of ill-health through poor diet, poor access to health care and the effect of living in squalid living conditions, because today's ill-health leads to deepening poverty tomorrow. The health status of the inhabitants of the settlements investigated in the present study bears testimony to a subpopulation of persons facing considerable health risks. There are many families unable to afford three meals a day, the occurrence of diarrhoea indicate the contributing risks posed by contaminated environments, while the analysis of surface water in the settlements indicate extensive sewage pollution. All these factors on their own would have constituted a health risk to the inhabitants, but together they create a high-risk environment putting pressure on the health of those who face these conditions every day.

Urgent attention should to be given to more comprehensive poverty alleviation strategies. While job creation and employment strategies fall outside this dissertation, the improved nutrition and health care resulting from improved income will certainly help improve the health status of these inhabitants. Poverty alleviation in itself will also allow inhabitants to take control over their quality of life.

The demographic attributes of the present study population point to some important social needs affecting health. The population includes a large proportion of children and young adults - 43% of the study population was aged 20 years or younger, with 31% of families were classified as single parent “female-headed” households. In all age groups above 10 years of age, there were more females than males. Many young persons in these communities therefore do not have a role model of the same gender living at home.

In all four communities combined, 47.3% of households received one or other form of social grant. This is an indication of welfare dependency of the members of these communities and it increases the overall contribution needed from the national fiscus to establish and maintain such housing settlements. The poorly educated youth of these communities is vulnerable in their turn to falling into the poverty trap - not being able to break the cycle of poverty. These young people require special social assistance and education to enable them to take charge of their own lives. At present no such programmes were encountered in any of these communities.

The large number of households reporting one or more cases of diarrhoea over the preceding two weeks was an indication of the contributing role of unhygienic conditions in these settlements. Improving this situation will require a well-coordinated plan of action.

1. Repairs and maintenance to the formal sewerage system and repairs to broken or blocked infrastructure inside the houses necessitate urgent attention. The repair of actual houses is not the jurisdiction of the City since these houses are now privately owned. It is however very clear that the system of handing over a new house to persons unskilled in home maintenance is not successful. New home owners need to be educated and trained in basic home maintenance as well as home hygiene and safe disposal of waste prior to taking possession of a subsidised house. Furthermore, some system of maintaining some conditional jurisdiction over the home (not signing off ownership completely for a little while) can help to inspire new owners to attain ownership by demonstrating their ability to maintain the home before being allowed to take full ownership. This window period can be utilised to help the new owners to acquire the necessary skills to repair their homes with materials more appropriate for the job than e.g. softened soap.

2. Any improvement in home hygiene and waste disposal will help to reduce the prevalence of diarrhoea in these communities. A system of sustained education of inhabitants e.g. in the use of oral hydration therapy will assist in reducing the number of seriously affected cases of diarrhoea. Much of this education can be carried out by community-based volunteers.

Education programmes need to be sustained over a long period, otherwise the relapse into old and unhelpful ways will simply overtake all progress made. These education programmes should be done collaboratively with the community. Community participation in disease control programs is a process that is affected by four factors: the political background of the country, the community characteristics, the managerial capacity of the provider and the epidemiology of the disease.[3] Community-based workers, either volunteers or part-time employees, are needed to keep the programme operational. Without community-based health care ‘advisors’ or community workers who can keep an eye on the situation regarding cleanliness and disease status in the community, no lasting improvements will be seen. These community workers should ideally be recruited from the communities they serve. With rudimentary training they can fulfil a useful function to bridge the gap between the health needs of the inhabitants and the City health services. Such a service will need some administrative support, but could be maintained at a relatively low cost. Such services do not at present exist in any of the low-income areas.

The reported incidence of HIV/AIDS cases in the present study are based on those willing to admit to their status. Due to the stigma attached to this disease, this was almost certainly an

undercount, especially when compared with the available prevalence from similar settlements elsewhere in the city.[4,5] There were also significant proportions of the inhabitants who have never been tested for HIV. There are three aspects of this problem that deserve serious attention:

1. The lack of any form of antiretroviral treatment for those who admitted their positive status is of great concern for the general health of these affected persons as well as for their increased life expectancy. The existing programmes for rolling out ART have not reached any of these communities and need to do so without delay.

2. No community-based education programmes or any form of official programme to manage HIV/AIDS in the community was encountered. This reflects a serious lack of involvement at community level to reduce the impact of a disease that has turned into one of South Africa's major killers.

3. HIV positive persons have impaired immune systems and dirty and polluted home environments pose serious risks to them. On the other hand, they also secrete large numbers of pathogens into the environment when they become infected. Thus the cleanliness of their environment and their own sanitation behaviour has a huge impact on their wellbeing and health. The present situations in these settlements pose serious risks to these people - another reason why improved home hygiene is of paramount importance.

Even keeping in mind the underreporting in our study, two out of every three HIV positive persons were TB positive as well. In addition, one case of MDR-TB was reported. The overcrowding, damp walls and frequent water leaks from overflowing or broken systems all constitute risk factors for further spread of TB. No person on anti-TB treatment was encountered in the study. This is as serious an omission as the lack of community-based programmes discussed for HIV/AIDS above.

Poverty may be the root cause of the large number of households who eat fewer than three meals a day. State-funded supplementation of food supplies is a short-term support strategy, but will almost certainly be unsustainable in the long run. The space occupied by backyard dwellings could also have been used for food gardens, but this competes with the extra income generated by the rent paid for these shacks. This is a dilemma faced by the owners of main houses. Almost half of these families already receive one or other form of social grant. It seems as if the most urgent need for these families is to receive help in deciding on budget priorities e.g. for spending their social grant on necessities such as food. This could be another responsibility for the suggested community health workers

The use of addictive substances impacts on the health and wellbeing of these communities in many ways beyond the obvious. The flourishing but illegal trade in these substances has led to a 'gang' culture and resultant social breakdown in many communities (as reported in interviews by the inhabitants). The members of the community addicted to these substances also present with predictable health problems as well as social disintegration of their personal lives. A factor sometimes overlooked, is the impact of widespread use of these substances (even if not to the level of addiction) on the total household budget, given that the incomes of these households are so low. By way of illustration, there were 15.5% of households with a total monthly income below R600 in the present study which is the equivalent of 2.5 cardboard containers with 200 cigarettes each (cost about R235 or US$31 per cardboard container).

