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Slum Dwellers and Savings:
Organizing for Change in Informal Settlements

By

Heena Dinesh Shah

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Public Health

in the

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University of California, Berkeley

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Professor Jason Corburn, Chair
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Abstract

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Perhaps one of the greatest public health challenges of the 21st century is managing the health of populations in the context of rapid urbanization and the growth of slums in the cities of the global south. Slums are characterized by insecure residential status, poor structural quality of housing, overcrowding, and inadequate access to safe water, sanitation, and other infrastructure. Currently, 828 million people live in slums—growing, living and working in conditions that threaten their health. Demographers predict that in the next 30 years, the urban population in the cities of the global south will double, further compounding the problem. Slum dwellers experience poor health as a result of a complex and intertwined set of social, economic, physical and political factors, a fact underscored by a growing body of research demonstrating health disparities between slum dwellers and their urban counterparts. In order to address the challenge of poor health in slums, global public health practitioners must be prepared to grapple with these complexities, both in terms of analyzing how health is shaped and in terms of responding to the factors that shape health in such places.

In this dissertation, I contribute to a growing body of knowledge focused on analyzing and responding to health in informal settlements. In the following papers, I describe health in informal settlements, drawing from the literature to describe slum specific social determinants of health. I probe deeper into understanding health in slums by using empirical data and employing the relational framework to analyze health in a specific place, the Mathare informal settlement in Kenya. Here, I examine which living conditions matter for health and how, integrating the voices of slum dwellers to better understand how health is shaped. I find that health in slums is a function of complex and interrelated social, economic, physical and political factors. I take a similar approach in exploring microsavings, a potential response to the complex determinants of health in slums. First, I draw from the literature to develop a theory for how microsavings may play a role in addressing health in slums, and delve deeper into how this may occur by conducting a case study examining four microsavings groups in Mathare. I find that microsavings has the potential to build health in informal settlements through five specific pathways: facilitating empowerment, building community, creating information and action networks, amplifying the voice of the poor, and building financial strength.

For my dad, who grew up without. Like many of the people I describe in these pages, he struggled to find a way out of poverty- he often told me that education was the key –he studied next to a streetlight by his home when they didn't have electricity, earned scholarships to get through school, and overcame many obstacles to come to the U.S. and establish a thriving medical practice where he was adored by his patients.

Because of him, we never went without. He taught me about the power of an education and the importance of pursuing excellence in whatever it is you do. I am infinitely grateful to him for paving the way for me to get my education and for the incredible privilege of pursuing a doctorate and writing a dissertation. On most days, I still hear his voice, urging me to do better.

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Introduction

Perhaps one of the greatest public health challenges of the 21st century is managing the health of populations in the context of rapid urbanization and the growth of slums in the cities of the global south.[1] Slums are characterized by insecure residential status, poor structural quality of housing, overcrowding, and inadequate access to safe water, sanitation, and other infrastructure.[2] Already, 828 million people live in slums—growing, living and working in conditions that threaten their health.[3] Demographers predict that in the next 30 years, the urban population in the cities of the global south will double, further compounding the problem.[4]

Slums are, in large part, a function of poor urban governance, with governments either unable or unwilling to keep up with urban growth.[3,5] In fact, a common response in many cities of the global south is to neglect slum population or to eliminate slums through eviction or razing, a response which only puts a band aid on a more profound problem.[1,3] Inadequate government response has forced non-governmental and development agencies to step into the vacuum that the government has created, working to provide the basic amenities, social services, and physical infrastructure that are lacking in slums. However, efforts to improve slums have been slow, all of which has implications for public health. A report examining progress on the Millennium Development Goals in Sub-Saharan Africa found that efforts were stymied by slums: access to improved drinking water increased by 16% between 1990 and 2012 and the proportion of people using an improved sanitation facility increased from 24% to 30%, while the proportion of slum dwellers dropped only slightly-from 65% in 2000 to 62% in 2012.[6]

In conjunction with inadequate government response, slow and negligible improvement in slum conditions may also be connected to the predominant way that health is analyzed and understood. Slums are complex urban environments, a fact that is acknowledged by those who *describe* the factors that shape health in informal settlements, but often overlooked by those who *analyze* health.[1,7–12] In fact, there are five ways that analysis of health in informal settlements is oversimplified:

1. *Proximal over distal factors*: Instead of analyzing how slum conditions get "into the body" to produce poor health, many studies focus on factors more proximal to health like access to care, behavior, and knowledge, which are often shaped by broader factors. Research on health in informal settlements typically neglects examination of factors more distal to health, such as physical and social environments or political context at the municipal, national, and international level.[10,13–16] For example, instead of looking at more distal factors like lack of drainage or waste disposal services, or even more broadly, at government policies, to understand rates of diarrhea in children, research in informal settlements may look at factors more proximal to health like mother's health-seeking behavior in the event of childhood illness or knowledge about how infectious disease is spread.

2. *A single-exposure, single-outcome model over multiple, cumulative, lifetime factors:* often, researchers examine health in informal settlements from one perspective in isolation (the single-exposure-single outcome model) instead of analyzing how exposures

interact to generate vulnerability or resilience.[10–12,17] It is critical to go beyond the relationship of single exposures to health outcomes and synthesize how various exposures (such as poverty, inadequate toilet facilities, and environmental pollution) interact with each other to produce poor health.

3. *A narrow conception of health over a broad definition of health*: Many studies conducted in informal settlements continue to take a relatively narrow view of health. With this approach, health becomes defined in terms of illnesses like HIV/AIDS, tuberculosis, diarrhea, or outcomes like infant mortality and maternal mortality. Such outcomes are at odds with a broader conception of health, which the World Health Organization defines as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

4. *Health as a process:* Narrow conceptions of health also obscure the fact that both good and poor health are *shaped by processes*: a study may highlight that risky sex is associated with HIV/AIDS, but provide no new insights about how or why individuals may engage in risky sex. Such findings do little to guide policy or intervention.

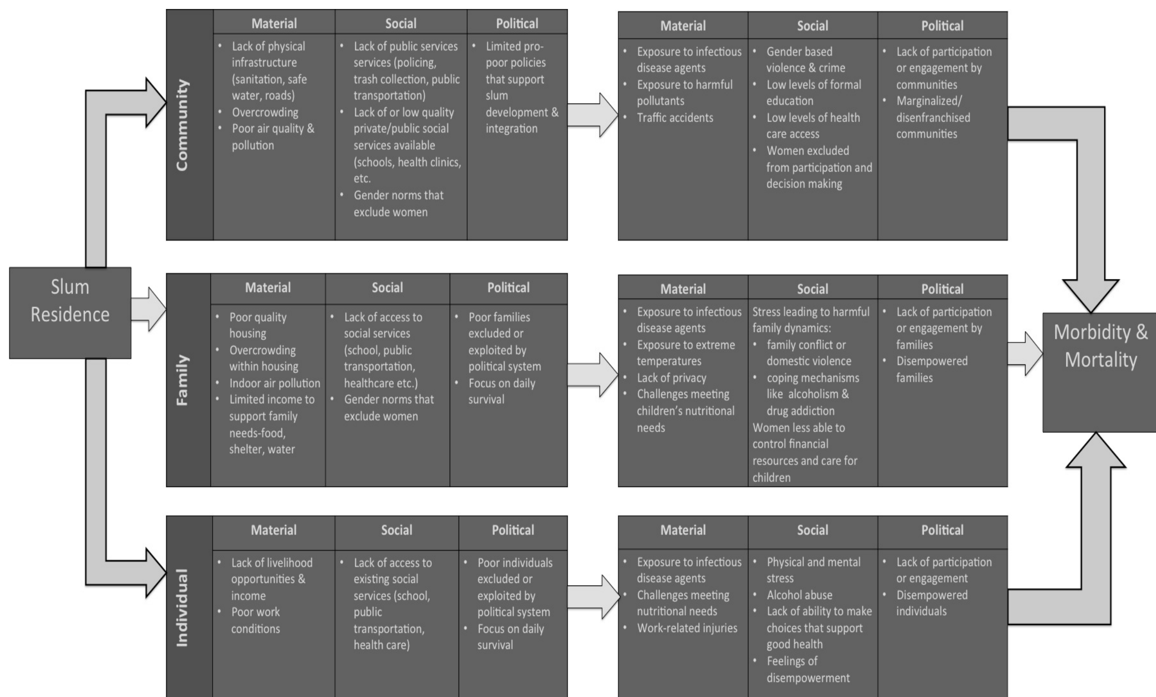
5. *"Research on" rather than "research with":* Slum residents are often not involved in attempts to analyze health and illness. Nor are their experiences and realities integrated into attempts to understand urban poverty and health: they are rarely asked to define what it means to them to be healthy or ill or to narrate the diverse ways in which they experience poverty. Such narratives can shed light into daily struggles that produce poor health or highlight innovative strategies that improve health, insight that is critical to understanding how health and illness are shaped and informing what actions need to be taken to reverse health inequities.

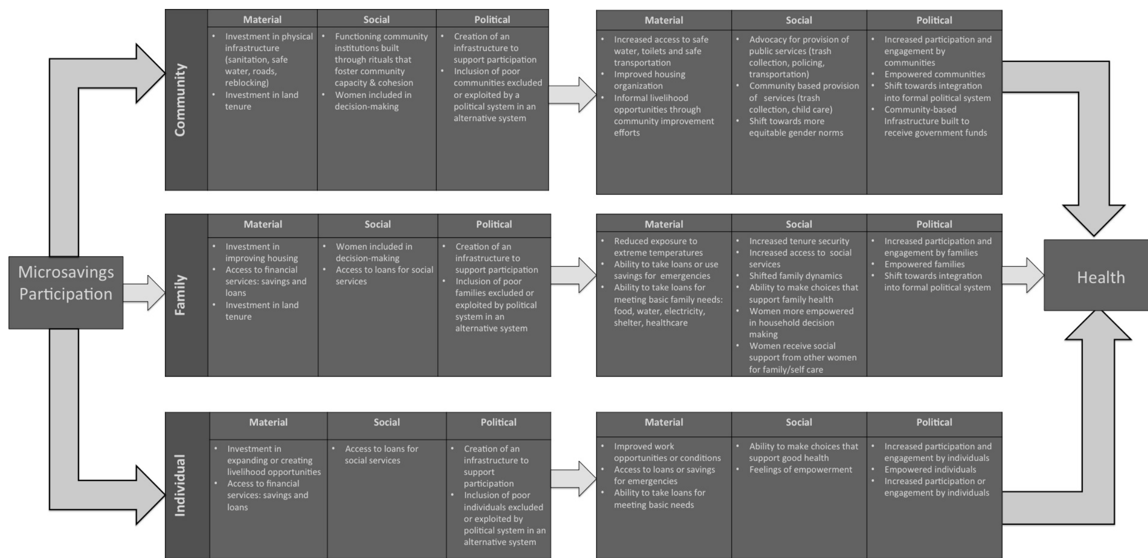
As an alternative to the static, fixed variable view of place offered by much neighborhood and built-environment and health research, in this work, I employ a *relational view of place* to better understand and analyze health in informal settlements.[18] In the relational view, place is understood as having physical and social characteristics, but these characteristics are given meaning through their interactions with one another and with the people living in a place.[18] Put another way, this framework focuses on physical, social and political factors—and the processes by which they interact in everyday lives—for characterizing the relationships between informal settlement conditions and health.[18]

While studies using the static, fixed variable view of place certainly contribute knowledge about health in informal settlements, the relational framework implicitly urges us, in public health, to do better and think bigger. Thus, in the following three papers, I use the relational framework as a guiding principle for thinking about how to analyze, understand, and respond to health. In *Paper 1*, I start with a global view, broadly describing the political, social, economic and physical determinants of health in informal settlements. I also introduce and analyze how a particular model of microsavings might be able to respond to the potential response to the determinants of health in slums, drawing from the literature to develop a theory of how this might work. In *Paper 2*, I describe health in a specific place, the Mathare informal settlement, a large and under described informal settlement in Nairobi, Kenya. As in paper 1, I examine health from a relatively 'upstream' perspective, using data

collected by and with slum dwellers to describe the economic, social, and physical conditions of people and place. Building on this analysis, I look to Mathare residents to tell me how they interact with place, using their narratives to understand how such interactions produce good or poor health. Papers 1 and 2 build on each other to create a picture of what matters for health in slums (the social, economic, physical, and political determinants of health in informal settlements) and how it matters (the way people interact with these factors). In Paper 3, I remain in Mathare and revisit the idea of microsavings as a potential response to the determinants of health in slums, this time empirically examining the ways in which it might be able to promote and protect health.

Building off of the relational framework idea, in the figures below, I make explicit and specific the conceptual framework that drove my analyses of health and microsavings in informal settlements. In the first figure, I highlight specify the material, social and political factors that shape health in slums, ranging from lack of lack of sanitation infrastructure and social services to limited income and poor quality housing. In the second figure, I conceptualize the ways in which microsavings may address these factors, by facilitating investment in housing, allowing access to loans, or empowering individuals to participate and advocate. The papers in this dissertation make an important contribution to better understanding and responding to health in slums, important at a time when global health practitioners are grappling with the complex challenge of slums.





