

### 3. Emptying, transport and disposal

Those most directly vulnerable during the emptying and transport phases of the service chain are the faecal sludge collectors and tanker operators. Households and communities are often indirectly vulnerable in their immediate locality as a result of poor quality practices of the collectors and operators.

The SPLASH studies have reinforced the fact that there exists extremely limited, if any, effective treatment of wastewater or faecal sludge within the cities. The final stage of the service chain is typically a disposal site (mostly informal and some formal), or a non-functioning treatment site.

The study in Cameroon specifically considered the challenges facing collectors of faecal sludge from on-site sanitation systems. Three characteristics of vulnerability facing emptiers during the emptying and transport stages of the sanitation service chain were identified; legislative, health and financial vulnerability.

#### Lack of regulated operations: Legislative vulnerability

In Yaoundé and Douala, many emptiers are unregistered as the mechanism to issue permits for registered operations is not effectively implemented. Even if tanker operators wanted to formally employ staff, there is little incentive to do so whilst they operate as an informal service. An association of operators has never been sustainable, leaving them with no representation at the city administration level to actively participate in decisions that affect their business. Whilst the legislation requiring registration exists, operators remain vulnerable to the city authority deciding to enact the legislation without an adequate compliance notice period. Individual operators and their employees could find themselves out of work if they fail to register in time and are forced to cease operations.

#### No physical protection: Health vulnerability

Emptiers of on-site sanitation systems are at significant risk from not only the faecal waste that accumulates in pits, vaults and septic tanks, but also from a range of domestic, commercial and industrial waste products that are also disposed of in the same on-site systems. Emptiers rarely receive training in understanding what the health risks are or how to minimize them, whilst working with equipment that is old and prone to breakdowns.

- An in-situ analysis of the characteristics of sludge removed from on-site latrines in Yaoundé and Douala found that it contained many potentially harmful items in addition to faecal sludge, including; oils and detergents, broken bottles, batteries, metal, syringes, pharmaceutical products, chemical and industrial pollutants. Employees of the truck operators reported awareness of the risks from working closely with faecal sludge and the range of other waste products mixed in with it, but they are neither provided with, nor use, protective equipment.

#### No job security: Financial vulnerability

Those who carry out the emptying activities do not usually have contracts with the tanker operators who use their services, neither do they have health insurance or any form of social security. The informal nature of their employment is a primary indicator of financial and social vulnerability. Workers who are injured or become ill as a result of the work do not receive employment-based healthcare and will have no income whilst unable to work.

#### Indirect vulnerability to households and communities: Public health vulnerability

Households who employ the services of emptiers can be vulnerable to the impact of poor quality emptying and transport operations, if this results in faecal waste being disposed of at, or close to living areas, water supplies, urban agriculture and public spaces. Communities more generally can also be put at risk from poorly managed operations, especially those living along the transport routes of faecal sludge trucks, or near to sites where faecal waste is discharged into the environment.

- The faecal sludge disposal site in Douala, Cameroon has been in use since 2005. As a mangrove swamp it is designated as a “green zone” and therefore illegal to build on, but over 900 families now live within 300m of the site. Due to poor management, much of the mangrove swamp has been destroyed, resulting in high levels of faecal contamination of surface water and soils in the area. Contamination levels are further exacerbated by tankers dumping faecal sludge along the road itself, or into the river

at the site entrance when the access road becomes impassable during the rainy season. The river is a source of fishing and therefore either food or income for nearby villagers. Analysis of river water quality found high levels of helminth egg contamination. A household survey found that 89% of households living around the disposal site had experienced sickness in the preceding two weeks, with women and children the most affected. The morbidity rate was found to be double that of households living in a flood-prone area of the city (MAFADY, 2014).