6.2.1.3 Behavioural issues

There were widespread signs of inappropriate household hygiene and sanitation behaviour observed qualitatively in the present study. Even actions that do not require incurring any costs, such as cleaning the toilet regularly were done in a desultory fashion (34% was cleaned once a week and 18% only "sometimes"). The stench of dirty toilets permeated most homes and the inhabitants reported having to keep the toilet door shut because it smelled so bad. The inhabitants of the houses seemed to lack awareness of the connection between the unpleasant smell and irregular cleaning.

There was extremely poor provision of essential cleaning materials at both the toilet and at household tap and in the so-called kitchen area. In most cases there was no soap or any form of cloth to wipe hands at the tap and no paper to use as wipes at the toilet. In some cases newspaper was provided at the toilet but such paper tended to block the sewage system fairly quickly. These instances are quoted as an illustration of inappropriate behaviour that could be ameliorated with the aid of community workers with a low level of training, but who knew their communities well and enjoyed some standing among their people.

Inappropriate disposal practices of household rubbish and wastewater presented the same situation as discussed under the previous paragraphs. The disposal of household wastewater by flushing it down the toilet has particularly serious implications for a city where periodic droughts cause the enforcement of water restrictions. Using purified potable water to dispose of household wastewater cannot be sustained on as large a scale as happens in these communities since the water supplies of the City.

There was a marked discrepancy between the reality observed in these homes and the knowledge of the inhabitants regarding risk behaviour. The vast majority of homes had dirty,

smelly or poorly functioning toilets lacking cleaning materials, yet 99% of respondents said that one can get sick from using a dirty toilet. The same percentage admitted that one can get sick from living in an unclean home, yet during the physical inspection the cleanliness of 72% of bathrooms was noted as poor. This confirms that the knowledge of safe hygiene possessed by the inhabitants did not influence their behaviour to the good. This discrepancy gap needs to be bridged by not only disseminating the correct knowledge but by home visits to observe that such knowledge is applied. A community health nurse would have the authority and standing in the community to carry out such home visits, especially in cases where illnesses such as diarrhoea have been reported. Using such cases of illness as a tactful opportunity for encouraging better hygiene practices averts any taint of 'inspection of premises' and enforced cleaning, which may only serve to aggravate the situation. At present very few community health nurses are employed in the low-income areas of Cape Town and they all cover huge areas, making home visits few and far between.

Many home owners display poor knowledge of simple repairs that would over the long term contribute to keeping the dwelling in a better condition. An example of such poor practices is the reparation of holes in the roof or wide cracks in the walls by filling them with softened bar soap. The walls were streaked white in these homes from dissolved soap running down the inner surfaces the next time it rains. Better techniques of repair with affordable alternative materials should be demonstrated to the inhabitants, while protecting the integrity of the walls from penetrating damp.

Another technique that resorts under this category is changing worn washers on taps so as to stop taps from dripping or even running continuously, reducing the wastage of water. For extremely indigent homeowners the City authorities may have to consider establishing a programme to assist the owners with the acquisition of repair materials in order to keep the homes and sanitation systems repaired. Since almost nobody paid for water, few inhabitants of these communities exhibited a sense of responsibility regarding water saving.

6.2.1.4 Design of Home Infrastructure

The design of the houses in the present study varied, but all the houses were very small in relation to the number of occupants (27m^2 to 42m^2 in total). All main houses had only one toilet and most had only one tap. Only one settlement (Tafelsig) had three taps on the premises, but these homes did not score any better on the assessment of cleanliness of the bathroom or dwelling. The single tap in most homes lead to unhygienic practices, such as washing bodies, food and utensils at the same tap - creating a risk of transmission of disease pathogens. This risk was especially hazardous in those homes containing individuals suffering from HIV/AIDS or TB.

In most settlements there was no access to a drain on the plot that was connected to the municipal sewerage system. The motivation behind this was because of the widespread habit of disposal of unwanted waste (even such things as old vehicle batteries, dead animals and motor oil) by discarding it down the drain, which resulted in widespread blockages and even damage to the system. A major effort at compromise is needed here and this can only be reached by patient and transparent negotiations between these communities and the city authorities. Whatever the upshot of these negotiations, the key to successful long-term solutions will be some or other form of *enhancement of compliance* with the agreement.

Discarding household wastewater containing soap onto tarred streets softens and eventually erodes the permanent tar surface, resulting in potholes and poor road surfaces. This is very much a feature of all the settlements in the present study. This is another behaviour that needs addressing, perhaps by means of the suggested community health workers.

A useful tool, in the form of a 'housing guide' designed in the language of the inhabitants with proper illustrations may be distributed to the new home-owners, especially when the drain or toilet is clogged. Such a guide will be very useful to the community health workers in their efforts to educate the inhabitants. This will also ensure that the inhabitants have a reference guide to assist them on what to do and not to do when taking up occupancy of the home. In a study in Kayamandi in 2001 Barnes (2003) found after 18 months that 97% of the community still had the illustrated pamphlet on display in their homes.[6]

6.2.1.5 Service delivery issues

The densification of the settlements in the study resulting from the increase in the number of dwellings on each plot had serious implications for the delivery of municipal services.[5] The toilet in each main house, intended to be used by four or at most five persons, now had to cope with up to 13 persons living on the same plot, excluding visitors from nearby houses with broken toilets. This contributed to the excessive wear and tear on the toilet, leading to more frequent breakages or blockages.

The increase in roof area resulted in increased storm water run-off during rain episodes. The storm water drainage systems were originally designed with only the impermeable surface associated with the main houses in mind. The excess storm water during normal rain events caused flooding in these settlements. Standing pools of water (both from storm water and from discarded wastewater or leaking drains) were observed gathering at the house foundations and contributed to the damp conditions and sometimes also eroded some of the foundation structures due to soil collapse.