Microsavings Participation
Community
Material
Investment in physical infrastructure (sanitation, safe water, roads, reblocking)
Investment in land tenure
Social
Functioning community institutions built through rituals that foster community capacity & cohesion
Women included in decision-making
Political
Creation of an infrastructure to support participation
Inclusion of poor communities excluded or exploited by a political system in an alternative system
Material
Increased access to safe water, toilets and safe transportation
Improved housing organization
Informal livelihood opportunities through community improvement efforts
Social
Advocacy for provision of public services (trash collection, policing, transportation)
Community based provision of services (trash collection, child care)
Shift towards more equitable gender norms
Political
Increased participation and engagement by communities
Empowered communities
Shift towards integration into formal political system
Community-based Infrastructure built to receive government funds
Family
Material
Investment in improving housing
Access to financial services: savings and loans
Investment in land tenure
Social
Women included in decision-making
Access to loans for social services
Political
Creation of an infrastructure to support participation
Inclusion of poor families excluded or exploited by political system in an alternative system
Material
Reduced exposure to extreme temperatures
Ability to take loans or use savings for emergencies
Ability to take loans for meeting basic family needs: food, water, electricity, shelter, healthcare
Social
Increased tenure security
Increased access to social services
Shifted family dynamics
Ability to make choices that support family health
Women more empowered in household decision making
Women receive social support from other women for family/self care
Political
Increased participation and engagement by families
Empowered families
Shift towards integration into formal political system
Health
Individual
Material
Investment in expanding or creating livelihood opportunities
Access to financial services: savings and loans
Social
Access to loans for social services
Political
Creation of an infrastructure to support participation
Inclusion of poor individuals excluded or exploited by political system in an alternative system
Material
Improved work opportunities or conditions
Access to loans or savings for emergencies
Ability to take loans for meeting basic needs
Social
Ability to make choices that support good health
Feelings of empowerment
Political
Increased participation and engagement by individuals
Empowered individuals
Increased participation or engagement by individuals

The Social Determinants of Health and the Potential of Microsavings in Informal Settlements

Introduction

Worldwide, an estimated 828 million people live in slum conditions, and more than 90% of slums are located in cities of the global south.[3] A slum is a contiguous settlement often not recognized or addressed by public authorities as an integral or equal part of the city, where inhabitants have inadequate housing and basic services, and residents living under the same roof lack one or more of the following: access to safe water; access to sanitation; secure tenure; durability of housing and sufficient living area.[2]

Many of these 828 million people experience poor health. Not only are the expected infectious diseases like tuberculosis, HIV/AIDS, dengue, hepatitis, pneumonia, cholera, and diarrhea highly prevalent in the informal settlement context, but residents in these settlements are also concurrently plagued by chronic illnesses, diseases of poverty (e.g. malnutrition and intestinal parasites), and preventable injuries.[7,19,20] One study examining the burden of disease in two of Nairobi's slums demonstrates this phenomenon: the top 10 causes of mortality for those over 5 years old included injury from road traffic accidents and interpersonal violence, cancer of the gastrointestinal tract, HIV/AIDS, and malnutrition.[19]

Not surprisingly, those who analyze and describe health in informal settlements consistently point to living conditions—from the social environment and physical infrastructure to limited livelihood opportunities and poor policies—as responsible for shaping health.[1,7,21] Data comparing the health of slum residents to the health of their urban counterparts provides evidence to support this notion, with slum dwellers experiencing poorer health than their urban counterparts: in 2008, the under five mortality of urban residents in Nairobi, Kenya was 63.5/1000, while the under five mortality in one of the capital city's informal settlements was 92.5/1000.[22] Similarly, the prevalence of HIV/AIDS in Kibera (Nairobi's largest slum) is 14%, almost double the national prevalence.[23] In a survey, approximately 33% of Nairobi's slum dwellers reported that their children had diarrhea compared to less than one in five in other areas of the city.[24]

An obvious implication of these data is that efforts to improve health in informal settlements must focus on improving the conditions in which people live, or the *social determinants of health*. In over 33 countries in Latin America, Asia, and Africa, place-based microsavings groups are doing just that. Designed with the broad objective of building more inclusive, equitable cities, microsavings is distinct from models of microcredit, in that they primarily serve to organize poor, urban communities.[25,26] This is accomplished through a wide variety of *economic, physical*, *political* and *social* mechanisms that are meant to address both the *immediate and individual* and *future and collective* needs of the urban poor. Savings groups allow individuals to save daily and access loans for acute *economic* needs, while groups work together to invest in shelter and housing or carry out community improvement projects to address *physical* conditions in slums. Working together on projects and savings collectively is intended to facilitate a *social* process whereby communities begin to trust each other, while data collection conducted in slums by savings groups members provides essential demographic data for engaging in advocacy efforts that build the *political* power of slum communities.

Despite the role microsavings might play in protecting and building health in the informal settlement context, such groups have received little attention in the public health literature. Nor has their been much collaboration between public health interventions and microsavings groups, a potentially powerful partnership. In this paper, I first identify the key determinants of health in informal settlements and introduce a model of microsavings that may be able to respond address these determinants of health. Next, I draw on existing literature about microsavings to develop a theory about how the role such groups might play a role in protecting and promoting health in informal settlements. I conclude with implications for new and ongoing public health research, practice and policy efforts in the informal settlement context.

A Model of Microsavings with Slum dwellers

An overview

The Slum/Shack Dwellers International (SDI) methodology for participatory planning has evolved under the umbrella of the transnational network Slum/Shack Dwellers International (SDI). SDI was launched in 1996 by 'federations' of the urban poor in countries such as India and South Africa, who realized the importance of sharing their experiences of success in fighting eviction.[27] In the time since its inception, SDI has expanded its scope beyond evictions to building the capacity of the urban poor and improving informal settlement living conditions. And what began as an effort to share strategies for fighting eviction has slowly evolved into an approach that employs specific, long-term methodologies for building more inclusive cities.[26]

Microsavings groups serve as the critical building block for engaging slum dwellers in broader participatory planning. Through microsavings, settlement residents can save and access credit for acute or immediate needs, while at the community level, microsavings participants come together to save and invest as a community in improvement projects they deem important. This broader process—saving, meeting, discussing priorities, managing savings and loans in partnership with other community members—is designed to facilitate a social process of building and empowering communities. Critical to the SDI methodology is the concept of federation, where microsavings groups from different communities create networks, coming together at various levels—at informal settlement, regional, national, and international scales-- to exchange ideas, engage in advocacy efforts, or work with service providers to bring basic services into slums. Today, SDI is a network of community-based organizations of the urban poor working to improve conditions in 33 countries in Africa, Asia, and Latin America.[26]

Formation, Function and Federation

In every country in which they exist, such groups generally *form*, *function*, and *federate* with the support of a local NGO *(see Figure 1)*. Initially, the supporting NGO creates interest in microsavings by creating awareness about the opportunity to build savings and access loans, often going into a village with members of successful microsavings groups from other slum communities. As groups become stronger, they engage in increasingly broader action that is targeted at improving the circumstances of the urban poor, saving collectively and buying land together, bringing physical infrastructure and social services to their communities, and working towards renegotiating their relationship with the government. This is accomplished through a series of rituals and principles that guide how microsavings groups *function*, which

are introduced by the supporting NGO. These rituals and principles are designed to meet short-term needs while working towards more long terms goals; they are also intended to broaden members' focus from *immediate and individual* needs to include the *future and collective* needs of the urban poor. Some of the key rituals that the NGO introduces include:

- *Weekly meetings* allow members to review their savings and access loans, and also create the opportunity for members to get to know each other, build trust and unity, discuss salient village issues, and ultimately engage in projects they have prioritized.[27]
- *Daily savings* collected from members by volunteers; this serves not only as a means for allowing the poor to save whatever they may have on a given day (instead of spending it), but also to create a mechanism for collecting and sharing information with residents—information which is subsequently used by the group to make decisions.[27]
- *Savings books* in which members document their daily savings, and *wall charts*, where all members are able to see savings and loans not only track financial transactions and progress, but facilitate transparency and accountability.[27]
- *Ensuring accountability* through such practices as keeping records of savings in *savings books*, maintained by both members and the group; posting savings/loan obligations on a wall for all group members to see, and regular *elections of* group leadership (chair, secretary, treasurer, etc.). These rituals are meant to facilitate short-term transparency and accountability, and develop functioning, informal democratic institutions in the long-term.
- *Enumerations,* or the household-level collection of basic demographic information about who lives in a community (through face-to-face interview and survey. This is done by residents themselves and helps to put invisible slum dwellers on the map. The process also helps residents learn about their own community by building knowledge about living conditions. Enumerations also serve as a source of information which assists local groups in advocacy efforts and partnerships with outsiders, such as government, public service providers, and other NGOs.[27–30]
- *Exchanges,* or the practice of visiting between groups to learn strategies, lessons, and resources between savings groups, not only represents a way of sharing information, but also builds solidarity between groups.[27]

In addition to rituals, microsavings groups are guided by specific principles, the first being democratic governance. Within each place, and within each group, specific governance systems must be put in place to provide financial transparency and accountability.[29] While the systems of governance can differ, they must exist. In Kenya, for example, the *Constitution of the Federation of Slum Dwellers of Kenya* specifies certain rules of governance, such as elected leaders (e.g. chair, secretary, treasurer) and specific teams that focus on various aspects of microsavings group activities (e.g. advocacy and enumeration, welfare, land and housing/projects, savings and loans, auditing).[31] The constitution also includes language about decision-making, e.g. every member has the right to be heard, every member has an equal share, and decisions must be made by majority or through consensus building.[31] Second, the SDI methodology prioritizes the participation of women as savers, but in particular as leaders, as a way to shift social norms around gender in the informal settlement context, an idea discussed more in detail below.[26]

This village level structure becomes the building blocks for *federation*, or networks, a critical component of the SDI model.[27] Village savings groups come together to form federations at the regional, national, and international level and provide the structure for a number of important activities. First, they create the opportunity for cross group sharing, or *exchanges*, through which the urban poor learn about strategies other groups are trying or successfully using. Second, the federation provides an efficient structure through which to channel funds directly to the urban poor. External funds may come from an external donor, the government, or the Urban Poor Fund International, an SDI subsidiary governed by federation leaders.[32] Third, the federation provides the structure for consolidating and amplifying the demands of the urban poor, as they campaign for the rights of slum dwellers, or work with local authorities to negotiate the terms for bringing in basic services.

The Social Determinants of Health in Slums

The idea that the conditions in which "people are born, grow, live, work and age" are responsible for influencing health is referred to as the *social determinants of health (*SDOH*)*.[33] Such conditions are shaped by broader factors, such as the "distribution of money, power and resources at global, national and local levels."[33] The SDOH lens probes into the root causes of health problems and is an important analytic tool for highlighting inequities: using this lens, waterborne diseases are not just the result of microorganisms, but a consequence of political, social and economic forces that fail to make clean water available.[3] In this section, I outline the key economic, social, physical, and political determinants of health in informal settlements.

Economic

Slum residents are often excluded from economic opportunities, as evidenced by high unemployment rates in slums.[34] According to one World Bank study, unemployment rates are highest for women and youth, a finding supported by a survey in two Nairobi slums, which found that 50.5% of women were economically inactive compared to 9.4% of male residents. [22,34] Those who are able to find work are often employed in the informal sector, do temporary or casual labor, and receive inadequate or inconsistent incomes.[29,35]

Such economic realities have major health implications. Most obviously, an inadequate or inconsistent income can make it difficult or impossible to buy health-supporting necessities like safe water, good housing, nutritious food, or healthcare. Low incomes also make it hard to save or build up an asset base, turning seemingly small shifts in circumstances—like a family member becoming ill, or an increase in the price of food—into an acute emergency that harms the emotional and physical health of the family.[36] In a study of more than 400 rickshaw pullers in Dhaka, health-related events were considered the 'single most important factor in downward mobility,' leading to missed work, healthcare costs that exceeded monthly income, and the accumulation of debt and depletion of assets.[37] Lastly, individuals with meager incomes may have to resort to behavior that harms their health to meet their basic needs, a fact highlighted by a study in a Kenyan slum, where young women engaged in commercial sex work to pay the rent or take care of their children.[38] Lastly, working in the informal sector often means exposure to pollutants, unsafe and unregulated working conditions, factors which have their own set of negative health implications including work place injuries and illness, all while lacking social protection or comprehensive health care.[3,39]

Physical
Slums are also characterized by myriad physical conditions that can harm health. They are often located in the least desirable parts of cities on unstable terrain, highly polluted areas, or furthest from employment opportunities, factors which expose slum dwellers to the risk of landslides or harmful pollutants.[7,40] Travelling increased distances to work makes individuals more susceptible to traffic accidents or injury, while living alongside congested streets may also reduce the health of individuals through traffic as well as air and noise pollution.[3]

Informal settlements often lack physical infrastructure that facilitates the provision of basic services, like pipes and trunk infrastructure that allow for water and sanitation; basic amenities like waste disposal services, and many of the physical characteristics that make places healthy, safe, and livable e.g. public lighting, adequate roads, community centers, bridges and footpaths. Without waste disposal, garbage piles up on riverbanks and pathways, blocking drainage and attracting rodents, mosquitoes and flies. Such piles often serve as sites for children's play, leading to exposure to sewage, infectious disease, reduced hygiene and increased injuries as roads become muddy and wet.[7,38]

Without access to water in home, residents are often relegated to using inadequate public facilities: water kiosks and vendors often charge high rates, have an inconsistent or contaminated supply of water, and have long wait times.[41] As a result, informal settlement residents may use a wide variety of coping mechanisms to access water, which may also compromise health. These include using sewage water, skipping bathing and washing, and using water from broken pipes that contain contaminated water.[42] The link between unsafe water, poor sanitation and health has been well documented, leading to a variety of serious health issues including, but not limited to diarrhea, malaria, worm infections, cholera, and hepatitis. Over half of city dwellers in Africa, Asia and Latin America suffer from at least one disease caused by lack of safe water and sanitation.[7,43] Not only does unsafe water cause illness, it eats up precious resources needed for food, water, and shelter: according to one study, poor people in sub-Saharan Africa spend at least one third of their income for the treatment of water-borne and water related diseases like malaria, diarrhea, and worm infections.[3,44]

As with water, public toilet facilities are also lacking: they are often poorly located, badly maintained, and lack privacy. Inadequate toilet facilities and ablution blocks also adversely impact health. In Mumbai, five million residents live without toilets—translating to millions of kilograms of human waste contaminating their environment and facilitating the spread of infectious disease in a given day.[7] An Amnesty International report highlights the particular burden of inadequate toilet facilities and ablution blocks on women; with women from informal settlements describing a range of consequences, from lack of privacy and an inability to maintain hygiene for themselves and their children (women in informal settlements are generally the primary caregivers)[45], to fear of using the bathroom at night and incidences of gender based violence that for the most part, go unpunished.[46]

In addition to the lack of life-supporting physical infrastructure in slums, these communities are also characterized by high density, poor quality, overcrowded housing. Worldwide, informal settlement residents live in a variety of substandard housing, from plastic sheets on pavement, to shacks, and high-rise tenements.[7] In Kolkata, India, slum residents cook, sleep,

and live with 13.4 people per 45 meters squared of room. Housing represents security, a place to keep belongings, a place for tapping into jobs, income, infrastructure and services.[3] It also provides security for belongings, safety for families, a place for social relations, trade, and service provision.[3] Because housing plays such a central role in the activities of life, lack of adequate housing is both intimately and broadly connected with health. Poor quality of housing is less protective in the face of natural disasters, temperature extremes, flowing sewage, or fires; overcrowding causes infectious diseases, tuberculosis and other respiratory illnesses, meningitis, scabies, skin infections, and injuries.[1,7] It has also been connected with family violence and stress, including, child maltreatment, intimate partner violence, and sexual violence and abuse of the elderly.[3] Taken together, lack of adequate physical infrastructure in informal settlements plays a significant role in shaping health in the informal settlement context.