Residents who have no part in the creation of contaminated wastewater and live away from sanitation services can become indirectly affected as a result of poor “end-of-pipe” disposal created by an incomplete infrastructure network. Contamination can end up being transported beyond urban areas to those living on the city boundary, transferred to those who have to live with the consequences of untreated downstream disposal. In the absence of a properly functioning and complete infrastructure network, securing demand for alternative uses of wastewater and faecal sludge has the potential to lessen the volumes of untreated faecally contaminated waste currently entering into the environment.

- Initiated by the FaME study, ongoing tests in Kampala, Uganda indicate that dried faecal sludge may offer a financially and technically viable alternative fuel source for the brick-making industry in the city. Demand for dried faecal sludge has the potential to reduce environmental contamination from dumped faecal waste, by generating greater demand for faecal sludge emptying and transportation services that reliably transport faecal waste to treatment sites. Increased demand could in turn drive competition between emptying service providers and hence raise the standard of services while reducing fees to service users.

### Key references

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The briefing notes in this series each focus on one of the key thematic areas that has emerged as a result of the research conducted under the SPLASH Sanitation Research Programme. These are;

- 1) Enabling environment;
- 2) Demand creation;
- 3) Vulnerability;
- 4) City wide planning.

Further details on the work from each project can be found at: [www.splash-era.net](http://www.splash-era.net)

Projects and cities (countries) where research took place:

- 3K-SAN:** Lead organisation – University of Surrey, Robens Centre for Public and Environmental Health, UK  
Kampala (Uganda), Kigali (Rwanda), Kisumu (Kenya)
- CLASS-A:** Lead organisation – International Water Association (IWA), the Netherlands  
Maputo (Mozambique)
- FaME:** Lead organisation – Swiss Aquatic Research Institute, Department of Water and Sanitation in Developing Countries (SANDEC), Switzerland  
Dakar (Senegal), Accra (Ghana), Kampala (Uganda)
- MAFADY:** Lead organisation – Ecole Nationale Supérieure Polytechnique de Yaoundé, Cameroon  
Douala and Yaoundé (Cameroon)
- U-ACT:** Lead organisation – Swiss Federal Institute of Technology Zurich, Centre for Development and Cooperation, Switzerland  
Kampala (Uganda)