Serious consideration should be given to improving the waste management systems in these settlements. This is a comprehensive requirement encompassing frequent removal of solid waste since these plots are overcrowded, more frequent inspection and clearing of blocked drains and some system of inspection of storm water drains to clear blockages, especially before the rainy season. The inhabitants need to be informed of who to contact when municipal drains are blocked and overflowing and they need some encouragement to do so. In this they can be assisted by the community health workers who circulate in the settlement during the day.

Recycling of reclaimable waste materials should be investigated for these communities, instead of only concentrating on more upmarket areas as is the present case. There is a high volume of waste generated in these settlements and recycling may help to reduce the environmental pollution, illegal dumping as well as the high cost of disposal of the solid waste.

The present poor habits regarding the disposal of solid waste have resulted in a high frequency of complaints regarding vectors such as rats, cockroaches, flies and mosquitoes. All these vectors can potentially carry diseases and enhance the risk of outbreaks that may erupt with very little warning. The diarrhoea prevalence is already so high that it serves as a warning that the situation may lend itself to the fast spread of other diseases.

The number of households paying for water (beyond the use of the allotted number of free litres per person under the scheme for indigent use of free water) is distressingly small. Only 7% of the households living in main houses actually pay the municipality for this essential resource. There are costs involved in getting water to all communities (apart from the actual water delivered). Maintaining this service and the infrastructure needed for this essential service becomes increasingly unsustainable when additional users refuse to pay at least a portion of their share of the costs. These huge losses are difficult to reconcile with improved service delivery, because municipalities are hampered by their lack of finances to improve services.

Electricity was supplied to all households by means of prepaid meters, thus the City received payment for electricity used. Illegal electrical connections to backyard shacks made of flimsy materials however posed increased fire risks. The numerous fires in settlements in Cape Town add to the municipal costs and pose a severe hazard to the inhabitants.

6.2.1.6 Health care matters

Very few illnesses reported in the present study were diagnosed at the available primary health care facilities in these communities. Many of the signs and symptoms reported were treated by home remedies. Although this is to be expected in a poor community where transport to a clinic

can be a strain on the household budget, this situation remains of concern. Home treatment may delay diagnosis of serious health conditions to a point where effective treatment may become much more costly or invasive. Apart from the burden of disease imposed on the sufferers, this adds to the cost of health care in these communities.

The access to primary health care needs to be improved in these communities so that not so many households resort to home remedies which may be ineffective or delay diagnosis unduly. It should be kept in mind during planning of such services that the existence of backyard dwellers increases the need for services to levels above that of the formally housed population alone. At present the capacity of the clinics in these settlements do not take formal account of the backyard dwellers, resulting in high demands for services. These clinics need extra resources and staff, as well as better levels of applied management to cope with the demand.

There were numerous instances where patients were on chronic medication for conditions that they were unaware of or could not identify. There is an urgent need for the primary health care centres making such diagnoses and issuing chronic medication to inform patients accordingly. For instance, patients need to be informed in the language that they can understand that insulin should be stored in the refrigerator at all times, not only when opened for use.

Inhabitants with a number of conditions need to access health care on a regular basis, especially those on chronic medication (particularly TB and HIV positive persons) or those who are in poor general health. In some cases such persons could walk to the nearest primary health care facility, but in many cases some transport by means of communal taxi was needed. The cost involved in such transport made such access difficult for some. It is of real concern that no HIV or TB positive persons actually visited their local clinics during the preceding two months, neither were any of them on any appropriate treatment. This needs to be addressed by the city health authorities on an urgent basis.

The study did not enquire into the nature of home remedies used to treat common complaints. Some of these home treatments were probably traditional medicines. This warrants further research to investigate whether these treatments are harmful, or whether they are effective enough. Regardless of the source or the reasons they are used, ineffective treatment waste the user's time and money and may delay crucial diagnosis and treatment.

There were no signs of the primary health care services involved in any preventative health promotion or any outreach programmes in the community. Health care services in these communities were entirely one way - those who reached the clinics in time and were lucky enough to be in the front of the queue received treatment. The rest did not receive care on that

particular occasion. Service quality and user-friendliness of these services need investigation so that the available services reach those who need it most. There was a high level of complaints regarding the availability and quality of the primary health care services noted during the study. When services are delivered in an unfriendly manner, the battle to improve the health of these communities will be much more difficult.

6.2.1.7 Policy aspects

Progress with the delivery of sustainable low-cost housing to the poor in South Africa has been slow and uneven, leaving millions of impoverished people without adequate shelter and living in a polluted environment without basic amenities - as was demonstrated in the present study. It is clear that progress in the quality as well as quantity of houses delivered cannot be accelerated without scaling up efforts to integrate the various policy aspects involved in this huge undertaking. At present there is a disconnect between the five major disciplines involved in delivery of quality low-cost housing for the poor, namely the fields of housing, health, civil engineering, urban planning and environmental sciences. A much more sustained focus is needed on the *integration* of these disciplines so that housing provision can benefit those who need these houses, but at the same time do not create severe health issues, municipal service delivery problems, sanitation failures as well as long-term environmental pollution.

It is suggested that a national action plan be drafted to oversee more and better financing of low-cost housing, robust accountability of the whole process from design to delivery and a renewed focus on areas that are the furthest behind or with the highest needs. Part of this action plan should contain an oversight structure to integrate the various laws and policies guiding low-cost urban housing provision. Co-operation should be established between all government structures (including the Department of Health, who is often side-lined in planning of this nature), the private sector and civil society. A “Housing Council” with senior representation of the five previously mentioned disciplines should have the powers to integrate the various actions so that the present fragmentation causing so many undesirable and unintended consequences can be averted. A strong emphasis on the monitoring and evaluation of the whole process, from inception to delivery, should be a strong focus of this body. The results of this monitoring and evaluation programme should be fed back into the planning cycle of all the role players involved in the delivery of low-cost housing. This does not happen at present.