Social

In parallel with economic exclusion and inadequate physical infrastructure, slums are sites of social exclusion, with governments neglecting to provide necessary social services like policing, affordable childcare, or quality healthcare. Poor quality of healthcare has a distinct role in harming population health in informal settlement, slums have fewer formal services than better urban neighborhoods, and many are characterized by an "inconsistent patchwork of private, public, and charity-based providers."[1,38] Particularly dangerous to health are the rise of informal, unregulated facilities, where health providers tend to be poorly trained, facilities are ill equipped, and care is substandard.[3,38] Many poor, urban women also lack access to facilities and providers who can provide skilled care during delivery or provide basic emergency obstetric services. [3,47,48] Slum dwellers not only confront poor quality health care, but low income inhibits access, with residents unable to access the care they need because they cannot afford it, lack transport, or do not have days off work, ultimately contributing to further reduced income, severe illness, and even premature death.[3,15,17,49,50]

While poor quality of healthcare is more obviously related to health, lack of policing has more subtle connections to physical and mental well-being. First, it may contribute to safety and the incidence of crime in informal settlements. Studies of slums in Nairobi reveal high rates of insecurity, with 63% of slum households reporting they do not feel safe in their settlement, and at least one person per household reported being a victim of a crime in the past year.[51] In the favelas of Brazil, young men are more likely to die from homicide than their urban counterparts.[52] Women in particular are vulnerable to violent crime in the informal settlement context. The Centre on Housing Rights and Evictions characterizes violence against women in Nairobi slums as not only prevalent, but rampant, both inside and outside the home.[23] At a legal aid center in Kibera, Kenya, up to 10 cases of domestic violence are reported every week.[46] Violence has negative effects on health and livelihood, while violence against women or control over women's reproduction and sexuality are thought to contribute to a range of reproductive sexual and health conditions for women.[3,53] Violence against women is a symptom of broader beliefs and norms about women, or a function of *gender inequity*, another social determinant of health that influences the health of women. According to UN Habitat, gender inequity intersects with other health determinants (e.g. access to economic and educational opportunities, control of resources, decision-making power, social status in family) to damage women's health.[3] For example, at the household level, gender inequity can mean that girls and women do not receive equal access to healthcare or nutritious food.[3]

Political

The political determinants of health are perhaps the most "upstream" of the determinants of health in slums, responsible for shaping many of the social, economic, and physical conditions that have already been discussed in this paper. Because slum residents are generally squatting "illegally" on land, many governments refuse them the individual rights of citizenship. For example, female pavement dwellers in India were denied ration cards for food and fuel because they did not have a legal address.[1,54] At the community level, the government refuses to invest in whole communities, neglecting to provide basic social services, build physical infrastructure, or support livelihood, all of which are essential to supporting the health of populations.[1] Moreover, in many places, slum populations are not counted in the census, or assessed as part of national health surveys, meaning that essential demographic information, the type of living conditions, and the extent of need are unknown, contributing to the fact that "when it comes to disease statistics, the billion voices of informal settlers across the world are silent."[1,55] A number of studies identify good governance as critical determinant of urban health; conversely, other studies attribute the growth and persistence of slums to poor governance. All point to the critical role of governance in shaping both poor and good health.[1]

Addressing the Determinants of Health: The Potential of Microsavings in Informal Settlements

In this section, I describe how place based microsavings may address the economic, physical, political, and social determinants of health, referring to both the more explicit, material outcomes of microsavings as well as the more implicit, theoretical social processes facilitated by microsavings. In each section, I first describe how microsavings may conceptually or theoretically respond to the determinants of health, and then highlight examples from the literature.

Economic

> *"I started getting small loans as well from the group to improve my vending business and I repaid the loans. I then joined other members of the group and got a big loan and we started a collective business of buying and selling snacks [in] our vegetable markets. This was a huge success and we never looked back."* [56]

The microsavings literature suggests that groups could respond to the economic determinants of health in informal settlements by allowing individuals to accumulate savings, improve or initiate livelihoods, access emergency credit, and build up an asset base. Microsavings is supposed to provide a structure to be more tailored to the complex needs of the urban poor: first, it provides them with a place outside of the home to keep savings, protecting it from immediate needs or other household members.[29] Microsavings also emphasize a 'discipline of savings,' encouraging individuals to put something in their savings each day.[29] Being able to save small amounts daily allows them to save more than they would otherwise, a service which many formal financial institutions might not be willing to provide.[29] Microsavings is also supposed to provide access to emergency credit on terms that are more immediate, more flexible, at lower cost, and with less risk of going into debt than the village money lender or formal financial institutions.[29] This is because groups are supposed to evaluate requests for loans based on an individual's saving history (both to

protect the saver and to reduce the risk of defaulting), know each other's personal circumstances and are more flexible about the terms and cost of repayment; unlike microcredit, the loans can be used for whatever the individual deems necessary.[29]

Case studies provide examples of how savings groups have been structured, how savings have been accumulated, and for what purposes loans have been used. In Mumbai, India, female pavement dwellers, called Mahila Milan, organized into groups of 15 members for savings and emergency credit.[29,54] The group emphasized the importance of savings and framed participation as an avenue for accumulating enough wealth to use a formal financial institution; in 6 years, 600 members from groups had started savings accounts at banks.[29,54] The group also had a specific structure for providing loans: in each group, one person was nominated to be the savings manager and was responsible for collect savings and distributing credit, while a loan committee was in charge of managing the money collected, keeping records, and setting rules.[29,54] For small loans (under 100 rupees), the savings manager could approve the loan. For loans up to 500 Rupees, three people had to approve the request, while for larger loans, the full committee had to review the request.[29,54] Mahila Milan had also built flexibility into the structure of the loan process: when a saver had a crisis, they requested credit by specifying how much they wanted, for what purpose, and under what terms they would repay the loans. Most members repaid their loans. In a few cases, the group made exceptions given personal circumstances: in one case a woman who was was not required to repay a loan, while in another a woman got a second loan before repaying her first because the entire stock of her business got confiscated.[29,54] The group charged a fee only for loans for small businesses, and even in this case the fee was 1 Rupee.[29,54]

In addition to making savings and loans more accessible to the poor through flexible terms, it appears that microsavings responds to the economic determinants of health in informal settlements by supporting livelihood, supporting individuals in emergencies, or increasing access to basic needs. Within Mahila Milan, the most common reason that individuals took loans was for emergencies—most often to buy medicine or treatment for family members, or to help make-up for income loss related to illness.[54] In other cases, women needed loans to support their livelihood: for travel in order to find work, to start a food kiosk in the informal settlements, or to get back goods confiscated from a vendor by the police.[54] In Kisumu, Kenya, women's savings groups helped women living with HIV/AIDS to buy goats---allowing them to both consume and sell milk (i.e. supporting good diet and livelihood).[57] In Burma, women established specific funds to support livelihood, while in Cambodia, savings groups had rice banks as a means to improve food security.[29]

Thus, in the 50,000 savings groups that have been formed across Latin America, Africa, and Asia, microsavings may help slum dwellers respond to the economic determinants of health in informal settlements.[36] This may happen in a number of ways: reducing vulnerability to emergencies by allowing individuals to buy health supporting necessities like food, water, medicine, and shelter, providing the infrastructure for members to build a financial cushion, allowing individuals to access loans for emergencies, and supporting new and existing livelihoods.

Physical

> *"We used our savings booklets as evidence of the capacity of the poor to save and to collectively build*

their own houses. Armed with our savings records, we engaged the city of Harare to allocate us land to build houses. The officials were surprised by how much we had saved. We earned their respect. In turn, they changed their conditions for registering on the municipal waiting list for accommodation. Anyone who did not have a pay slip was required by the municipality to join a savings scheme and use their savings record in lieu of a pay slip to register. Even though it took us five years, the city eventually allocated us land to build houses. Using the same method, we started talking to national government ministers as well."[56]

Microsavings groups also address the physical determinants of health in slums; allowing group members to improve or build new housing and bring essential physical infrastructure to their communities. The way this is accomplished is highly attuned to the local context; but what remains consistent across each setting is that microsavings provides the structure (e.g. bringing people together regularly, creating a network through which information can be shared) and employs well-established strategies (e.g. using data from enumerations for advocacy, collective savings, establishing the capacity of the poor through demonstration projects) for pushing the process of securing housing or basic amenities forward.

In terms of housing, microsavings puts new and improved housing, which is out of reach for most slum dwellers, within reach in a number of ways. First, micro-savings brings people together to save collectively for improved or new housing, allowing them to save together more than they could independently. However, the amount that is saved is rarely enough to secure new or improved housing; instead groups that demonstrate an ability to manage savings and repay loans receive outside support from a variety of sources--funds from the Urban Poor Fund, international donors, or often, the government.[29,32,58] Generally, groups receive loans from the donor for a small proportion of the cost (e.g. 10%), which they repay over a pre-specified amount of time, while the external donor subsidizes the rest.[32,58] In addition to funding, in many cases, slum dwellers are supported in designing and building their own homes, with architects and urban planners from the supporting NGO providing guidance and facilitating discussions between slum dwellers about feasible design and layout, necessary materials, and housing construction.[28] All of this is done with an eye to reducing cost in order to make housing more affordable for the poor: using cheaper materials and buying in bulk, finding cheap land in the case of resettlement, buying smaller plots, working to change coding standards, and doing some or all of the improvements or housing construction themselves instead of through contractors, etc.[58] According to a working paper called *Building Homes, Changing Official Approaches* from the International Institute for Environment and Development, housing built this way costs one third or one fifth the cost it would through contractors.[36]

Case studies demonstrate how microsavings has contributed to slum dwellers securing housing: in South Africa, the new post-apartheid government had a program to subsidize housing and infrastructure for the poor, with funds being channeled through housing developers and contractors. In an exchange between the federations of slum dwellers from India and South Africa, the Indian federation shared that funds for housing routed through state agencies had not reached them very effectively. Partly as a result of this exchange, the South African federation, known as FEDUP (Federation of the Urban Poor) formed local housing savings groups and were able to come together to demand a pilot initiative to receive the funds directly to build their own houses.[59,60]

Perhaps one of the most ambitious and large-scale examples of slum dwellers securing housing using the SDI approach is Baan Mankong, a national slum upgrading program in Thailand.[61] In 1992, the government set up the Urban Community Development Office (UDCO) to create more housing, support livelihoods, and access to basic services. UDCO had $50 million dollars to provide loans, small grants and technical support to community organizations. The money was also used to help create networks of savings groups based around various themes (taxi cooperative, shared land tenure, etc.). Increasingly, UCDO began to loan to networks rather than individual community organizations because of the efficiencies of this approach: the money went directly to those who needed it and was used for the more real time needs of the network members and the network members worked with provincial or city authorities to plan. Within 8 years, the program had provided loans and technical support to 47 housing projects involving 6,400 households. In 2000, UDCO merged with the Rural Development fund to form the Community Organizations Development Institute (CODI), which worked with community savings group networks on an ambitious national program, called Baan Mankong, aimed at improving housing, living conditions and tenure security for 300,000 households in 2,000 poor communities in 200 Thai cities over 5 years.[29,58,61]

Similarly, microsavings has also provided the structure for the sustained advocacy efforts, information sharing, and the creative resourcefulness necessary to deliver community infrastructure. While housing improvements and infrastructure improvement projects often go hand-in hand, as with the Thai example where water and sanitation provision was a part of housing upgrades, other times slum dwellers prioritize infrastructure specifically, or strategically to pursue infrastructure upgrades.[28,58] An example from India, described in a case study titled *Community-designed, Built and Managed Toilet Blocks in Indian cities* illustrates the iterative process undertook to bring public toilets into slum communities, a process which unfolded over 10 years.[28,62,63] In this example, three organizations worked together: Mahila Milan, the federation of women slum and pavement dwellers, SPARC (Society for the Promotion of Area Resource Centres) the Indian NGO that supports the slum dwellers, and NSDF (the National Slum Dwellers Federation) the network of NGOs and slum dwellers throughout India.

The project started when female pavement dwellers in Mahila Milan identified toilets as a priority. They had no toilets where they lived and no legal access to water forcing many of them to use their employers' facilities (most worked cleaning homes) or wait until nightfall to defecate in the open. In discussions organized by Mahila Milan and SPARC, slum dwellers debated the best model of toilet for their context; though they preferred in-home toilets, they decided that community toilets would be the most affordable and feasible (since their homes were less than 100 square feet and a community toilet would also allow for a large water tank where they could access safe water). In parallel to these dialogues, the women visited communities with public toilets and made observations about problems: they were poorly managed, had long lines in the morning, and children often defecated in the open since their mothers did not have time to wait with them. Many women were also anxious about their children using the toilets, since they had large openings through which they could easily fall.

The women approached the municipality and international donors with suggestions for improvements for community toilets but were rejected. In response to that rejection, SPARC decided to fund a pilot project and the community built a public toilet. This is a common SDI strategy: doing a project to allow the community to experiment and improve on the project (called a *learning cycle*) while concurrently demonstrating poor's abilities to municipalities and donors (called *precedent setting*).[28] This pilot project was partly responsible for generating enough confidence in the capabilities of the federation that both the government and external donors offered additional funds. Eventually, the SPARC-NSDF-Mahila Milan Alliance worked in three Indian cities Mumbai, Bangalore and Kanpur to build toilets that reflected community priorities.

In each of the three Indian cities, enumerations were conducted to both demonstrate the extent of the need for services and inform the work (determine where facilities should go, etc.) and slum dwellers were involved with actual construction of the toilets. As the projects evolved and expanded, the toilet design also changed to better fit the informal settlement context. For example, instead of one entrance for females and males, the entrances were separated so that women get privacy and avoid conflict in line; there was a special design developed for children that included balancing handles and smaller openings. Doors were made to swing both ways to allow people to enter more easily with a bucket for the pour flush toilet design. There were also some innovations that reduced cost: toilets were constructed back to back in order to share a tank, while some toilets were connected directly into the city's water and sewer line to avoid the need for additional pipes. The slum dwellers also developed some innovative methods to facilitate better maintenance: for example, they negotiated with the city to design, build and manage the small pipes if the local authorities would manage the larger ones. In other places, a community center or live-in unit was attached to the toilet, generating the fees and the labor required to keep facilities clean.[62]

These examples highlight *how* the microsavings structure allows the urban poor to respond to the complex challenge of bringing improved housing and physical infrastructure into their communities, while the number of examples and array of projects indicate that microsavings has the potential to build health in a wide variety of settings: in Mumbai, more than 30,000 slum families have moved into secure housing over the past 10 years.[56] In India, South Africa, Thailand, Namibia, Malawi, the Philippines, Zimbabwe, and Kenya, groups have initiatives for upgrading or developing new housing with the local government, and over 150,000 families within federations have secured tenure between 1993 and 2008.[64] In Pakistan, slum dwellers brought high quality sanitation and drainage to over 300 locations in Pakistan—financing, managing and building the "small pipes" that are in the streets and neighborhoods, while government agencies laid the "big pipes" (trunk infrastructure).[64] The federation in Khemara Phoumin, Cambodia, worked in partnership with an NGO, the government, and private donors to build a 180 meter paved road linking the slum to the city.[65] As of 2010, communities in 708 settlements, 153 cities, and 19 different Asian nations had engaged in a wide variety of 'physical capital' related projects: road-building projects (126), drainage projects (68), water supply projects (103), electricity and street lighting projects (30), toilet building projects (980, solid waste and composting projects (8), playgrounds and parks (48), and clinics and health centers (2).[66] Taken together, the literature provides evidence that microsavings may be able to respond to the physical determinants of

health in informal settlements by improving housing and creating critical community infrastructure.