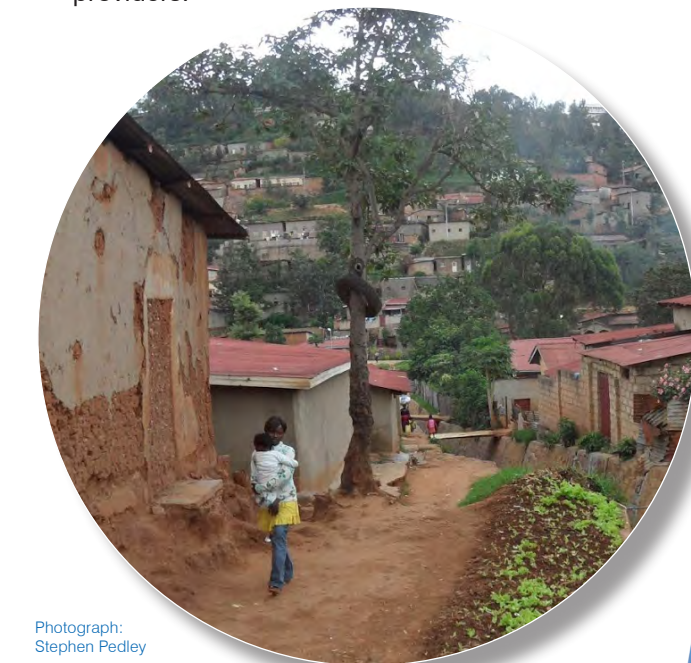


## SPLASH Urban Sanitation Research Programme Briefing Note 3

# Understanding and addressing vulnerability in the sanitation service chain

### Headline findings

- Vulnerability can be related to a number of characteristics affecting sanitation services: legislation, physical environment, social dynamics, family and personal health, wider public health, access to finance, and levels of knowledge and awareness. Where multiple characteristics exist, vulnerability increases and the ability to absorb external shocks decreases: these in turn can lead to a vicious circle of service deprivation.
- Vulnerability affects both sanitation service users and service providers: service users are predominantly vulnerable within the containment and storage stages of the sanitation service chain, while service providers are vulnerable during the emptying, transport and disposal stages. All stages need strategies that address the specific characteristics and vulnerabilities.
- Overcoming vulnerability may require trade-offs, at least in the short term, in an effort to overcome apparently insurmountable challenges and incrementally improve sanitation services. Tenure security is an example, where landlords need to be targeted with specific initiatives to encourage investment in facilities, whereas tenants need initiatives that protect them from legal risks.
- Demand and willingness to pay for improved sanitation facilities and services by poorer households are higher than might be expected. Poorer households are potentially active contributors to initiatives, when appropriate support is provided. Establishing mechanisms for household-level access to finance, such as through savings and credit schemes, is a way to enable their participation.
- Indigenous knowledge about the health risks associated with certain sanitation-related practices can be identified through the use of community workshops and local stakeholder assessments. Peer-based consultation that allows reflection on how ‘other people’s behaviours’ affects individual health generated rich information.
- Demand for improved wastewater and faecal sludge treatment options, driven by the revenue generation potential at the end of the service chain, may offer a basis to improve services. Greater demand for treated faecal sludge could act as the catalyst for increased coverage, efficiency and quality of services, which in turn reduces vulnerability for service providers and service users.
- Through increasing our understanding of vulnerability in relation to sanitation provision, it is possible to identify incremental improvements that reduce vulnerability for both service users and service providers.



Photograph:  
Stephen Pedley

Photograph:  
Rebecca Scott



## 1. Vulnerability and sanitation services for the urban poor

Vulnerability can be characterised and defined in different ways: for the purpose of this briefing note, it encompasses the idea that individuals and households can be negatively affected by events relating to the sanitation service chain as a result of their specific circumstances.

SPLASH research has identified how different characteristics of vulnerability influence the extent to which sanitation services are effective and why achieving good service provision is so important, particularly for the urban poor. The vulnerabilities, both influencing and influenced by sanitation services, can be grouped into those that are 'external' and those that are 'internal' to the individual or household, as summarised in Box 1.

Much of the research addressing issues of sanitation services in high density, informal urban areas focuses on the physical and financial constraints facing both service users and the service providers.

More recently, there has been greater attention given to understanding the social and legal constraints affecting levels of service provision for the urban poor, such as weak or non-existent tenancy agreements restricting investment in improved infrastructure or services (Scott, 2011).

SPLASH studies have identified how household demand and safe use of sanitation facilities and emptying services is influenced by a range of vulnerabilities – from the ability to pay for infrastructure and services, to social cohesion affecting their functionality.

### Box 1: Typologies of vulnerability

Vulnerabilities *external* to the individual or household;

- Legislative vulnerability: e.g. lack of tenure security, lack of sector coordination
- Physical vulnerability: e.g. poor infrastructure planning, lack of access for services
- Social vulnerability: e.g. lack of community cohesion

Vulnerabilities *internal* to the individual household;

- Health and Public Health vulnerability: e.g. risky behaviours (personal and of others) increasing disease risk
- Financial vulnerability: e.g. ability to pay for services, security of income
- Knowledge vulnerability: e.g. limited technical knowledge or awareness of health risks

*The internal vulnerabilities in particular can be exacerbated by additional factors such as; disability, chronic illness, single parent- elderly- or child-headed households.*

**Physical constraints** include the lack of space for on-site latrines, unplanned areas making sewer construction extremely challenging, difficult terrain such as steep slopes, flood-prone areas and narrow or un-paved access. All make it harder to construct sanitation facilities in the first place and for on-site systems to have access for emptying services. This in turn restricts the number of emptying trucks that can operate viably and the extent to which treatment facilities can accept and process waste.