The monitoring and evaluation of the many housing schemes and areas already in place should be repeated at suggested five year intervals so that the long-term problems that only manifest after a number of years are not overlooked. Another issue that has been seriously neglected is the oversight of sound financial management during planning and building of these housing

projects. In some cases the poor building quality only manifested after some time and these are missed if no long-term monitoring is carried out.

There is an urgent need for various municipal service delivery centres and organisations to co-operate in order to establish an integrated approach to provide better services to the urban poor. Amongst others, proper investigations are needed to determine the existing risk areas requiring additional resources so that rational planning may be applied to utilise scarce resources optimally. At present the political process of decision-making regarding service delivery priorities is not optimal. There is no ring-fencing of municipal funds and the central government has little control over the spending of grants allocated to improve local services. A collaborative partnership between non-governmental sector (such as social housing organizations) and the Department of Human Settlements should be fostered. Social housing organizations can assist with home education campaigns and oversee the transition between moving from an informal dwelling to a formal house, especially during the first two years of ownership.

6.3 Lessons from the experience

The present approach to the crisis of low-cost housing needs in South Africa is not sustainable when viewed from a community health perspective. In order to fulfil the demand, formal housing settlements developed into augmented housing due to the proliferation of informal shacks in the back yard. The densification of a state-funded housing development, intended to improve the lives of those newly rehoused cancelled out many of the expected improvements in health and quality of life.

The information arising from the housing and health surveys in the present study, together with the dwelling inspection quantified and described ‘communities at risk’ in these dense settlements and provided a bleak picture of overcrowding, poverty, lack of education, poor sanitary practices leading to a high incidence of diarrhoea, inadequate TB control and ill health, in addition to pollution of the environment. The *E.coli* levels found in environmental water samples provided a ‘community-wide diagnosis’ of serious infection risk that warrants comprehensive intervention. Rehousing impoverished urban slum dwellers in subsidised low-cost housing schemes without considering the need for education in the upkeep of their new home and home hygiene – which is essential for maintaining the health of the household - virtually created new slum areas with much of the attendant problems of their previous life.

“It is science alone that can solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people...Who indeed could afford to ignore science today? At every turn we have to seek its aid.”

- Jawaharlal Nehru[7]

6.4 References

1. South African Press Association. Role-players to brainstorm housing crisis - Sexwale. Cape Times, 23 April 2010. p 9.

2. Huchzermeyer M, Karam A. The continuing challenge of informal settlements: An introduction. In, Huchzermeyer, M. and Karam, A. (eds.) *Informal Settlements – A Perpetual Challenge?* Cape Town: Juta/University of Cape Town Press; 2006. pp. 318.

3. Bermejo A, Bekui A. Community Participation in Disease control. Social Science Medicine. 1993;9:1145-1150.

4. Medecins Sans Frontieres. International Activity Report 2010. [online] 2011 [cited on 20 July 2011]. Available from: http://www.doctorswithoutborders.org/publications/ar/report.cfm?id=5376.

5. City of Cape Town. HIV, AIDS and TB Plan 2010/2011. [online] undated [cited on 19 July 2011]. Available from: http://www.capetown.gov.za/en/IDP/Statutory%20plans%202011%20%202012/AnnexureH_City_Health_HIV_AIDS_TB_Plan_2010_2011.pdf.

6. Barnes JM. The impact of water pollution from formal and informal urban developments along the Plankenbrug River on water quality and health risk. [Dissertation]. Stellenbosch: University of Stellenbosch; 2003.

7. Nehru J. Atma Ram, the Making of Optical Glass in India: Its Lessons for Industrial Development, Proceedings of the National Institute of Sciences of India. 1961;27**:**564-5.

ADDENDUM

APPENDIX A: Health Evaluation Questionnaire

Good day Sir / Madam

My name is Sister Lethuka. You are invited to take part in a research project carried out by the Medical Faculty of the University of Stellenbosch. We are going to be studying your health and home. Note that your participation in the study is voluntary and you may opt to leave the interview at any time. All answers and comments will be kept highly confidential. We will not record your name and we promise that no information you give us will be attached to you or anyone living in your home. Please do not hesitate to ask any questions that you may have with this study.

Section 1: Biographical Details

1.1 Please provide us with the following information, so that we can learn more about your family.

Code of Person	Role in Household	Age	Is this person disabled?		How long has the person Lived in this house (years)	Sex		Status of individual	Educational Status:
			Yes	No		Male	Female	U – Unemployed F – Full time employed P – Part time employed IRR – Irregular employment S – Scholar C – Child at home A – Adult at home	A – No schooling B – Pre-primary to grade 4 C – Grade 5 to grade 7 D – Grade 8 to grade 10 E – Grade 9 to grade 12 F – Tertiary level U – Unsure
A1									
A2									
A3									
A4									
A5									
A6									

1.2 Are members of the household

Mark the person's choice **(✓)**

South African Citizens	Yes	
	No	
If no, what is your country of citizenship		
And for how long have you lived in South Africa		

1.3 Have there been any deaths among the persons living in the house in the past 6 months and if possible please specify the cause? Mark the person's choice **(✓)**

Yes		Specify:
No		

Section 2: Disease and health services

2.1 During the past two weeks, are there symptoms that affected you or persons living in your house?

Symptom	Code of person / persons with symptom										Home treatment (✓)	Visited clinic / Doctor (✓)	Is the person still suffering from the symptom (Y/N)
Diarrhoea													
Fever													
Nausea													
Vomiting													
Cramps / Abdominal pain													
Blood in stools or vomit													
Worms in faeces													
Body / hand sores													
Eye infection													
Coughing													
Shortness of breath													
Tiredness & weakness of body													
Coughing blood													
Loss of appetite & weight													
Night sweats													
Headaches													
Nits / Lice													
Yellow looking skin													
White of eyes are yellow													
Itchy skin													
Coughing for more than 1 week													
Other:													

2.2 Have any members of your household visited the clinic and/or doctor in the past two months and been diagnosed with an illness/disease?