Social

> *"When I started attending the savings meetings myself, I began to understand that I had the power to improve my life. I did not want to live the same life of poverty my mother lived. . .Mayors and government ministers in Zimbabwe now know me by name because with other federation leaders we never get tired of fighting for other poor families. I am now a very confident woman, and by sharing ideas with other savers and visiting different communities I learn from and teach them how, by coming together and saving, we can improve our lives. Through the federation I now have a house for my family."*[56]

> *"Federation friendships are very strong, they all help each other when they are sick or when there is a funeral. . . they helped me when I was sick. They brought me medicine and cared for my children. When I was well, they trained me as a builder. I have learned a big thing. I learnt that a poor person is not without brains! By talking with my friends I learnt that poor people have knowledge."*

Using some of the same processes highlighted in the physical infrastructure section, microsavings groups have been able to bring social services in to their communities e.g. Indian slum dwellers without policing in their community worked with local police to establish "police panchayats," groups comprised of ten representatives from the settlement and a police officer, while women's groups in Kisumu, Kenya engage in home-based care in their communities and carry out campaigns on healthy living,[57] perhaps bolstering the quality of care available in their communities.[29,57]

More distinct from the way that microsavings facilitate bringing in physical infrastructure and social services, is the role that microsavings seems to play in addressing gender inequity in the informal settlement. Microsavings participation appears to positively influence women by shifting both their attitudes and beliefs about themselves as well as community perceptions about them.[29] Savings groups are also supposed to build supportive relationships between women in a community.[28,29] Like with other aspects of microsavings, this is accomplished by design: women are deliberately sought for participation and leadership with the intention of "renegotiating their relationship with families, communities, and federations."[26] In addition to being targeted for participation, in *Capital, Capacities and Collaboration: the Multiple roles of Community Savings in Addressing Urban Poverty*, Mitlin et al suggest that women have a particular interest in the activities of microsavings. They assert that though family remains a central and powerful unit in many of these contexts, the relationships and responsibilities can be challenging and microsavings supports women in getting through these difficulties.[29] As with other aspects of microsavings, the process of participation is supposed to facilitate positive outcomes. Having women manage their friends' and neighbors' savings is thought to develop leadership capacity, financial management skills and confidence. Women are also supposed to develop the skills to manage increasingly large amounts of money by handling group savings, repayment of loans, and reading bank statements. [29] While such an approach is supposed to shift gender norms and women's own beliefs about their abilities, the modalities of women's participation and leadership are theoretically not supposed to "generate opposition from men" because women are engaging in activities complementary to their roles of taking care of their families

(i.e. women take care of their families by working to improve housing and basic services or getting health care, etc.).[56]

While case studies from Kenya, Zimbabwe, South Africa, and India suggest that women experience positive outcomes through microsavings participation, the examples tend to be less concrete and more general than the examples highlighted for the economic or physical determinants of health.[27–29] The following excerpts, written by leaders of the NGOs that support slum dwellers in Kenya and India, illustrate the types of benefits that are described:

> *"Microsavings change the role that women play in informal settlements – both in their own eyes and in the eyes of their community – since they manage the savings."*[27]

> *"Using a federation structure, possibilities for communities to conceptualize, design and manage vital assets become visible and this, in turn, raises the possibility of the poor, and women in particular, being able to participate in an exploration of new roles with their communities."*[28]

> *"Women also find that their participation in savings groups transforms their relationships with each other, their family and community."*[56]

At the same time, high participation rates by women--women make up 60-90% of most city and national federations—lend weight to the idea that women experience benefits from microsavings participation.[56] And, there are myriad examples of how microsavings changes the way women relate to each other, with women offering each other practical support to leave an abusive relationship, help (borrowing or giving food, money, or childcare) and support for broader ambitions.[36] These examples indicate that microsavings may be able to build social capital for women. Social capital is an umbrella phrase that refers to a broad range of ideas. One dimension of social capital is social cohesion, or having trusted and reciprocal relationships with family, community and a more extended network of people. Another important dimension of social capital is social integration, or participating in civic society.[67]

All of these outcomes connected to microsavings participation have positive health implications for women. Shifting gender norms may reduce violence against women in informal settlements, while building social capital may contribute to better health in a number of ways. Having trusted and reciprocal relationships can provide women with health protective emotional and physical support.[3] A greater network means more opportunities to both provide and receive such support, while civic participation may build self confidence, protect women from feelings of alienation and tensions around their gender role.[67] Indeed, social capital has been linked to improved health in a number of ways, through buffering the impact of stress, providing access to emotional and material goods, and providing people with the practical resources they need.[3] In contrast social isolation and exclusion are associated with poor health and premature health.[3] All of these processes may potentially benefit the health of women in slums.

Political

> *"Our message was simple! That we were slum dwellers but we were not hopeless. We wanted government to change the policies that make it difficult for the poor to live decently in towns. We wanted the government to give us money to add to our savings. That way more poor people can have decent homes and safe water to drink and proper toilets. The houses the federation has built help us to convince government that the poor are not hopeless. This has made government change its housing policy. For the first time we have a policy that recognizes that there are poor."*[56]

Perhaps most importantly for population level changes in health, microsavings has shown the potential to respond to the political factors that shape the social determinants of health in urban informal settlements. The network structure that links coalitions of microsavings groups is meant to build solidarity and amplify the demands of the poor while contributing to specific strategies that combine advocacy, confrontation and negotiation with the government.[28,68] SDI federations use campaigns, marketing, legal action as well as small precedent setting projects that convince officials of the abilities of the poor.[28] Once this is done, the federation "keeps pressing."[28]

There are many examples of how microsavings has built the political power of the poor, small and large. Many of the cases already discussed in this paper have political dimensions. Success in providing funds to networks of groups in Thailand for housing contributed to the generation of a large-scale, national program.[61] The work of the Indian federation to secure public toilets changed national policies around sanitation: the Indian government introduced a new program subsidizing half the cost of constructing community toilets, and made the funds available to local organizations and public authorities.[62] The Indian federation also worked with the UN Human Settlements Program to launch a good governance campaign in India in 2000, with access to sanitation by women and children an indicator of good governance.[28] In Kenya, slum dwellers in Mukuru, buoyed by the new constitution, which contains language about the rights of slum dwellers, filed two landmark lawsuits (with the support of Muungano Support Trust, the supporting NGO): one asserting their rights to land, while another was filed on behalf of women who did not have access to adequate sanitation or toilets.[69] Microsavings is thus able to make known the demands of the urban poor, push for policy reform, and help slum dwellers access land tenure, all of which have important implications for health.

Bringing it together: Pathways from Microsavings to Health

In this paper, I have described a number of ways that microsavings may be able to respond to the determinants of health in informal settlements. While **Table 1** draws specific connections between the social determinants of health and the role of microsavings in addressing them, the list below provides a summary of these important connections:

- Participants are able to get small, immediate loans. Loans may be used for a variety of needs in ways that directly or indirectly impact health—getting healthcare when a family member becomes ill, paying school fees, initiating a small business or maintaining it during a challenging period, allowing for travel to look for work, etc.
- Group members come to know and trust each other and form social ties and build social capital, relying on each other in health supporting ways, through childcare exchange,

small short term loans, information sharing, etc.

- Participants contribute to collective savings in order to improve housing and secure tenure. Permanent housing and secure tenure may indirectly and directly impact on health by creating living environments that are less crowded, less vulnerable to extreme weather, and have adequate toilet facilities, electricity, and safe water in residence.
- Microsavings groups work with stakeholders, including the government and service providers to coproduce badly needed public services (water, sanitation, waste disposal, policing, etc.)
- Groups work independently or partner with stakeholders to build physical infrastructure in informal settlements (e.g. sanitation pipes, public water points, toilets, etc.). Such efforts could clearly impact health in myriad ways, including reducing infectious disease and violent crime, improving safety and hygiene, etc.
- Microsavings groups also act with other groups (in *federations*) to give voice to the needs of the urban poor. They may engage in advocacy efforts to combat eviction threats or assert their right to basic services. Such efforts may have both direct and indirect connections to health in terms of building knowledge and empowering individuals and communities.

While the aim of this paper was to discuss the potential of microsavings to build health, there are a number of challenges associated with participation, challenges which can limit the ability of microsavings to address the economic, political, social and physical determinants of health. Microsavings primarily responds to the economic determinants of health through its loan and savings function, and it runs into some of the same challenges that microcredit or microfinance interventions confront: lenders who do not repay loans, specific community members who dominate groups, mistrust between members, or people who cannot meet administrative fees to participate, leaving out the poorest of the poor.[27,56] There are also challenges unique to microsavings, which operates in a different way from microcredit—for one; there can be reluctance by groups to submit to external audits (by the supporting NGO), potentially compromising the transparency and accountability of the group.[27] For many of these challenges, there are built in measures to counter these threats—some of which were discussed earlier in the paper, e.g. examining savings history of members, having borrowers determine the terms of the loan.

There are also limits in terms of microsavings ability to respond to the physical determinants of health. Because housing and infrastructure is politically charged in many settings, many of the infrastructure improvement projects I took several years to show results.[28] The effort to scale-up public toilets in three cities in India took over 10 years with slum dwellers confronting a wide range of challenges. These challenges included negotiating for land, complaints from neighbors and landowners, and an external donor that created a bidding war for funds between communities.[62] Such a lengthy process begs the question: could other avenues, such as private investment, take less time and provide similar or better results? At the same time, these processes are supposed to renegotiate the relationships between the poor and local authorities, contributing to better future interactions and perhaps, more investment into poor communities.

In addition, while microsavings may be able to reduce gender inequity and facilitate higher rates of participation in civil society and leadership among women, it may also put a larger

burden on women. Women who participate in microsavings may be required to to take care of their family both inside and outside the household, potentially letting men, and the government off the hook.

Lastly, while microsavings may help individuals avoid eviction, or secure ration cards, the impact of microsavings is limited if slum dwellers are unable to successfully engage the government or the international development community. In most places, there is no way to sidestep the government when it comes to providing trunk infrastructure, creating and funding social programs, or creating broad policy changes that can impact the health of the population. Without the support of the government, it is likely that the successes of microsavings would be limited to small-scale projects. To maximize the likelihood of government involvement, unlike many organizing efforts, the microsavings structure not only confronts, but partners with government, using well established strategies developed over years of practice.[28]

Overall, microsavings has the potential to address the political, economic, social and physical determinants of health in the informal settlement context. For public health, microsavings represents an opportunity to *lift up what is already working*. There are many ways this could manifest: donors could channel public health monies to federations, while policy makers could ally with local federations to advocate for health-supporting services. Researchers could share health data with microsavings groups or federations or collaborate with federations to conduct enumerations that collect essential information about health, while those in ministries of health should be aware of opportunities to work with such groups. NGOs could collaborate with microsavings groups to improve ongoing public health interventions (e.g. bed nets could be distributed through the extensive microsavings networks, or outreach workers could attend microsavings meetings, etc.) or even build new interventions that layer onto the activities of the microsavings groups, for example creating a funding pool to help individuals access preventative health care regularly or support transport for care. The possibilities are powerful, and in the context of increasing urbanization and the rapid growth of slums, there is no better time than now.

Figure 1: Formation, Function, and Federation-A progression of microsavings in an informal settlement

Formation

Ath the informal settlement level, the supporting NGO makes residents aware of the opportunity to save and access loansto participate within villages

Function

Within each village, The NGO introduces rituals (e.g. enumerations, daily savings, elected leaders, etc.) and principles to guide the group in first doing savings and loans, then buildlng to saving together for housing and land and ultimately to engage in advocacy and community improvement projects.

Federation

The NGO supports as needed, federation at the settlement, regional and national level allows groups to work together on even broader projects and engage in advocacy.

Table 1: The Social Determinants of Health and the Role of Microsavings

Social Determinant of Health	Role of Savings Groups
Economic	
Inadequate and unstable income	Microsavings individuals to accumulate savings or access loans to smooth consumption.
No/limited livelihood opportunities	Microsavings allow individuals to create new livelihood opportunities or support existing businesses through loans or withdrawal from savings.
Limited/no safety net	Microsavings allow individuals to accumulate savings, providing a cushion, or safety net during emergencies.
Inadequate or unstable or risky asset base	Microsavings allow individuals to build up an asset base, particularly new housing
Physical	
Poor quality and insecure, hazardous and overcrowded housing	Microsavings allow groups to save collectively and secure loans from external donors, while the network and NGO support structure facilitate the process of negotiating with relevant authorities, designing and often building improved or new housing, sometimes including in home toilet facilities and piped water.
Inadequate infrastructure for basic services (sanitation pipes, roads, lights, footpaths, water points, toilets, etc.)	Microsavings allow groups to negotiate with local authorities and engage in long-term processes to bring infrastructure into communities
Social	
Inadequate provision of social services (water, health clinics, policing, waste disposal, etc.)	Microsavings allow groups to negotiate with local authorities and engage in long-term processes to bring services into communities
Gender inequality	Microsavings encourage female savers and leaders, shifting women's perceptions of themselves, and communities perceptions of women
Political	
Inadequate protection of poorer groups through law	Federation negotiates for better social protections, through advocacy efforts aimed at government policies
Lack of land tenure/threat of eviction	Microsavings equip groups with rules of how to fight eviction, federation allows groups to negotiate with local authorities about tenure, and exchange facilitates sharing of successful strategies
Poorer groups voicelessness and powerlessness	Federation leads to consolidation and amplification of the voice of the urban poor, forcing the government to hear their demands, while enumeration quantifies the extend of need and living conditions
Source: Adapted from Mitlin et al. "Capital, Capacities and Collaboration: the Multiple roles of Community Savings in Addressing Urban Poverty." 2011.	