**Financial constraints** include the limited willingness or ability of users to pay for infrastructure and services, or of the service providers to charge for sewerage or emptying services. Financial viability is also exacerbated by the high operation and maintenance costs of equipment and treatment processes, as well as the limited skills and availability of operators and technicians.

## 2. Capture and storage

Householders are most directly affected by the quality of construction and level of service offered by the containment and storage stages of the sanitation service chain. They are also influenced by the extent to which emptying and transport arrangements (sewered or non-sewered) can match the requirements for keeping sanitation facilities functioning safely.

### Lack of secure tenure and land titles: Legislative vulnerability

Lack of secure tenure is known to be a significant constraint to tenants having access to adequate sanitation services. Relying on landlords to provide facilities leaves tenants vulnerable to poor service levels. Landlords typically prefer to invest in more profitable rent-generating buildings than latrines; tenants are not allowed to build permanent structures on a landlord's property even if they are willing to make the investment.

- Research in Kampala, Uganda found that housing ownership and property rights were the strongest determinants for the presence of an improved latrine in the home. Only 5% of tenants surveyed had access to an improved, private latrine compared to 39% of owner occupiers. No other household characteristic was found to have such a high correlation with latrine ownership.

While the Ugandan Public Health Act requires landlords in Kampala to provide 'sufficient sanitary facilities' for tenants, the act is not effectively enforced. Tenants are

vulnerable to the will of their landlord and have little recourse to protection provided for in the legislation while it remains ineffective. Studies in Cameroon, Rwanda and Kenya also highlighted an additional level of vulnerability for tenants when a landlord does not own the land title on which their property is built. Security of tenure is needed both for the land titles and the property on it.

A recommendation of the 3K-SAN project is that the Human Right to Sanitation is explicitly recognised and implemented as a way to improve access to services for the most vulnerable, including those living in areas informally. The Right implies the expectation that everyone should eventually receive sanitation services that fulfil criteria relating to accessibility, affordability, quality and quantity. However, a key challenge in realising the Human Right to Sanitation relates to tenure status and informal occupancy of land. A significant number of urban dwellers currently lie outside normal jurisdiction and as such have limited recourse to action if their right is deemed to have been denied.

### Community cohesion: Social vulnerability

There is much debate around the extent to which 'community' exists in informal urban settlements. Social fragmentation is considered to be more significant and a reason for greater social vulnerability resulting from less sense of 'community', or having a 'network of support' in the urban context (Völker *et al*, 2007). This can exacerbate, for example, the extent to which shared and public latrine blocks are hygienic, compared to privately owned facilities.

- Poor levels of toilet cleanliness in Kampala and Kisumu were found to result from the difficulty of managing a shared resource in areas where there is little community cohesion or sense of shared responsibility.



Photograph: CLASS-A

- Without access to a private latrine, many urban residents are vulnerable to problems associated with the prevalence of poorly-managed shared or public latrine blocks. A detailed assessment by U-ACT of the state of both shared and public latrines in Kampala found that they are generally less hygienic and people may be forced to resort to open defecation when latrines are not accessible or safe to use, especially at night. The U-ACT study did however find that shared latrines are better maintained if shared by no more than four families.

### Risky health and hygiene behaviour: Health vulnerability

When access to a range of public services, such as sanitation, drainage and solid waste disposal are not available, people find solutions for themselves. This often results in solid and liquid waste being disposed of close to the home. The research in Cameroon by MAFADY found that the majority of households in Yaoundé and Douala dump solid waste and wastewater into their surroundings and are not aware of the dangers this can create. In addition to faecal waste from households, there are often additional risks from disposal of commercial and industrial waste (e.g. piggeries and garages) in the same areas. In parts of Yaoundé, wastewater flows over ground before eventually reaching lower-lying settlements near the rivers, which are populated by slum dwellers.