Code of the person	Illness/disease	Was medicine given for the illness? (Y/N)	Is the illness cured? (Y/N)	Have you or any member in your household suffered from the illness before? (Y/N)

2.3 Are any members of the household on chronic medication? Mark the person's choice **(✓)**

Yes	
No	
If yes, specify for what illness	

**** Note to interviewer: If the answer is yes, ask to see the medication.*

2.4 Do you think that people in your household suffer from the following diseases at the moment? *(Optional)*

Mark the person's choice **(✓)**

	Yes	No	Unsure
TB			
HIV/AIDS			

2.5 What are some of the other health problems facing your household?

1.	2.	3.
4.	5.	6.

2.6 Do members of your household take part in using the following substances?

Mark the person's choice **(✓)**

	Cigarettes	**Alcohol**	**Drugs**
Yes			
No			
Unsure			

2.7 What is the name of the clinic that members of your household visit when ill?

_____

2.8 How do you get to the clinic?

Mark the person's choice **(✓)**

Walk	
Taxi	
Bus	
Private transport	
Other, specify:	

2.9 What does a return trip to the clinic cost (if you need to pay)? R ____, __

2.10 Has there ever been a time when you or a family member needed to visit the clinic, but did not have the money to pay for transport?

Mark the person's choice **(✓)**

Yes	
No	
Unsure	

2.11 Are you satisfied with the services provided by the clinic?

Mark the person's choice **(✓)**

Yes	
No	
Unsure	

2.12 Do you think that private health facilities provide better services than your clinic?

Mark the person's choice **(✓)**

Yes	
No	
Unsure	

2.13 Have you or members of your household ever called for an ambulance?

Mark the person's choice **(✓)**

Yes	
No	
Unsure	

2.14 Usually, how many meals does your family eat per day?
Ring the person's choice 1 2 3 4 5 6 7 8

Section 3: Hygiene and the environment

3.1 Do you think that you can get sick from the following?
Mark the person's choice **(✓)**

Using a dirty toilet	Yes	No	Unsure
An unclean home	Yes	No	Unsure
Dirt and rubbish in your yard or the street	Yes	No	Unsure
Drinking dirty water	Yes	No	Unsure
Drinking water from rivers and streams	Yes	No	Unsure

3.2 Is it difficult to keep your home clean?
Mark the person's choice **(✓)**

Yes	
No	
Unsure	

3.3 Do you find it expensive to purchase cleaning material for your home?
Mark the person's choice **(✓)**

Yes	
No	
Unsure	

3.4 Have you or any member of your household been a victim of crime in the past six months?
Mark the person's choice **(✓)**

Yes	
No	
Unsure	

3.5 Can you mention some of the crime committed in your community?

1.	2.	3.

3.6 Are there safe places to play for the children in your household?
Mark the person's choice **(✓)**

Yes	
No	
Unsure	

Notes:

_____

_____

_____

Thank you for taking the time to answer our questions. Again, any information provided by yourself during the interview will be kept confidential. Your participation in the study is highly appreciated.

Date of interview:	
Time of interview:	
Street Name and House number (This information will be kept strictly confidential)	
	Classify: **Main house** or **Shack**
	Suburb: 1 2 3 4

APPENDIX B: Housing Evaluation Questionnaire

My name is Thashlin Govender. You are invited to take part in a research project carried out by the Medical Faculty of the University of Stellenbosch. We are studying your health and home. Please note that your participation in the study is voluntary. All answers and comments will be kept highly confidential. We would appreciate it if you could allow us to ask you some questions about your home and have a look at the structure of your house. We will not need your name and we promise that no information you give us will be attached to you or anyone living in your home. Please do not hesitate to ask any questions that you may have regarding this study.

Section 1: Household information

1.1 What is the total income of the household living in the dwelling per month?

Mark the correct one **(✓)**

Less than R600 per month	
R600 to R1 200 per month	
R1200 to R2500 per month	
More than R2500 per month	
Unsure	

1.2 What is the dwelling used for?

Mark the correct one **(✓)**

Main household accommodation	
Additional household accommodation	
Rented out accommodation	
Business premises	
Storage room	
Garage	
Other:	
Other:	

1.3 Who owns this home?

_____

1.4 Does he/she stay here?

Mark the correct one **(✓)**

Yes	
No	
Unsure	

1.5 If you rent the home, how much do you pay per month?

R _____, __

1.6 Where did you stay prior to moving to this settlement?

1.7 **Backyard dwellers only:** Have you applied to join the housing list? If yes, how long have you been waiting for a house?

Mark the correct one **(✓)**		**On waiting list for:**
Yes		_____ years
No		_____ months
Unsure		

1.8 **RDP house only:** Did you get this home by joining the housing list? If yes, how long ago did you receive this home?

Mark the correct one **(✓)**		**When did you receive the home?**
Yes		_____ years
No		_____ months
Unsure		

1.9 Who pays for the repairs of this home?

_____

1.10 Can you afford the repairs of the home?

Mark the correct one **(✓)**	
Yes	
No	
Unsure	

1.11 Do you pay for water to drink and clean your home and if yes, who do you pay?

Mark the correct one **(✓)**	**Yes**	**No**	**Unsure**	**Recipient of payment:**
Drink				
Clean your home				

1.12 Do you pay for electricity and if yes, who do you pay?

Mark the correct one **(✓)**		
Yes		Recipient of payment:
No		
Unsure		

1.13 Do you (or somebody in your home) receive a social grant?

Mark the correct one **(✓)**	
Yes	
No	
Unsure	

Section 2: Toilet facilities

2.1Where is the toilet for the persons living in this house?

Mark the correct one **(✓)**	**Primary**	**Secondary**
Toilet inside the house		
Toilet outside the house, but on the same property		
Communal toilet away from the dwelling		
No toilet available within easy walking distance		
If no toilet is available, what do the inhabitants use?		

2.2What sort of toilet is it?

Mark the correct one **(✓)**	
Flush toilet	
Longdrop (pit latrine)	
Bucket system	
Other, specify:	

2.3 Does your toilet break or is it blocked often?

Mark the correct one **(✓)**	
Yes	
No	
Unsure	
Not applicable	

2.4Where do the members of the household dispose of soiled products, e.g. sewage, soiled nappies?