People, Place and Health in the Mathare Slum, Nairobi, Kenya

Introduction

For the first time in history, more than half world's population lives in cities.[3] By the middle of the 21st century, the proportion of people living in urban places will almost double, increasing from approximately 3.4 billion in 2009 to 6.4 billion in 2050.[4] Much of this growth occurring in cities of the global south; in fact, in the next 30 years, the urban population in these countries will more than double.[3] Many of these governments are already unable to keep pace with such rapid rates of urbanization, leading to the growth of urban poverty and the mushrooming of slums, or informal settlements.[5] As defined by United Nations Human Settlement Program, a slum is a contiguous settlement that is often not recognized or addressed by public authorities as an integral or equal part of the city, where inhabitants have inadequate housing and basic services, and residents living under the same roof lack one or more of the following: access to safe water; access to sanitation; secure tenure; durability of housing and sufficient living area.[2] Worldwide, an estimated 828 million people live in slum conditions, and more than 90% of slums are located in cities of the global south.[3]

While urbanization can be beneficial for health, the rise of slum populations and lack of carefully designed health promotion strategies targeted for the specific needs of urban slum dwellers has made many cities in the global south confront deep health inequities.[1] As the UN-Habitat and World Health Organization stated in their 2010 report, *Hidden Cities: Unmasking and Overcoming Health Inequities in Urban Settings*:

> *"Health inequities are the result of the circumstances in which people grow, live, work and age, and the health systems they can access, which in turn are shaped by broader political, social and economic forces. They are not distributed randomly, but rather show a consistent pattern across the population, often by socioeconomic status or geographical location. No city – large or small, rich or poor, east or west, north or south – has been shown to be immune to the problem of health inequity."* [3]

The challenge of urban slums is particularly acute in Kenya and its capital city Nairobi, where over 65% of the capital's 3.1 million people live in informal settlements occupying less than 10% of the land area.[70,71] Slum dwellers in Nairobi experience poorer health than their better off urban counterparts: in one study, under five mortality in Nairobi was found to be 64/1000, while the under five mortality in Korogocho (an informal settlement) was 92.5/1000.[22] Approximately 33% of Nairobi's slum dwellers reported that their children had diarrhea compared to less than one in five in other areas of the city, [24] and HIV/AIDS prevalence in Kibera (often referred to as Nairobi's largest slum) is 14%, double the national prevalence.[23]

While poor health in slums is generally attributed to the conditions in which people grow, work and age, most empirical analysis examining health in informal settlements focus on one disease, risk factor, or treatment regime and fails to account for the multiple and related forces that influence health in these communities. One implication of such analyses is that health promotion strategies will attempt to treat health outcomes but fail to alter the underlying conditions that are making slum dwellers sick in the first place.

In this paper, I highlight the importance of a *relational approach* to understanding and analyzing health in places. By a *relational approach*, I mean that rather than just focusing on one disease, risk factor, or treatment regimen, I focus on more distal factors that shape health like the economic, physical and social factors which constitute *place*. Moreover, rather than focusing on economic, physical, and social characteristics of place in a static way, I examine how people interact with place to shape health.[18] I accomplish this by using detailed household survey data collected by and with slum dwellers in the Mathare informal settlement of Nairobi, Kenya, in order to assess *what* living conditions matter for health. I use interviews, focus groups, and observations to understand *how* such conditions matter for health, i.e. how people interact with place to produce good or poor health.

Background

In the context of inadequate government response to the growth and persistence of slums, Kenya's urban slum dwellers have had to turn to non-governmental organizations (NGOs) in providing life-supporting essential services. One important group in Mathare is Muungano wa Wanavijiji (Muungano), an organization of over 60,000 slum dwellers across Kenya that supports organizing, microsavings and advocacy for slum upgrading and human rights.[27] Microsavings groups serve as the primary means of organizing slum residents for Muungano, and these groups provide a social and financial safety net for slum dwellers. In addition, the savings groups survey and map their communities to assist and inform advocacy efforts to demand basic services such as water, sanitation and electricity.[27] The local savings groups are supported by Muungano Support Trust (MuST), an NGO that provides technical, surveying, planning and mapping support for savings groups.[72] Both Muungano and MuST are members of the international network Slum/Shack Dwellers International (SDI), which works in over thirty-three countries in Africa, Asia, and Latin America to promote community driven, inclusive urban development.[26] At the request of these NGOs, the University of California, Berkeley (U.C. Berkeley), partnered in data collection, analysis and spatial mapping in Mathare starting in 2008 and continuing through today.

Methods

Study Setting and Population

Mathare Valley is situated approximately 6 kilometers northeast of Nairobi's central business district and is bordered by Thika Road to the north and Juja Road to the south ***(see Figure 1).*** The settlement lies within a valley between the Mathare and Gitathuru Rivers. Mathare informal settlement is comprised of 13 villages including Mashimoni, Mabatini, Village No. 10, Village 2, Kosovo, Bondeni, 3B, 3C, 4A, 4B, Gitathuru, Kiamutisya, and Kwa Kariuki. One hundred and fifty thousand residents live in the 13 Mathare villages that we sampled from for this study, translating to a population density of .889/km^2.[41] Despite being one of the oldest and largest settlements in East Africa, little work has been done to describe living conditions that might shape health in this place.[73]

Data Sources and Collection

The primary source of data I used for this paper was a *household cross-sectional survey (n=650)* developed by Muungano, MuST, and U.C. Berkeley. In addition to basic demographic information, the survey included questions meant to measure living conditions. The survey contains an amalgam of questions deemed important by Mathare residents and key social, economic, and physical factors identified as important for shaping health in the informal

settlement context such as access to safe water, quality of housing, income and livelihood, etc.[1,3,45] The survey also includes questions about self-reported health outcomes, including self-reported health and frequency of childhood illness (see *Appendix I* for survey). The initial survey was pilot tested by Mathare residents; questions were modified based on the results of the pilot-testing (e.g. adding in units for a question about water consumption in a given day). In August 2011, Muungano members and University of Nairobi students administered survey questions, conducting interviews with residents of 650 households randomly stratified across thirteen villages in Mathare. The intended recipient of the survey was a household adult who could be found at home. University of Nairobi and Muungano members jointly worked to enter this data.

In addition to the household survey, I used on-the-ground *spatial and mapping* data collected by Muungano and MuST using Geographic Information Systems in April-August 2011. Muungano and MuST mapped households and features such as water taps, toilet and ablution blocks, sewers and open drains, transportation routes, commercial districts and other environmental features.

Lastly, I used qualitative methods—*in-depth interviews, focus groups, and observations*—to get the perspective of local residents and local experts on living conditions and health. I interviewed 40 Mathare residents (24 of whom were Muungano members) and 8 community health workers across four villages in Mathare, 7 MuST staff members, and conducted 7 focus groups with males and female Muungano members who were also Mathare residents (*see Appendix II, III, IV and V for guides, respectively*). I used convenience sampling to select a broad range of female and male Mathare residents who were also Muungano members for interviews, with the rationale that the ongoing partnership between Muungano and MuST would facilitate greater trust, rapport, and willingness with research participants. In order to select non-Muungano, Mathare residents for interviews, I used aerial maps of villages, numbered each structure, and generated random numbers using an online number generator.[74] I used these randomly generated numbers to determine which households to approach for interviews. If no one was home, I went to the next number on the list. In order to identify community health workers to interview, I worked with Muungano members, who connected me with to two community health workers from four villages. Finally, I purposively selected MuST team members for interviews based on whether they had experience working in Mathare or working with savings groups. A Muungano member served as a translator during interviews and focus groups in Mathare. I developed an understanding of the broader context of health in Mathare through direct observations in Mathare and informal conversations with vendors, service providers, outreach workers, and residents.

Analysis

I conducted basic descriptive analysis of survey data and assessed the relationship between individual-level and community-level exposures and self-reported health outcomes. I selected variables for the analysis that described the physical and social dimensions of individuals' living conditions (such as type of toilet, quality of health services, etc.) as well as the economic circumstances of households. These variables have been characterized as important for shaping health in the informal settlement context.[3,7,9,45] In Table 1, I identify which variables I included from the cross-sectional survey, provide information about how each variable was categorized for analysis, and the question used to collect that information:

Table 1. Definition and Categorization of Variables from the Cross-Sectional Survey

Variable Name & Categorization	Question & Definition
Basic Amenities	
Reliability of Water Source	*Question 24. How reliable is your water?*
Not reliable throughout the day	Only morning and evening; daytime; only daytime; only nighttime; now and then
Reliable throughout the day	Reliable throughout the day
Location of Water Source	*Question 23. What is the water source for the household?*
Away from Household	Well; Buying from water vendors; Water kiosk
Near or In Household	Piped water connected to the house; yard tap
Water Collection Time	*Question 25. Time Spent Collecting Water*
< 1 hour	Less than 1 hour
$\geq$ 1 hour	About 1 hour; 2-6 hours; More than 6 hours
Distance to water source	*Question 23. Distance from the house*
Meters	meters
Shared toilet	*Question 26. What type of toilet do you use?*
Private toilet	Individual toilet
Shared toilet	Public toilet
Distance to toilet	*Question 26. Distance to the toilet*
Meters	meters
Electricity in the House	*Question 32. What type of electricity connection is in the house?*
No	None
Yes	Formal; Informal; Both Formal and Informal
Organized Waste Disposal	*Question 29. Methods of Solid Waste Disposal*
No	Disorganized Methods
Yes	Organized Methods
Adequate Internal Roads	*Question 47. Would you say the internal roads in this village are adequate for people and vehicles?*
No	No
Yes	Yes
Social Services	
Satisfaction with quality of healthcare	*Question 42. How would you rate the quality of health services for your household?*
Not Satisfied	Unsatisfactory; Extremely Poor
Satisfied	Satisfactory; Good; Very Good
*Accessed formal healthcare**	*Question 38. Where do you access health services?*
No	Dispensary; Private Hospital; Herbalist
Yes	Health Centre; Clinic run by NCC; Clinic run by NGO; Public Hospital
Distance to health facility	*Question 38. Distance of health facility accessed*
Kilometers	Kilometers
Type of school children attend	*Question 34. What type of schools do your children attend?*
Informal	Informal primary school; informal secondary school
Formal	Formal primary school, formal secondary school
Distance to school	*Question 34. Distance to school attended*
Kilometers	Kilometers

Land tenure & Housing Conditions	
Type of Structure Owner	*Question 7. Type of Structure Owner*
Rent	Rented
Own	Owned
House Size	*Question 17. How big is this structure*
≤ 100 sq. feet	≤100 square feet
> 100 sq. feet	>100 square feet
Type of Household Floor	*Question 19. Type of building materials (floor)*
Cement/Wood	Cement; wood
Earth	Earthen
Type of Wall Materials	*Question 19. Type of building materials (wall)*
Not Permanent	Mud; Iron sheet; Scrap Metal
Permanent	Stone; Wood; Bricks
Type of Cooking Energy	*Question 33. What is the source of energy for cooking and lighting?*
Clean sources	Electricity, Paraffin, Gas
Unclean sources	Charcoal, Firewood, Briquettes
Income & Livelihood	
Income	*Question 50. Approximate income per month form all household members*
< 10,000 Ksh	Below 2500; 2501-5000; 5001-10,000
≥ 10,000 Ksh	10,000-15,000; above 15,000
Type of Employment	*Question 50. What is the household's source of income?*
Informal	casual laboring; informal business; relatives & friends outside household; begging
Formal	salaried employee; formal business
Community & Safety	
Perceives village to be safe	*Question 46. Do you consider this village to be secure enough?*
No	No
Yes	Yes
Victim of crime in past year	*Question 48. Have you or anyone in this household been a victim of crime in the past year?*
No	No
Yes	Yes
Participates in a community group	*Question 52. Are you a member of any community group in Mathare?*
No	No
Yes	Yes
Village-Level Exposures	
% Income above 10,000 Ksh	Calculated as the % of respondents within a village with income above 10,000Ksh
% Formally employed	Calculated as the % of respondents within a village who are formally employed
% Reporting secure village	Calculated as the % of respondents within a village who report that they perceive the village to be safe
% Participating in community group	Calculated as the % of respondents within a village participating in community groups
% With Household Water Source	Calculated as the % of respondents within a village with a household water source
% With Quality Health Care	Calculated as the % of respondents within a village reporting

	satisfaction with quality of health care
% With Earth Floors	Calculated as the % of respondents within a village with earthen floors
Health Outcomes	
Self Reported Good Health	*Question 36. In general, how would you rate your health?*
No	Fair; Poor;
Yes	Excellent; very good; good
Self-Reported Low Frequency of Childhood illness	*Question 41. If you have children under 5 yrs., how frequently do they get sick with a fever, vomiting or diarrhea?*
No	once every few months; once a year or infrequently
Yes	Once a week or more; About every 2 weeks; once a month

*From the cross-sectional Survey: see Appendix I
**In the Mathare context, private hospitals refer to conveniently located, substandard facilities with unqualified providers

I generated frequencies and means to describe the study population across villages. I used logistic regression to calculate odds ratios and corresponding 95% confidence intervals for associations between exposures and outcomes (self-reported rating of health and frequency of childhood illness). To account for village-level clustering, I used mixed-effects models. As a first step, I generated unadjusted odds ratios for each of the variables of interest. I included all variables with a p-value < 0.2 in unadjusted analyses in the multivariable model, and retained all variables with a p-value < 0.2 from the multivariable analysis in the final model. I used a criterion p-value of 0.2 because it was a moderate threshold for a variable to be considered in the final multivariable model given the sample size. The unit of analysis for all models is at the individual level. To ensure robust results, I performed sensitivity analyses whereby I analyzed the data with linear probability models, re-categorized the outcomes, and assessed the impact of missing data and omitting certain variables.

For mapping data, Geographic Information Systems (GIS) was used to make various maps each with a specific focus, e.g. assessing water and toilet access by plotting water points and assessing spread and distance from residents, mapping electricity connections, sanitation infrastructure, roads, rivers, facilities, businesses, etc.

Lastly, a local translator translated and transcribed data from all interviews and focus groups, which were conducted in Kiswahili or Kikuyu, while I transcribed interviews conducted in English. I also transcribed notes from observations. My approach to coding was guided by *Qualitative Research Design: An Interactive Approach*, by Joseph Maxwell and employed two stages of coding after a few of transcripts. The first stage of coding involved *organizational coding* (excerpting all health related texts), and the second stage used *substantive coding*, which is used to further organize organizational codes.[75] I chose to use substantive coding because it is apprropriate for primarily descriptive codes (versus theoretical codes, which imply a broader theory is being generated).[75] Thus I identified all health-related excerpts by using organizational codes, and then further coded those excerpts based on substantive codes like pathway-toilet, pathway-water, pathway-livelihood, pathway-food, general health, etc. I subsequently examined excerpts from each code to identify common narratives by sector.

Results

In the following sections, I describe living conditions *across* and *within* the 13 villages of Mathare by sector. I highlight which relationships between living conditions and health were statistically significant in the final multivariable model. Lastly, I expand on some of the 'relational meanings' of these variables using narratives from residents, community health workers, and members of the MuST team to highlight how people interact with place to produce poor or good health.

Central to the analysis in the subsequent sections are the results from my analysis of the survey data, which can be found in **Tables 2**, **3** and **4**. In **Tables 2 and 3,** I summarize selected descriptive statistics from Mathare to provide an overview of living conditions across a number of sectors, from basic amenities to housing at the individual and community level. **Table 2** not only serves to highlight Mathare-wide deprivation, but also showcases how conditions vary across villages. For example, across Mathare, 83% of survey respondents share a toilet (versus a private toilet). However, this number varies dramatically across villages: 66% of residents report using a shared toilet in 3B, while 100% report using a shared toilet in Kiamutisya. Across Mathare, only 16% of residents report access to a reliable water source, with respondents from 6 of the 13 villages reported no access at all. While 55% of Mathare's residents reported that they were satisfied with the quality of healthcare, in two villages, Mabatini and 3B, less than half report satisfaction with healthcare quality. Fifty-four percent of residents live in a home smaller than 100 square feet, with walls made out of mud, iron, or scrap metal (80%), and earthen floors (52%). Only 42% of Mathare residents make an income over 10,000 Kenyan Shillings, with only 10% of the earning their income through formal employment. A more comprehensive summary of descriptive analysis can be found in *Appendix VI*.

