



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

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A B S T R A C T

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This paper provides an assessment on the structural living conditions of selected government-subsidized 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 backyard. 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.

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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 (Lawrence, 2004). Populations with less disposable income have fewer choices and are liable to end up in poor housing (Howden-Chapman, Isaacs, Crane, & Chapman, 1996). 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 (Chaudhuri, 2004).

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 (Chaudhuri, 2004). Prolonged poor maintenance of houses leads to dilapidated buildings – leaking pipes, peeling paint or cracks and holes in ceilings. Buildings in 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 (Lehmann et al., 2001; Rauh, Chew, & Garfinkel, 2002). Housing disrepair among the poor exposes them disproportionately to lead, pests, air pollutants, contaminants and greater social risks (Rauh et al., 2002; Sharfstein, Sandel, Kahn, & Bauchner, 2001).

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 (Hemson, 2004). Recently, the RDP was replaced by the Breaking New Ground (BNG) programme (City of Cape Town, Department of

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Housing, 2004). 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 (Lizarralde & Massyn, 2008). With the rising need for adequate housing and the availability of space in the backyards of new housing settlements, backyard dwellings (informal housing) sprung up across all the new improved housing settlements (Crankshaw, Gilbert, & Morris, 2000). 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 (Lemanski, 2009). 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 (South African Institute of Race Relations, 2008), representing 5.7% of all South African households (Statistics South Africa, 2006). 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 (South African Institute of Race Relations, 2008). The aim of this paper is to provide an assessment on the structural living conditions of selected government-subsidized 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 (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, 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 3 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 4 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 backyard (referred to as 'shack' from this point forward) (Figs. 1–5). 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



Fig. 1. A shack attached to a low-cost house in Masipumelela.



Fig. 2. Backyard shacks in Driftsands – waterlogged after brief rain spell.

by a qualified registered nurse who spoke all 3 languages prevalent in the area. All dwellings on a selected plot (formal house and informal dwellings in the backyard) 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.



Fig. 3. Adjoining shacks in the Greenfields settlement obscuring municipal reticulation systems.



Fig. 4. Makeshift shack structure in Masipumelela. Note the flimsy building materials.

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



Fig. 5. Virtually no space between shacks on adjacent plots in Greenfields – which are against municipal building codes. Note the tap on the left hand side wall with no drain to receive dirty water.

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 1). 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 and R60 000 (about US\$4666–US\$8000).

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 and R1200 (US\$80–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 m² and 2.0 persons per 10 m² in backyard shacks (Chi-square test, *p* value < 0.01).

Design of low-cost houses

In 3 of the 4 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

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 ^a	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

^a Zimbabwe, Botswana, Mozambique, Namibia, Tanzania and Zambia.

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

‘kitchen area’ (Table 2). All main houses were constructed of cement blocks and were unplastered.

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.

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 1 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

Table 3
Housing quality indices of main houses.

Independent variable	Number (<i>n</i> = 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

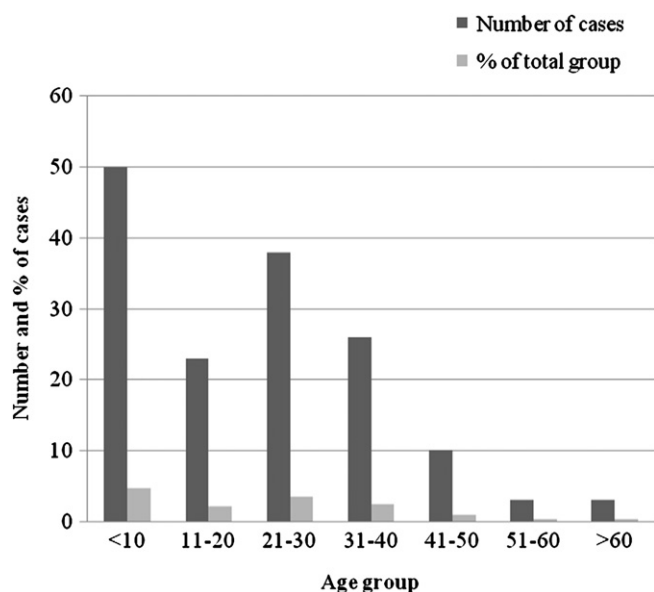


Fig. 6. Diarrhoeal cases classified into age groups.

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 (Table 3). 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 (38%) persons reported suffering from one or more attacks of diarrhoea (Fig. 6).

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 persons in the survey was diagnosed with TB after a visit to their local clinic (Table 4).

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 backyard, which are rented out for income (Watson, 2009). 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 (Carp, 1975). 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 (Rauh et al., 2002; Sharfstein et al., 2001). 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

Table 4
Health aspects of households in survey.

Dwellings affected	Main house	%	Shack	%	Total group	%	p-Value	Odds ratio (95% CI)
Diarrhoea	70	40	38	23	108	32	<0.01	1.16 (0.82–1.66)
TB	24	14	14	9	38	11	<0.01	1.12 (0.57–2.20)
HIV positive	8	4.62	10	6.13	18	5.35	0.68	3.45 (1.51–7.89)

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. Cash poor populations have fewer choices in housing and are liable to end up in poor housing (Howden-Chapman et al., 1996). These homes tend to have exorbitant housing expenditures, which worsens their incidence of poverty after housing costs were subtracted (Stephen, 1994). 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 (Chaudhuri, 2004). 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 (Lehmann et al., 2001; Rauh et al., 2002).

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 (Abegunde, Mathers, Adam, Ortegón, & Strong, 2007). Research undertaken by Goebel (2007) suggests 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.”

Lewin, Norman, Nannan, Thomas, and Bradshaw (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 (Lewin et al., 2007). 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 2 of the 4 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 (Nath, 2003).

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 (Darbyshire, 1995; Singh, Upshur, & Padayatchi, 2007). 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 (WHO, 2006). 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 (Zignol et al., 2006). In South Africa at least 60% of TB patients are estimated to be infected with HIV (WHO, 2006). 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 (Joubert, Stewart, & Eberhard, 2003). 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 (Kilian, Fiehn, Ball, & Howells, 2005).

Promulgating more laws to prohibit shacks in the backyard 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 (Lemanski, 2009).

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 (Dannenberg et al., 2003). 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.

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