Please mark ✓=Yes, **X**=No

In the street		Outside bin	
Into the storm water drain		If other, specify:	
Rubbish skip			

2.5 If the toilet is away from the dwelling, how far do the inhabitants have to walk to get to the toilet?

Distance: [ ] paces

2.6 Do you know who to contact if there is a drain blocked or overflowing? If yes, specify.

Mark the correct one **(✓)**	
Yes	
No	
Unsure	

2.7 Who would you tell if there is a drain blocked and overflowing?

1.	2.

2.8 What will happen if rubbish is thrown into the toilet?

Mark the correct one **(✓)**

Nothing	
It will block the toilet and the pipes	
Don't know	

2.9 Can you get sick from not washing your hands after you used the toilet?

Mark the correct one **(✓)**

Yes	
No	
Unsure	

2.10 How often is your toilet cleaned?

Mark the correct one **(✓)**

Once a day	
Twice a week	
Once a week	
Sometimes	
Unsure	

2.11 What are the cleaning materials used to clean the toilet?

Please mark ✓=Yes, **X**=No

Disinfectant	
Soap	
Detergent	
Toilet brush	
Cloth	

2.12 Do you pay to use the toilet?

Mark the correct one **(✓)**

Yes	
No	
Unsure	

Section 3: Washing and other water use

3.1 Is there a working tap available?

Mark the correct one **(✓)**

Inside the house	
On the property	
Nearby (not on property)	

3.2 Are there facilities nearby to wash your hands after using the toilet?

Mark the correct one **(✓)**

Yes	
No	
Unsure	

3.3 Where are your clothes washed?

_____

3.4 What happens to the water used to wash your clothes?

3.5 When water is used to wash and prepare food, what happens to that water?

3.6 Where do the persons living in the house wash themselves?

3.7 What happens to the wash water?

Section 4: Solid waste

4.1 Where does the household dispose of its rubbish?

Please mark ✓=Yes, **X**=No

In a rubbish bin inside the house	
At the skip outside on the street	
Throw it on the street	
Other	

If "Other", please specify: .....
.....
.....

Section 5: Vector identification

5.1 Have you found any rats, mice or cockroaches in your home?

Mark the correct one **(✓)**

Yes	
No	
Unsure	
If yes, specify the type of animal	a)
	b)
	c)

Thank you for taking the time to answer our questions. Again, any information provided by yourself during the interview will be kept confidential. Your participation in the study is highly appreciated.

Date of interview:	
Time of interview:	
Street Name and House number (This information will be kept strictly confidential)	
	Classify: **Main house** or **Shack**
	Suburb: 1 2 3 4
Survey Number:	

APPENDIX C: Dwelling Checklist

Survey Number:					
		Ring the appropriate answer			**Comments**
1	Type of dwelling	Main dwelling	Shack in backyard	Other	
2	Is the house neatly maintained?	Poor	Fair	Good	
3	Are the outside walls of the home painted?	Yes	No		
4	Are the inside walls of the home painted?				
5	Are there cracks on the wall?	Yes	No		
6	Does the house have electricity?	Yes	No		
7	Is the roof of the house leaking?				
8	Is the door well fitted?	Yes	No		
9	Does the house have any broken windows?	Yes	No		
10	Is the bathroom clean?	Poor	Fair	Good	
11	Is the toilet in working order?	Yes	No		
12	Is the toilet leaking?	Yes	No		
13	Is the tap leaking?	Yes	No		
14	Is there toilet paper in the bathroom?	Yes	No		
15	Is there soap available in the bathroom to wash hands?	Yes	No		
16	Is there a clean towel or paper towels available in the bathroom?	Yes	No		
17	Is the drain clean?	Poor	Fair	Good	
18	Is the roof leaking?	Yes	No		
19	Are there any structural damages to the home?	Yes	No		
20	Are there any structural alterations or extensions to the home?	Yes	No		
21	What is the state of the yard outside the home?	Poor	Fair	Good	
22	Is there a bin inside the home?	Yes	No		
23	Is there a bin outside the home?	Yes	No		
24	Is there a garden outside the home?	Yes	No		
25	Is rubbish evident outside the home?	Yes	No		
26	Are there pools of water outside the home?	Yes	No		
27	Is there broken glass evident outside the home?	Yes	No		
28	Does the family own pets/animals?	Yes	No		
29	Does the home have electricity? And if yes, is it legal or illegal?	Yes	No	Legal	Illegal
30	Is there evidence of other forms of heating/lighting?	Yes	No		
31	Does the home have an operational refrigerator?	Yes	No		
32	Does the home have an operational stove?	Yes	No		

APPENDIX D: Participant Information Leaflet and Consent Form

TITLE OF THE RESEARCH PROJECT:

A study on the health and sanitation status of specific low cost housing communities as contrasted with those occupying 'backyard dwellings' in the City of Cape Town, South Africa

REFERENCE NUMBER: N09-08-214/215/216

PRINCIPAL INVESTIGATOR: Thashlin Govender, PhD Candidate, Division of Community Health, Department of Interdisciplinary Health Sciences, Faculty of Health Science, Tygerberg Campus, Stellenbosch University

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

This study will take place in the settlements of Masipumelela in Kommetjie, Greenfields in Strand, Tafelsig in Mitchells Plain and Driftsands in Sikhumbule. A total of 50 homes with a plot number will be randomly selected to take part in the study. The reason for us doing the study is to investigate the health of the people in your community and the water use and sanitation in your home. There are two parts to the study that we need your assistance with. Firstly, we will ask you questions about your home and your water use and sanitation. For this part of the survey we will also take a look around your home. You may accompany us during this part of the survey. Secondly, a nurse will ask you some questions about the health of your family. These surveys will be done for your home alone. We will be taking down your address, but we will not be taking

down any names of you and your family in the interview. This is done so that no one will be able to identify from whom the information was obtained and who is sick or who became ill in your home. This consent form will not be attached to your answer sheet, so that again no one will be able to find out that this information was provided by you. Once you have completed this consent form, this form will be placed in a sealed box together with all the other forms from your community, for safety purposes. A report of the findings from the study will be sent to your ward councilor, and we will try to make the information available in a community newspaper. We will also send a report to the City of Cape Town offices, so that they know about the living conditions in your community and the problems that you and your community are faced with. You can contact Dr J.M Barnes at 021-9389480 if you have any questions or problems or would like to know the results of this study. You may also contact the Committee for Human Research at Stellenbosch University at 021-938 9207 if you have any concerns or complaints. You will receive a copy of this information and consent form for your own records.