In **Table 4**, I summarize the statistically significant relationships between individual-level and community-level exposures and self-reported health outcomes from the multivariable model. The results of the complete analysis can be found in *Appendix VII*. Residents who reported satisfaction with healthcare quality, attendance of their children in formal school, and income over 10,000 KSh had a higher likelihood of self-reported good health, while residents who reported having earthen floors and perceiving internal roads as adequate tended to have a lower likelihood of self-reported good health. In addition, residents who lived in communities with a higher proportion of the community participating in community groups tended to have a higher likelihood of self-reported good health. Residents who reported a water source near their home, water collection times of one hour or longer, satisfaction with healthcare quality, children in formal school and structure ownership were more likely to report low frequency of childhood illness.

The main findings were robust to sensitivity analysis (with the exception of the relationship between the perception of adequate internal roads and self-reported health, which did not demonstrate a statistically significant association in all analyses).

Livelihoods

Almost 90% of Mathare residents work in casual or informal employment, which is generally characterized by instability, subsistence level pay, and poor working conditions, and fewer than 40% can find employment outside of the informal settlement.[22] Employment in the informal sector (i.e. casual labor, informal business, support from family or relatives,

begging) is a Mathare-wide reality. Only 25% of residents reported being formally employed (i.e. salaried employment or formal business) in Gitathuru, the village with the highest proportion of residents reporting formal employment. Common casual employment for women includes washing clothes, which earns about 100 – 200 Ksh per day and construction labor for men, which earns 200-250 Ksh per day. More than half of residents (58%) do not earn greater than 10,000 KSH per month (115 USD); this proportion rises to 80% in Kiamutisya and falls to 13% in Village No 10. An income of 10,000 Ksh or less is inadequate to support even the most basic expenditures, as highlighted by the breakdown of average monthly costs reported by Mathare residents during the household survey:

- Food= 6538 KSH
- School Fees = 1602 KSH
- Transport = 1523 KSH
- Security = 1450 KSH
- Rent = 1245 KSH
- Health Care = 792 KSH
- Water = 437 KSH
- Electricity = 337 KSH
- Toilet use= 184 KSH

TOTAL= 13,938 KSH

While primary school is a fight and free in Kenya, there are not enough public schools in Mathare to accommodate all children, so families are often forced to send their children to private school. Many families believe the education is better at private schools and are willing to pay additional costs for these facilities. Thus, in the list above, *school fees* refers to fees that residents might pay for private school. Transport fees refer to bus and matatus (private vans) for traveling to work and accessing basic goods.

The total average monthly expenditure comes out to almost 14,000 KSH per month, while the average income is 8,500 KSH. While this gap between expenditure and income may be a function of recall error (with residents having a difficult time reporting specific expenses and/or average income in the context of informal labor), such data seem to point towards extremely tight margins between household income and household expenditure, an idea reinforced by resident narratives (described below).

In the multivariable model, those who made an income equal to or above 10,000 Ksh were almost twice as likely to report good health than those who made less than 10,000 Ksh (adjusted odds ratio [aOR]=1.91; 95% confidence interval [CI]: 1.11-3.27; p=0.02). Though not statistically significant, residents reporting formal employment (also had a higher likelihood of reporting a lower frequency of childhood illness than those who were informally employed (aOR=2.52; 95%CI: 0.91-6.92; p=.07).

Narratives from Mathare residents highlight *the many ways* income and health is connected. Some are straightforward, like low income leaving them to be unable to buy nutritious food (one of the most commonly cited examples), pay to use the toilet, pay for water, afford a permanent home, or pay school fees for their children. But the narratives also highlight

more complex connections. This excerpt from an interview with a female vegetable vendor in Bondeni, a village in Mathare, highlights one way which income and health are connected.

> *"This is how stress comes. You go to the market and buy things. You know every day is different. An example. For kale, by the second day they are turning yellow, so you get rid of those. For tomatoes, there are rats in my store. That is stress. Second, I cannot refuse credits to my friends. So to go to the market, I will have to get loans from my friends. These are my customers, I must adjust to their needs, cause I know eventually they will pay. That is stress. Also, at the end of the month, there is house rent and school fees. By the 20th, stress is jumping up and down . . . You know, ulcers and stress are not friends. Sometimes I close shop for a week when the ulcers wake up . . .When you don't have money, you cannot have good health . . .When I have money, it's easier. I eat well, and tomorrow will look after itself. When I have a 100 bob [slang for Kenyan shillings] I eat meat. Tomorrow I'll continue to eat spinach."*

This example highlights a *cyclical* relationship between income and health for this woman: low income leads to stress and exacerbates ulcers; ulcers force her to take time off work, which limits her ability to earn income and buy nutritious food. Importantly, this narrative points to potential reverse causality in the relationship between income and health. The increased likelihood of reporting good health among those making more than 10,000 KSh might therefore be a spuriously inflated estimate of the association between income with health. Not only do Mathare residents shed light into how income and health are connected, they also highlight how factors that are not statistically significant in multivariable analysis might also interplay with other factors to shape health: in the excerpt above, this resident highlights how low income, the low income of her customers, and the challenges of working in the informal economy interplay to create stress and exacerbate her ulcers.

A Mathare-based community health worker highlights another complicated relationship between income and health:

> *" . . . now I have a client, I know this woman who is infected [with HIV] and is running around with men, and when I went to talk to her, she told me 'My children slept hungry for 2 days, and when this man came with 200 Ksh, I couldn't tell him no because I needed that 200 bob [Kenyan slang for shillings] to cook for my children. So, I had to do that.' And she went further to tell me, 'And when I told him to use a condom, he said he didn't want to use a condom. So I had to agree for my children.' She had to go with that man so her children would eat . . . Yes, it happens. It's common, very common."*

While the relationship between income and childhood frequency of illness was not statistically significant in the multivariable model, this example tells a story of how lack of income leads to food insecurity for a woman and her children. In order to feed her children, she potentially puts her own health and the health of the person with whom she has unprotected sex at risk (i.e. she could get reinfected, exposed to additional sexually transmitted infections, or he could become infected with HIV). In this example, the relational framework allows us to better understand how income and health are connected in the informal settlement context.

Housing

The majority of Mathare residents (83%) are renters, meaning they do not have title to the land or the structure they live in. The quality of housing is poor, with the majority of residents (54%) living in housing that is scarcely bigger than 100 square feet, with roofs and walls made of impermanent materials like iron sheets, mud, or scrap metal (80%). The size of housing ranges dramatically between villages: only 19% of residents from 4B have housing over 100 square feet while in Kosovo, 70% of residents have housing over 100 square feet.

The conditions inside the house are equally inadequate: an average of 4 people share housing, with 52% of residents living in a house with an earthen floor. Forty-two percent of residents report cooking indoors with wood, briquettes, or charcoal, unclean sources of fuel known to contribute to indoor air pollution.[76] Only 17% of residents have access to a private, individual toilet, and 51% report using a yard tap, meaning that water piped into the home is rare. While most people have access to electricity (22% report no electricity), only 9% have a formal metered connection and the majority (68%) were informally connected. Here too, the data points to differing conditions in housing between villages: all residents in Kiamutisya have earthen floors, while in Gitathuru most residents report having a cement floor (86%).

Of the housing-related variables that were included in the multivariable model, renting (not owning), having an earthen floor (as compared to a cement or wood floor), and cooking indoors with wood, briquettes, or charcoal (versus cooking with paraffin, gas, or electricity) were statistically significantly associated with poor health. Structure owners were two times more likely to report low frequency of childhood illness than renters (OR=2.27; 95%CI: 1.28-4.02, $p=.04$), while those with an earthen floor were significantly less likely than those with a wooden or cement floor to report good health (aOR=.38, 95%CI=0.23-0.65, $p < 0.001$). Lastly, those who cooked indoors with wood, charcoal, or briquettes (a measure of indoor air pollution) were significantly less likely to report good health than those who cooked with paraffin, gas or electricity (aOR=0.51, 95%CI 0.36-0.72, $p < .001$, respectively).

The finding that cooking indoors with wood, charcoal, or briquettes is associated with poor health is consistent with the well-documented relationship between indoor air pollution and health.[77] Similarly, the finding that having earthen floors was significantly associated with reporting poor health was in sync with a large-scale study done in Mexico where dirt floors were replaced with cement floors. The study found that adults reported increased satisfaction with housing and quality of life and had lower scores on depression and perceived stress; the study in Mexico also found a positive health impact on young children, who had reduced incidence of parasitic infestations, diarrhea, and prevalence of anemia as well as improvement in children's cognitive development.[78]

While resident narratives did not help elucidate the exact nature of the relationship between earth floors and health, interviews with residents and MuST staff did help piece together the nature of the relationship between structure ownership and health. Many residents talked about the desire to own their own land and home—in fact, when they were asked what they would change in their community if they could, over and over the response was housing. As one staff member said, residents believe "*own a home, and the rest [toilets, water, etc.] will come*." MuST's work doing slum upgrading in Nairobi's informal settlements also offers insight into how structure ownership and health might be related—unlike many slums around the world

where slum dwellers are squatting on land that does not belong to them, in Nairobi, the shacks in which residents live are owned and rented by individuals. In Nairobi slums, those who rent are often hesitant to engage in efforts to improve housing without guarantees that they will be the ones that benefit from the investment.[27] Thus, taken all together, structure ownership may be associated with increased perception of quality of life, it may be connected to having better housing as a result of investing in it, and/or it may be that structure owners have other assets or characteristics that those who rent do not.

While housing materials and informal electricity did not have a statistically significant association with health in multivariable modeling, a number of residents discussed the role of frequent fires in harming health, pointing to impermanent housing materials as part of the problem:

> *"Here in this village, the thing we are not happy about is that when houses catch fire, they burn completely because they are not made of stone. They are temporary houses. And when they catch fire they burn completely. The things that bother us very much in this area are things like that."*

This narrative is corroborated by media reports that attribute frequent fires in slums to poor quality of housing, illegal electrical connections, and inadequate roads that make it difficult for emergency vehicles to respond fires.[79] Such narratives highlight the interplay between several conditions of place—impermanent housing materials, housing density, and illegal electricity connections—to shape health. One Mathare resident articulated less obvious relationships between fire and health, alluding to both mental and physical health changes as a response to fires in his village:

> *"Another thing, when these houses burned down, we were left with nothing. So whenever you see smoke, you start to worry because it reminds you . . . So as I was saying, I would like to build my own permanent house instead of living inside 'polythene bags' plastic, this paper house . . . But, since my house burned down I have had high blood pressure. I have to take pills everyday (shows the pills). I pay 600 shillings every month. But only since the fire. So BP [blood pressure] and diabetes bothers me."*

Another resident describes another potential connection between poor housing and health, describing how impermanent housing materials, poor construction, and inadequate sanitation and drainage (discussed more below) combine to bring sewage and rain water into the house, potentially leading to infectious disease:

> *"Even refugees live better than us. When the rain comes it washes us away.*
> *Rain, and bursting drainage floods the houses."*

In these examples, the relational framework unpacks relationships between housing and health that while not significant in the multivariable model, are important in the lives of Mathare residents.

Basic Amenities

Given the lack of private toilets or water piped into homes, most residents rely on public or shared infrastructure for both. According to respondents of the household survey, 51% of residents have water near or in their household (water that is piped in to the house or

through a yard tap), while the remaining residents report use water vendors or kiosks. Our mapping data indicate that the geographic spread of water points was fairly good, as 76.3% of the population in Mathare live *within* a 50 meter walk to a water point and 100% within the 500 meters that Sphere standards (a set of internationally recognized, universal minimum standards in *humanitarian response areas)* recommend.[80] However, our mapping data reveal that the total number of water points is far too low to adequately serve the communities: while Sphere standards specify a maximum of 250 people should share one water point, our mapping data indicates that only 4 of Mathare's 13 villages meet this standard, with residents in some villages share water points with many more people (e.g. 1504 people per water point in Kwa Kariuki). Residents reported unreliability of water (84%), high cost (14%), distance (14%), and contamination (3%) as challenges to water access. Similar to water, more than 83% of residents rely on a public toilet facility. Community blocks with either pit latrines or toilets that are generally not connected to a formal sewer system act as the primary community toilet. Toilet infrastructure falls short of Sphere international standards as well: while a maximum of 20 people per latrine is recommended; across Mathare, anywhere from 17 to 232 people share a toilet.

While our survey and mapping data indicate a lack of adequate public facilities for both water and toilet, only water-related variables were associated with health. Specifically, those who had a water source near or in the house were two and a half times more likely to report low frequency of childhood illness than those who bought water from vendors or a water kiosk (aOR=2.52; 95%CI: 1.39-4.55, p=.002). Surprisingly, those who reported water collection times greater than one hour were more than two and a half times more likely to report low frequency of childhood illness (aOR=2.61, 95%CI 1.34-5.10, p=.005).

While survey and mapping data begin to tell the story of water in Mathare, staff at MuST add an additional layer, highlighting that a high demand on the existing system and poor maintenance has caused the system to leak, leading to low pressure flows, intermittent supply and dry taps. A large number of illegal connections further contribute to low water pressure and contamination of clean water supplies. A Mathare resident provides the final link in the causal chain connecting water and poor health:

> *"Us, we drink sewage all the time. When the plastic pipe breaks, of course sewage gets in. It passes by a toilet, through a garbage. That's why we often get sick."*

This last narrative may provide insight into why toilet facilities were not statistically significant in their association with health in the multivariable model; as with water, mapping and survey data do not tell the whole story. Resident narratives suggest that it is not toilet facilities themselves that create poor health, but rather the fact that inadequate infrastructure forces residents to resort to specific behaviors, like open defecation of the use of flying toilets (the practice of defecating into a plastic bag and throwing waste outside the house), a practice commonly referenced in Mathare and documented in other Nairobi slums.[38,42] In the context of limited waste disposal services (72% lack organized waste disposal) and poor sanitation infrastructure, residents become ill, as highlighted in one focus group with male Mathare residents:

> *Interviewer: And what prevents you from maintaining healthy bodies?*

Respondent: Open sewer. I could be sleeping and I'm breathing sewage fumes, with mosquitoes biting me all over. That's a problem.

Respondent: Also lack of good food. Sometimes the sewer overflows and gets into the house.