The risk of contracting faecal-oral diseases in areas where waste is not safely managed is high. The risk assessment tool applied in Maputo, Mozambique by CLASS-A adopts an extended F-diagram as a tool for conducting a rapid participatory sanitation system risk assessment (RPSSRA). The tool specifically includes vulnerability (or susceptibility to disease) as one of the three core elements for assessing risk, together with elements of hazardous events and the extent of contact between the hazard and citizens (exposure).

### Ability to pay for services: Financial vulnerability

One of the main challenges highlighted by the 3K-SAN, U-ACT and MAFADY studies is the high cost of constructing sanitation facilities, or paying for the associated pit emptying services of on-site systems. Certain activities and services can incur high charges, up to several times the average monthly family income and households in urban areas are typically dependent on irregular cash incomes (Wratten, 1995).

- In Cameroon, the poorest households have to spend at least 70% of their average monthly family income to construct even a very basic latrine (MAFADY, 2014). Residents of slum settlements and flood-prone areas have been found to be willing to pay



Photograph: 3K-SAN

the greatest contribution of their income to improve their latrine, but need significant financial support mechanisms to be in a position to construct an improved latrine.

- Accruing debts to pay for goods and services is a high-risk strategy for the poorest households, as high levels of debt can worsen vulnerability over the long term, rather than improve it. Research in Kampala, Kigali and Kisumu has shown that the availability of finance, be it formal, semi-formal or informal, is one of the key enablers of demand creation for latrine ownership and use at the household level. A national programme to support the use of bank accounts by the poorest people in Kigali, Rwanda is demonstrating a positive, long term solution to this type of vulnerability.

### Limited technical knowledge: Knowledge vulnerability

Limited knowledge of options and risks relating to the construction of household facilities can influence decisions made within households, as well as by the service providers supporting households. With no certification of technicians or builders and poorly regulated building standards, poor practices and their ensuing risks can continue unabated.

### Box 2: The Rapid Participatory Sanitation System Risk Assessment Tool

In the RPSSRA tool, people's vulnerability to diseases accounts for how prone people are to exposure (influenced by their activities – such as washing clothes in open drains, or the frequency of hazardous events – such as unsafe emptying of latrine pits), and their physical resistance (influenced by age, for example). Contextual factors defined by the local environment are found to influence exposure, such as population density. The tool helps to quantify risk and then map these risks to locations across the city, highlighting the 'hot spots' where specific interventions would be required to reduce the health risks.



Photograph: CLASS-A

- In Cameroon, unlined latrine pits are routinely dug down to the water table and within close proximity to wells, risking contamination of groundwater that is used for domestic purposes. Households often discharge grey water into latrines, further increasing contamination risk. Householders' knowledge of these risks has been found to be very limited, leaving them unable to ensure that facilities are being safely constructed.

- A lack of knowledge amongst the building community was identified in all of the cities studied, with lower quality of construction placing households in a very vulnerable position. Collapsing latrines can act as a disincentive to construct a replacement, forcing people to resort to other unsafe sanitation practices.

Identifying indigenous knowledge as part of the assessment and decision-making process when planning to improve sanitation facilities and services can support, or indeed contradict, previously held pre-conceptions and assumptions made by decision-makers. A consultation stage helps to identify the type of knowledge people already have about their sanitation systems, as the basis for designing and implementing educational or awareness raising programmes.

- The risk assessment tool developed in Mozambique sought to address knowledge vulnerability by identifying and making use of indigenous knowledge, through community workshops. These facilitated workshops provided a means for indigenous knowledge about practices and risks within households and communities to be reported to those working at the municipal and local government levels. Workshops provide a mechanism to actively involve vulnerable households in the assessment process, giving an opportunity for their views to be heard by planners and decision makers. The use of this approach can help reduce both knowledge vulnerability and social vulnerability in areas at most risk, such as for those living in flood-prone areas.