Why have you been invited to participate?

You have been selected by chance so that the information we gather is a fair representation of your community. We want to investigate the health status of you and your family and the living conditions in and around your environment.

What will your responsibilities be?

To please answer the questions as best as you can.

Will you benefit from taking part in this research?

The results from this study will be summarised and provided to the local, provincial and national government in order to improve planning for housing and health. The results will help us understand the needs of your community and environment.

Are there any risks involved in your taking part in this research?

There are no risks involved in taking part in the study. And we assure you of your anonymity.

If you do not agree to take part, what alternatives do you have?

You have a right to not take part or stop the interview; and there will be no implications if this is your decision.

Declaration by participant

By signing below, I ……..…….. agree to take part in a research study entitled, **A study on the health and sanitation status of specific low cost housing communities as contrasted with those occupying 'backyard dwellings' in the City of Cape Town, South Africa.**

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- I have given permission to take and use pictures of my home and family members for publication purposes.

Signed at (*place*) .....…..…….. on (*date*) ……...…….. 2009.

....

Signature of participant **Signature of witness**

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....…….....…….. on (*date*) ……...…….. 2009.

....

Signature of investigator **Signature of witness**

Declaration by interpreter

I *(name)* ……..…… declare that:

- I assisted the investigator (*name*) ……. to explain the information in this document to (*name of participant*) ……..…….. using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) .....…….....…….. on (*date*) ……...……..

....

Signature of interpreter **Signature of witness**

Appendix E: Photographs from study areas

1. Illustrations of various backyard shacks

Figure 1: A shack attached to a low-cost house in Masipumelela

Figure 2: Backyard shacks in Driftsands – waterlogged after brief rain spell

Figure 3: Adjoining shacks in the Greenfields settlement obscuring municipal reticulation systems

Figure 4: Makeshift shack structure in Tafelsig. Note the flimsy building materials

Figure 5: Virtually no space between shacks on adjacent plots – which are against municipal building codes. Note the tap on the left hand side wall with no drain to receive dirty water. Solid waste distributed on premises on the left

2. Structural problems in low-cost houses

Figure 6: Visible dampness on walls in kitchen area of main house

Figure 7: Dampness penetrating bedroom wall with infant sleeping on bed

Figure 8: Design of the main house is inappropriate for the terrain. Access to this house difficult is for the young, the aged and the physically challenged

Figure 9: Leaking roof structure inappropriately fixed with soft soap

Figure 10: Illegal electrical connection to backyard shacks – potential fire and electrocution risk

Figure 11: An example of structural damage – seriously cracked wall of main house

3. Sanitary infrastructure

Figure 12: An example of a dirty toilet and wet walls in Driftsands

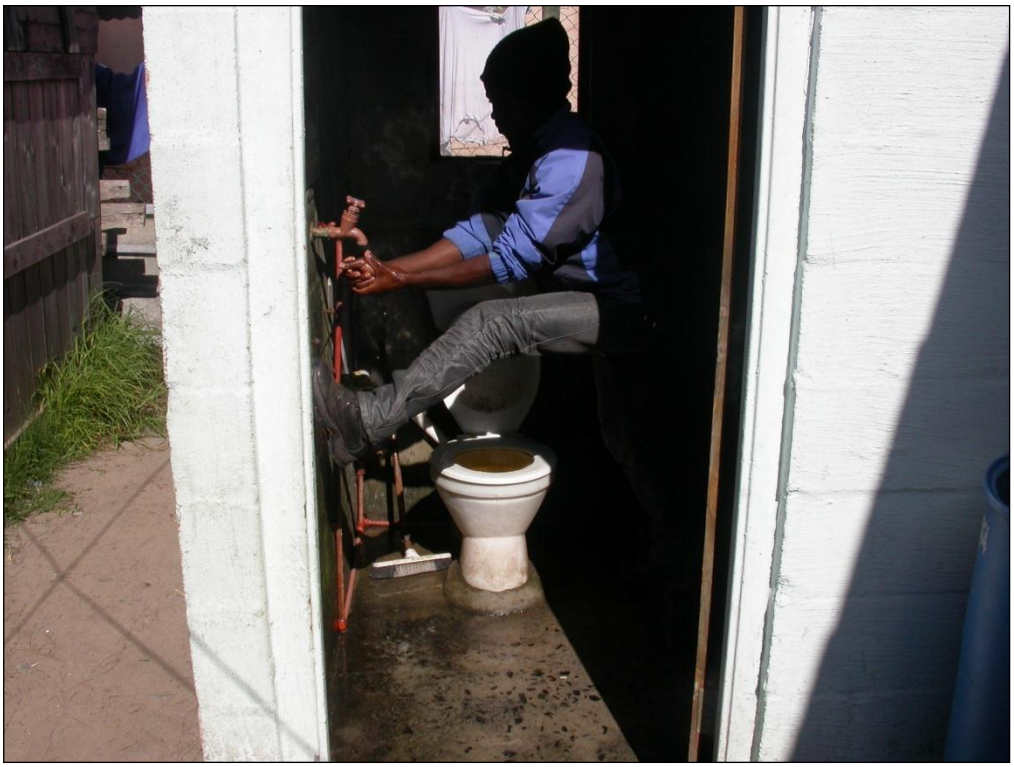

Figure 13: Tap in toilet with no access to drain to receive dirty water. User forced to perch over toilet to avoid getting his feet wet while using the tap. Toilet area is permanently wet as a result