Security

Seventy-five percent of Mathare residents perceive their village to be unsafe. In some places, this sense of insecurity reaches epidemic levels: in Village 3C, 95% of reported residents feeling unsafe, and a staggering 43% reported being a victim of crime in the last year.

While perception of village safety was not significantly associated with health in multivariable modeling, it was a salient issue according to both Mathare residents and MuST staff. Their narratives come together to depict a reality where insecurity is a function of inadequate physical infrastructure, lack of social services and poverty. MuST staff provided insight into the extent and nature of gang activity in Mathare, highlighting the paradox that in a context where police services are lacking, gangs both charge residents to provide security and contribute to insecurity by controlling 'shared' water and toilet infrastructure (while charging higher prices per use or per jerry can of water—3ksh/20L in general, but higher during shortages, according to one article).[81] According to MuST, these cartels frequently control who has access by using a lock and/or armed guards, creating stress for residents, particularly women and children, who carry a disproportionate burden for gathering water.

Insecurity is a particular burden for women; female residents repeatedly cited insecurity as one of the things they disliked about their community. According to one female resident of Bondeni, insecurity is such a concern that they do not use the public toilets at night:

"Past eight [at night] . . . we use flying toilets at night…normally. . .you can't even go out!.... Do you understand flying toilets? You cannot go out at night if you live in the iron sheet houses below."

While she does not explicitly articulate the reason why women cannot go out at night, an Amnesty International Report synthesizing the experiences of Nairobi's female slum dwellers fills in the details. In this report, myriad features of place—public toilets instead of private ones, lack of public lighting, and inadequate or unresponsive police (i.e. reported crimes go unpunished) combine to create an environment that makes women vulnerable to sexual violence, physical assaults and possibly sexually transmitted infections.[46]

While I chose to describe crime and insecurity as facet of living conditions in Mathare, a community health worker from the village of Kiamutisya framed crime (both being a perpetrator and being a victim) as a health outcome instead, providing a unique way of understanding insecurity in informal settlements:

Oh, there is always something happening in our villages. Sometimes people are beaten. Like yesterday, there was someone who was so much beaten. They were saying he was a thief; he had stolen pipes. He had two broken limbs . . .Yes, more or less. Because that person who was stealing pipes yesterday, he was doing that because he didn't have money. People here don't have money; they are so down.

Social Services

In terms of social services, 55% of Mathare residents report satisfaction with healthcare, indicating that the quality of healthcare is either good, very good, or satisfactory. Satisfaction with healthcare varies between villages ranging from 30% (Mabatini) to 70% (Village No. 10) Sixty-nine percent of residents access formal health care (rather than informal care) when they need care, visiting clinics and hospitals. The remaining 31% of residents report that when they access care, they go to dispensaries, private hospitals and herbalists, informal care which is known for having unqualified providers, inadequate facilities, and limited equipment and supplies.[24] Across Mathare, 11% of children attend informal school rather than formal school, with rates as high as 25% in Gitathuru.

Respondents whose children attended formal school (versus informal school) were more likely to report both good health and low frequency of childhood illness (aOR=3.7; 95%CI: 1.69-8.08; p<.001, and aOR=3.33; 95%CI:1.18-9.45; p=.02 respectively). Although I controlled for one measure of income (those who earned 10,000Ksh or more versus those who make less than 10,000Ksh), it is possible that formal school could be acting as surrogate for socioeconomic status and that children who attend formal school come from families with more resources than those who attend informal schools. In other words, it is possible that the association between formal school and health is attributable to a correlated variable. It is difficult to know the exact nature of the relationship without additional input from Mathare's residents.

Being satisfied with healthcare quality also appears to be a significant predictor of self-reported good health, with those who report satisfaction with healthcare quality being almost eight times more likely to report good health (aOR=7.80; 95%CI: 4.52-13.44; p<0.001) and two times more likely to report low frequency of childhood illness (aOR=2.25; 95%CI: 1.25-4.06; p=.007). However, it is possible that those who report good health might be more likely to report being more satisfied with healthcare, perhaps because they are healthier and use healthcare less, or because they go to better facilities when they are ill. The nature of the relationship is not clear from the data. Mathare residents, local providers, and community health workers help fill in some of the details about healthcare quality, access, and health-seeking behavior. According to one resident:

> *". . . the proper health facilities are also not easily accessible. You have to go far to get treatment and you may not have the resources to do so. The government facilities may also lack medicine. You may be sent to buy the medicine from a chemist."*

A provider at a government clinic confirmed that medication outages were common. He added that being understaffed while seeing up to 200 patients in a given day translated to long wait times for patients. The picture that emerges from talking to providers, community health workers, and Mathare residents is that the average Mathare resident confronts a variety of healthcare options: private clinics characterized by little or no wait times and a convenient location but higher prices and inconsistent (often poor) quality, NGO-operated clinics with higher quality care at lower cost but long queues and highly specialized services (e.g. HIV/AIDS, TB), or government clinics that seem to fall somewhere in the middle--reasonable costs, adequately trained staff compared to private clinics, but long wait times and common outages. According to community health workers and local providers, residents often look to local, private clinics and chemists (local drug stores) as first line healthcare.

These findings are consistent with others who have looked at healthcare provision and health seeking behavior in other Nairobi informal settlements.[15]

When it comes to healthcare-seeking patterns, an outreach worker at a government clinic proclaimed that "*the language of the day is poverty*." He went on to describe what he meant with examples: a person who works in Eastleigh (an area neighboring the informal settlement) washing clothes, or a person who obtains a 'cash job' on the day he or she has a clinic visit scheduled will miss that visit, potentially compromising his or health. He also talked about the existence of '*informal mapping*,' whereby residents track the services each clinic provides: one clinic gives powdered milk, while another provides food every Saturday, and another provides 'ready food.' He mentioned that they commonly find patients who are getting follow-up care for HIV/AIDS at two clinics, collecting drugs, goods, and payment at each place, potentially compromising the quality of their care.

Resilience and Resources

While life is extremely harsh in Mathare, most residents are resilient and many find a way to survive and thrive. Too often in public health studies of urban slums, the data focus entirely on problems, but not the active solutions and innovations that local people employ, often in the absence of and sometime in opposition to the state. Perhaps one of the more compelling findings of this analysis was related to participation in community groups—the majority of which were savings groups. Across Mathare, 32% of residents reported participating in community groups. The rate of participation ranged from 17% in Village No. 10 to 48% in Gitathuru, where almost half of residents participated in community groups.

Multivariable analysis indicates that individuals living in communities with higher levels of participation in community groups had a higher likelihood of reporting good health than individuals living in communities with lower levels of participation in community groups (aOR=1.04 per one unit increase in the proportion of village-members participating in community groups; 95%CI: 1.01-1.07; p=0.011). I explore participation in depth one specific type of community group, microsavings, more extensively in *Paper 3* of this dissertation.

Discussion

There were a number of limitations with this study. With a cross-sectional study, I was only able to look at *associations*, not determine *causality*, as the temporality between exposures and outcomes is not always clearly defined. There were a number of associations I examined where the direction of the relationship remained unclear based on survey data, e.g. perception of quality healthcare and self reported health, or the association between income and self reported good health. In addition, statistically significant associations may have been a function of omitted variables, which may have led to overestimating the relationship between exposure and outcome. For example, the relationship between structure ownership or children attending formal school and self reported health may have been overstated because there were other unmeasured characteristics (e.g. socioeconomic status) that made these individuals different independent of structure ownership status or having their children attend formal school. In addition, while the survey was randomized and representative of Mathare, there were a relatively small number of observations in some villages, limiting my ability to do more sophisticated quantitative analysis, such as modeling interactions between various exposures to explore impact on health. My use of qualitative methods to examine

the connections between exposure and outcome variables helped address some of these limitations and bolstered the strength of the findings. Narratives from MuST, community health workers, and Mathare residents make reference to temporality, interactions between exposure variables, as well as the nature of the relationship between living conditions and health outcomes. For example, the narratives around income and health served to highlight that income impacted health, but that health also impacted income. In other cases, the narratives did not provide insight into the direction of the association, but served to fill in a more detailed picture, e.g. the relationship between satisfaction with health services and self-reported health and childhood frequency of illness.

The use of self-reported health as a measure of health also had limitations. In contrast to disease-based outcomes, which are generally based on clinical criteria or other objective measures, self-reported health is based on people's perceptions, which may vastly vary between individuals. Self-reported morbidity can be particularly misleading, with individuals who live in communities with high rates of illness and few clinics more likely to assess certain symptoms as normal when they are actually preventable.[83] Recall bias can also be an issue with self-reported health, particularly for childhood frequency of illness, where respondents were asked to report how often their child is ill (once a week/or more, about every 2 weeks, once a month, once every few months, once a year of infrequently). At the same time, self-reported health has been shown to have a predictive value with regards to mortality and use of physician services (but not with chronic disease), is arguably the best measure of how people feel, and has been consistently used for national health surveys as a measure of health.[83–86] This measure was consistent with our approach of conceiving of health in broad terms, not just in terms of illness.

Taken together, our survey, narrative, and spatial mapping results paint a rich and dynamic - albeit incomplete- picture of living conditions and health in Mathare, an under described informal settlement in Nairobi, Kenya. While many of our findings support those by other researchers working in different informal settlements of Nairobi, our use of the relational approach sheds light onto the *processes* by which health is shaped in Mathare.[22,24,34] These processes or pathway, were often unexpected, complex and multifactorial--for example, toilets were not associated with health outcomes in our study, but resident narratives and findings from other Nairobi slums highlighted that in the context of insecurity and gender inequity, toilets become a space for violence against women. An understanding of such unexpected connections may shift potential health interventions and calibrate them to be more responsive to the broader conditions in which health is actually shaped. In this example of toilets becoming a space of violence against women, building more communal toilets without attention to security may just create more of the same—instead, or in addition, interventions focused on bringing in more public lighting, shifting social norms around gender, or advocating for private toilets may be more effective. Similarly, through the relational framework, we understood that the person who steals pipes in his village is doing so as a consequence of being poor, which itself is a function of broader anti-poor policies, potentially reflecting a need for broader level policy change that ensures he can earn a living wage. For some, the process by which health is shaped is one where residents responded to living conditions in ways that ensured short-term survival and jeopardized long-term health, like the woman with HIV who put herself at risk for reinfection and other sexually transmitted infections in order to feed her children. In this case, health promotion efforts that emphasize condom use or try to increase awareness about how HIV is spread are

conceivably less likely to be effective than interventions focused on improving livelihood opportunities for women or increasing food security. On a positive note, one of the more interesting findings of this study was that communities with higher levels of participation in community groups (particularly savings groups) were more likely to self report good health, suggesting that public health efforts that build upon community group affiliations, which may be able to positively build health.

This analysis also underscores the heterogeneity of places. In a context of deprivation, Kiamutisya is more deprived than other villages across several sectors, including quality of housing, village safety, and income. In contrast, Gitathuru appears to be faring well when compared with other villages in Mathare: a relatively large proportion of residents reported having housing bigger than 100 square feet with cement floors, income above 10,000 Ksh, or perceiving their village as safe. These findings highlight that there are marked differences between villages, even in one informal settlement. Such differences have implications in terms of understanding which factors shape health and in terms of informing more targeted responses. Kiamutisya may require more intervention across multiple sectors than a place like Gitathuru. At the same time, Gitathuru residents reported the highest rate of children enrolled in informal school, potentially important from a health perspective given the significant relationship between formal school and self-reported health and frequency of childhood illness. Conducting analysis that is sensitive to meaningful differences between places (i.e. residents in Mathare refer to villages, and interact with villages as different spaces) can translate to more nuanced and effective interventions.

While this study provides new insight into living conditions in Mathare and emphasizes opportunities for intervention, there are a number of specific questions that remain for future research about the nature of interactions between people, place and health in the informal settlement. Informal electricity, toilet facilities, impermanent house materials, and insecurity were not associated with self-reported health in Mathare, yet resident testimonials seemed to point to salient connections. We hypothesize that the lack of an association points to a need for additional specificity in future survey questions—in addition to asking about location and cost of toilet facilities, future questions should focus on some of the issues alluded to by narratives—how or if toilets were connected to sanitation infrastructure, the prevalence of fecal matter or sewage in the residents' general environment, or whether toilet facilities felt safe, getting at both infectious disease and violence against women as health outcomes. Instead of asking about formal versus informal electricity, we may have elicited better information if we had asked about or assessed the quality of the actual connections, since resident narratives referred to frequent fires. If we had asked residents about their ability to find work consistently instead of asking them whether they were formally or informally employed, we may have seen an association between type of employment and self-reported health. In addition, while we were able to examine the interplay between various exposures through resident narratives, future research may be bolstered by larger surveys where interaction effects could be quantitatively explored. At the same time, the survey data highlighted surprising associations we were unable to explain without engaging residents: perception of having adequate internal roads or requiring more than one hour to collect water was positively associated with health in our multivariable model, potential areas to explore for future research. One of the more compelling associations that we were unable to interpret was the way in which high levels of participation in community groups impacted health. In addition to further examining some of the relationships we were unable to

elucidate, future research should look at multiple sources of data for health, using both clinic and self-reported health to more broadly and specifically characterize health. There also remain a number of broader questions for future research. Future research should look to use the relational framework for even more ambitious, larger-level questions about how political, historical, and cultural forces shape health in Mathare and what it means for action. Beyond implications for research and action in Mathare, this paper serves as an example of how the relational approach can serve as an important analytical tool for better understanding health and informing more targeted action in the informal settlement context, critical in an increasingly urban world.