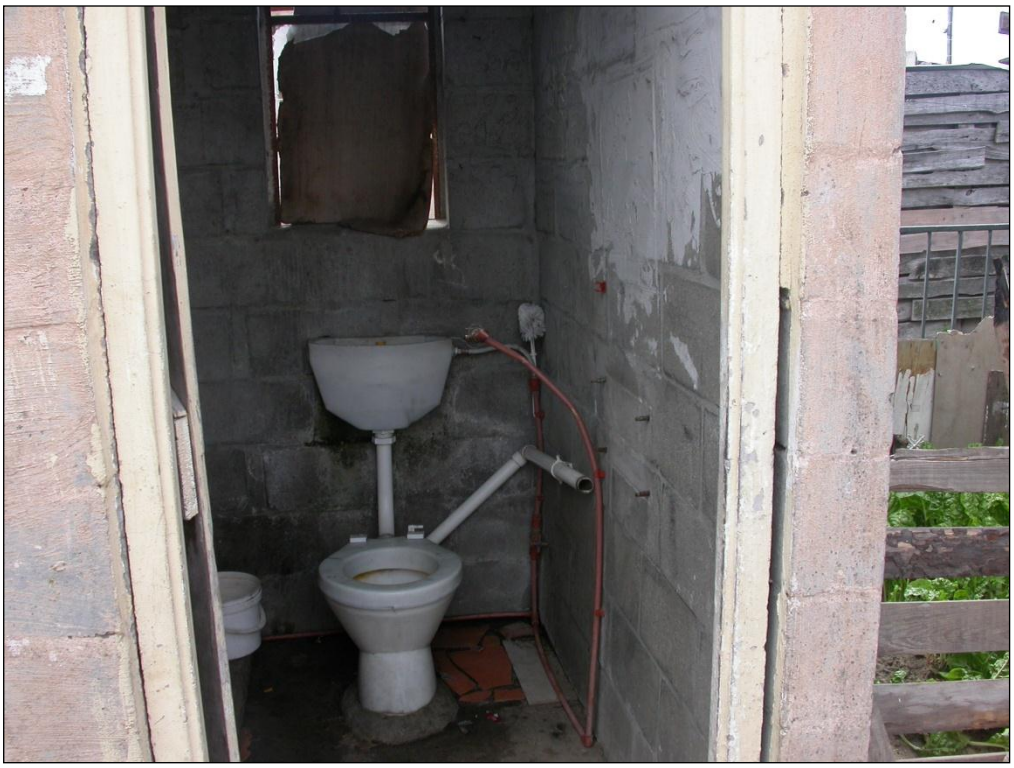

Figure 14: Tap against the wall on right is either lost or removed. Note the broken pipe and cistern, as well as the broken window which has been repaired with cardboard

Figure 15: Flushing mechanism on this toilet is broken. Users flush toilet by manually manipulating the mechanism inside the system. Note that the toilet is dirty

Figure 16: An example of a blocked toilet in Masipumelela. Note the newspaper used as wipes

Figure 17: Toilet used as storage area in Tafelsig

4. Kitchen and bathroom area

Figure 18: An example of a kitchen set-up in Tafelsig

Figure 19: An example of a kitchen area in Greenfields. Note the rudimentary facilities and dirty wall. This is the only working tap in the main house

Figure 20: An example of the bathroom area in the Tafelsig settlement. There is only cold water provided. This unrepaired tap leaks permanently

5. Condition of the yard and environment

Figure 21: An example of water draining out of the toilet area and standing in the yard in Driftsands

Figure 22: Solid waste littering at the entrance to shack in Masipumelela. Door leading to backyard shack – unable to keep out dust, water or vermin

Figure 23: An example of a blocked outside drain in Tafelsig

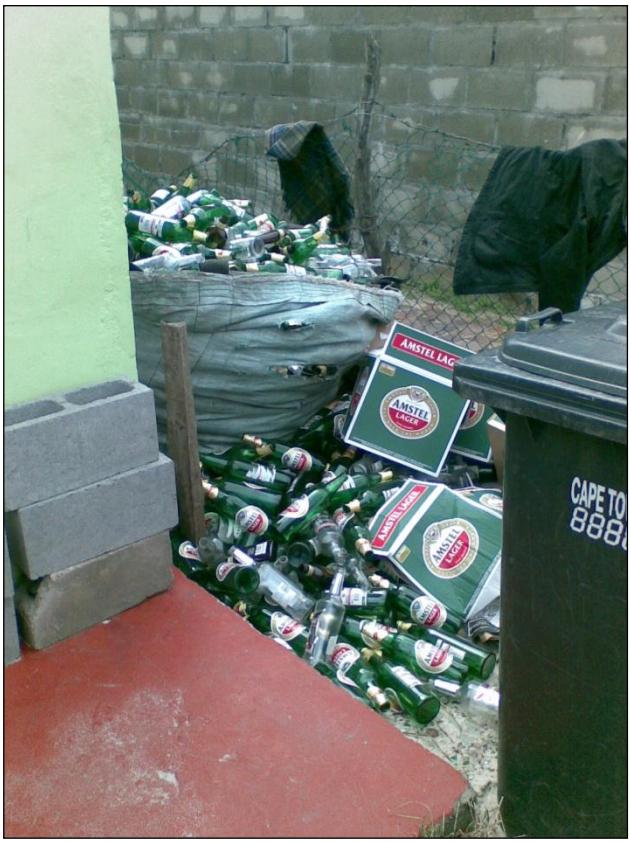

Figure 24: Evidence of heavy alcohol use of inhabitants living in this house - adding to the volume of solid waste generated by the Driftsands community

Figure 25: Solid waste blocking the storm water inlet on street causing subsequent flooding during rain storms in Tafelsig

6. Environmental water pollution

Figure 26: Faecally polluted drainage water running into storm water inlet in Masipumelela. Therefore the abundant growth of grass due to the fertilizer effect of polluted water. This growth also invades the storm water system causing further blockage

Figure 27: Wastewater running down a street in Driftsands. This water carries large amounts of sand into the storm water system causing further blockage

Figure 28: An example of smelly and polluted water puddling away from the storm water drain in Greenfields

Figure 29: Wastewater running down the street in Greenfields. The woman doing her washing on the side walk is adding to the polluted water stream