Figure 1: Map of Mathare Valley

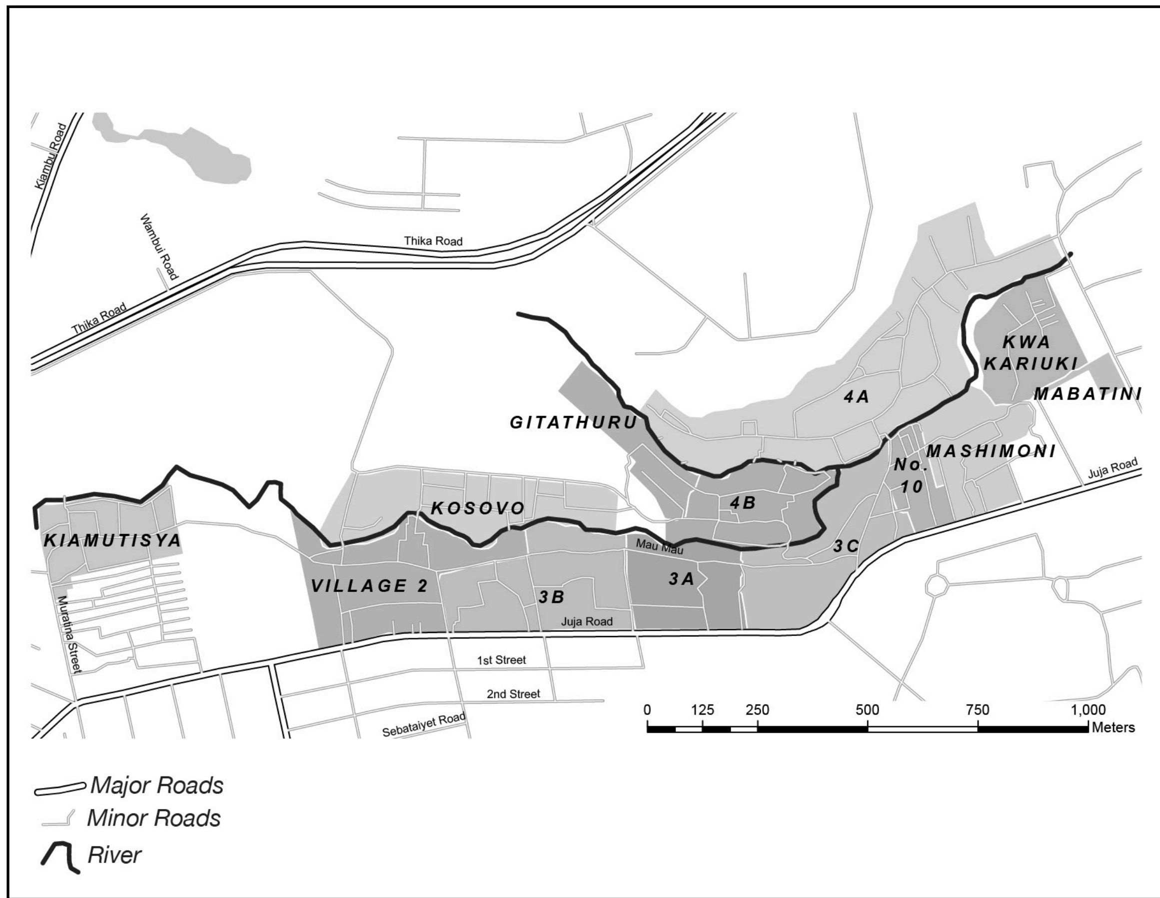


Table 2: Living Conditions in Mathare, by Village

	Kiamutisya # (%)	*Kosovo # (%)*	*Village 2 # (%)*	*3B # (%)*	*3A # (%)*	*3C # (%)*	*4B # (%)*	*Gitathuru # (%)*	*No 10 # (%)*	*Mashimoni # (%)*	*Mabatini # (%)*	*Kwa Kariuki # (%)*	*4A # (%)*	*Total # (%)*
Basic Amenities														
Type of toilet														
Private toilet	0 (0)	10 (15)	13 (19)	21 (34)	11 (31)	10 (22)	1 (2)	7 (25)	3 (14)	3 (8)	2 (20)	10 (23)	16 (12)	107 (17)
Shared toilet	55 (100)	56 (85)	54(81)	41 (66)	25 (69)	35 (78)	41 (98)	21 (75)	19 (86)	37 (93)	8(80)	34(77)	113(88)	539 (83)
Reliability of water Source														
Not reliable throughout day	35 (64)	60 (91)	58 (88)	53 (87)	36 (100)	43 (98)	42 (100)	23 (100)	14(61)	39 (100)	10 (100)	40 (91)	83 (64)	541 (84)
Reliable throughout day	20 (36)	6 (9)	8 (12)	8(13)	0 (0)	0 (0)	0(0)	0 (0)	9 (39)	0 (0)	0(0)	4 (9)	46 (36)	102 (16)
Social Services														
Satisfaction with Healthcare Quality														
Not Satisfied	24 (44)	27 (41)	31 (46)	33(53)	17 (47)	22 (49)	16 (38)	14(48)	7 (30)	16 (40)	7 (70)	18 (41)	59 (45)	291 (45)
Satisfied	31 (56)	39 (59)	36 (54)	29 (47)	19 (53)	23 (51)	26 (62)	15 (52)	16 (70)	24(60)	3 (30)	26 (59)	72 (55)	359 (55)
Type of school child(ren) attend(s)														
Informal	3 (10)	1 (3)	7 (20)	2 (5)	0 (0)	4 (14)	2 (6)	5 (25)	3 (14)	2 (8)	0 (0)	3 (12)	13 (15)	45 (11)
Formal	26 (90)	38 (97)	28 (80)	39 (95)	28 (100)	25 (86)	33 (94)	15 (75)	18 (86)	24 (92)	5 (100)	22 (88)	75 (85)	376 (89)
Land Tenure & Housing														
House Size														
≤ 100 sq. feet	19 (35)	20 (30)	33 (49)	31 (50)	21 (58)	19 (42)	34 (81)	18 (62)	15 (65)	26 (65)	4(40)	31 (70)	78 (60)	349 (54)
> 100 sq. feet	36 (65)	46 (70)	34 (51)	31 (50)	15 (42)	26 (58)	8 (19)	11 (38)	8 (35)	14 (35)	6 (60)	13 (30)	53 (40)	301 (46)
Type of Indoor Cooking Energy														
Clean sources	22 (41)	38 (58)	38 (57)	42 (69)	18 (50)	21 (49)	20 (49)	21 (75)	13 (59)	31 (78)	6 (60)	28 (65)	75 (59)	373 (58)
Unclean sources	32 (59)	28 (42)	29 (43)	19 (31)	18 (50)	22 (51)	21 (51)	7(25)	9 (41)	9 (23)	4 (40)	15 (35)	52 (41)	265 (42)
Livelihood & Income														
Income														
<10,000 Ksh	44 (80)	29 (44)	44 (66)	32 (52)	22 (61)	33 (73)	21 (50)	13 (45)	3 (13)	21 (53)	6 (60)	27 (61)	80 (61)	375 (58)
≥10,000 Ksh	11 (20)	37 (56)	23 (34)	30 (48)	14 (39)	12 (27)	21 (50)	16 (55)	20 (87)	19 (48)	4 (40)	17 (29)	51 (39)	274 (42)
Type of Employment														
Informal	49 (89)	58 (92)	57 (90)	55 (92)	28 (80)	43 (96)	37 (95)	21 (75)	15 (79)	33(87)	10 (100)	42 (95)	116 (91)	564 (90)
Formal	6 (11)	5(8)	6(10)	5 (8)	7 (20)	2(4)	2(5)	7(25)	4(21)	5(13)	0 (0)	2(5)	11 (9)	62 (10)

Table 3: Descriptive Statistics of Village-Level Exposures

	Mean (Standard Deviation)
% Income above 10,000 Ksh	44 (16)
% Formally Employed	11 (7)
% Reporting Secure Village	27 (14)
% Participating in Community Group	33 (10)
% With Household Water Source	48 (26)
% With Quality Health Care	54 (9)
% With Earthen Floors	38 (23)

Table 4: Results from a Multivariable Model Examining Living Conditions and Health Outcomes in Mathare

	Self Report Good Health				Self Report Low Frequency of Childhood Illness			
	OR (95% CI)	*p- value*	*aOR (95% CI)*	*p- value*	*OR (95% CI)*	*p- value*	*aOR (95% CI)*	*p- value*
Basic Amenities								
Water source near or in household	—	—	—	—	1.85 (1.20-2.86)	0.005	2.52 (1.39-4.55)	**0.002**
Water collection time ≥ *1 hour*	—	—	—	—	2.06 (1.15-3.70)	0.015	2.61 (1.34-5.10)	**0.005**
Perceives internal roads adequate	0.60 (0.36-0.99)	0.045	0.32 (0.15-0.67)	**0.002**	—	—	—	—
Social Services								
Satisfied with quality of healthcare	6.70 (4.58-9.79)	<0.001	7.80 (4.52-13.44)	**<0.001**	1.61 (1.06-2.42)	0.024	2.25 (1.25-4.06)	**0.007**
Child(ren) attend(s) formal school	2.48 (1.30-4.74)	0.006	3.70 (1.69-8.08)	**<0.001**	2.48 (1.06-5.78)	0.036	3.33 (1.18-9.45)	**0.023**
Land Tenure & Housing Conditions								
Structure owner	—	—	—	—	2.27 (1.28-4.02)	0.005	2.13 (1.05-4.35)	**0.037**
Earthen household floor	0.45 (0.31-0.65)	<0.001	0.38 (0.23-0.65)	**<0.001**	—	—	—	—
Use unclean sources of energy for cooking	0.51 (0.36-0.72)	<0.001	0.61 (0.36-1.01)	0.056	—	—	—	—
Livelihood & Income								
Income equal to or above 10,000 KSh	2.30 (1.60-3.31)	<0.001	1.91 (1.11-3.27)	**0.019**	—	—	—	—
Formally employed	—	—	—	—	2.03 (0.92-4.49)	0.079	2.52 (0.91-6.92)	0.074
Village Level Exposures								
% Participating in community groups	1.02 (1.00-1.05)	0.068	1.04 (1.01-1.07)	**.011**	—	—	—	—

Pathways to Building Health: A Case Study Examining Microsavings in Mathare, Kenya

Introduction

Like many other states in the global south with rapid urbanization, Kenya is grappling with the challenge of slums. In Nairobi, Kenya's capital city, slums emerged as a function of colonialist policies that relegated black Africans to the least desirable parts of the city. These areas have subsequently grown and persisted as a function of government response, which has alternated between benign neglect and aggressive policies of eviction and razing.[27,87] Today, more than half of Kenya's urban population lives in informal settlements; in Nairobi over 65% of the city's 3.1 million people live in informal settlements occupying less than 10% of the land area.[70,88]

A slum is a contiguous settlement that is often not recognized or addressed by public authorities as an integral or equal part of the city, where inhabitants have inadequate housing and basic services, and residents living under the same roof lack one or more of the following: access to safe water; access to sanitation; secure tenure; durability of housing and sufficient living area.[2] The same conditions that characterize slums are the very factors that shape poor health in informal settlements, an idea known as the social determinants of health (SDOH). The SDOH draw attention not only to the conditions in which "people are born, live, work, and age", but also to the broader "distribution of money, power, and resources at global, national and local levels" that shape these conditions.[33] The broad factors contributing to health are thus proximal and distal, multi-level (community and individual), and multifactorial (political, social, and economic). A growing body of research has underscored that conditions in slums play a key role in shaping the poor health in informal settlements.[1,3,8,24,38] Health inequities between slum dwellers and their Kenyan counterparts were documented in one recent study, which showed that while under-five mortality in Nairobi was 64/1000, mortality in that age group in Korogocho (an informal settlement) was 92.5/1000. Similarly, in contrast to the national average maternal mortality, which was 560/100,000 live births in 2005, maternal mortality in two of Nairobi's slums was 706/100,000.[22] Finally, HIV/AIDS prevalence in Kibera (often referred to as Nairobi's largest slum) is 14%, double the national prevalence.[23]

Participatory planning work being done in Mathare, a Kenyan slum, by Muungano wa Wanavijiji (Muungano) and Muungano Support Trust (MuST) may be able to reduce such health inequities by responding to the complex set of factors that produce poor health in the first place. Muungano, the Kenyan federation of slum dwellers, and MuST, a non-governmental organization (NGO) that supports these federations, work to improve conditions in slums. Central to this approach are *place-based microsavings groups*: slum residents join a microsavings group where they live, allowing them to save daily and access loans. Members of microsavings groups come together regularly to discuss community issues, identify priorities, and ultimately invest in community projects they prioritize (e.g. building basic infrastructure such as toilets, buying land, etc.). Beyond allowing residents to access financial resources and enabling groups to build physical infrastructure, microsavings groups

are designed to facilitate important social processes through which community capacity and cohesion is built, trust is facilitated, and communities are built and empowered.[26,36]
While microsavings groups have the *potential* to build health and reduce health inequities in informal settlements, little explicit empirical study has examined how such groups may already be building health in the informal settlement context. In this paper, I describe a mixed-methods case study focused on 4 microsavings groups in Mathare, Kenya. I use focus groups, interviews, and observation, coupled with extensive fieldwork, to understand the connections between microsavings and health.

I demonstrate that microsavings promotes community health in at least five ways. These are (1) building financial strength within families and the community at large, (2) creating a network that allows residents to learn about and access health-promoting resources (3) building political power by coordinating and amplifying the often marginalized voice of the urban poor (4) facilitating empowerment, especially among women and (5) building community. Whether through increased savings and the ability to access loans, the ability to collectively fight eviction or secure land, or increased political participation, microsavings promotes health and well being in a number of ways across multiple levels.

Methods

Design Overview

I used a mixed-methods, embedded case study design to examine the connections between microsavings and health. The embedded case study design is well-suited for examining phenomena that operate at multiple levels, an appropriate study design given my hypothesis that microsavings operates at the individual, group, and community level to effect health.[89] In order to examine the relationship at multiple levels, the design involves multiple, embedded units of analysis (*see Figure 1 for a visual representation of the units of analysis*).[89] Embedded case studies are also appropriate for studies with the objective of describing the features, context and process of a particular phenomenon.

Within this framework, it is common to use mixed methods to add depth and breadth to the findings; case studies data from various sources, integrating documentation, interviews, focus groups, and other data from each level (individual, group, and community).[89] Within this case study, I used interviews, focus groups, observations, and walk-throughs, guided in particular by the methods for community health assessment outlined in *Community Organizing and Community Building for Health*, which outlines methods for eliciting data and learning the stories of a community.[90]

Within Mathare, I selected four microsavings groups for study; in each of the groups, I conducted focus groups and interviews with members, observed meetings, and reviewed relevant records. To understand how microsavings groups fit within the broader network, I attended regional and network meetings.

To better understand the context of health in Mathare, I undertook additional fieldwork including: spending time in each of the villages, doing walk-throughs, visiting residents' homes, and interviewing Mathare residents. I also spent time at MuST attending meetings and interviewing staff members. Lastly, I visited a range of public, private and NGO run clinics and formally and informally interviewed a range of health workers in Mathare, talking to health providers and interviewing village level community health workers. I took

extensive field notes and regularly wrote memos to make sense of the data. I did formative research for this study from May-July 2011 and conducted data collection from August-November 2012. I describe each of the data collection methods and sources in more detail below.

Study Setting and Sampling

This study takes place in Mathare, one of East Africa's oldest and largest informal settlements.[73] Mathare Valley is situated approximately 6 kilometers northeast of Nairobi's central business district and is bordered by Thika Road to the north and Juja Road to the south (***see Figure 2***). The settlement lies within a valley between the Mathare and Gitathuru Rivers. One hundred and fifty thousand residents live in Mathare's 13 villages, translating to a population density of .889/km^2. The 13 villages are Mashimoni, Mabatini, Village No. 10, Village 2, Kosovo, 3A (also known as Bondeni), 3B, 3C, 4A, 4B, Gitathuru, Kiamutisya, and Kwa Kariuki.

I selected four of Mathare's eight active microsavings groups in the villages of *Kosovo, Mabatini, Bondeni* and *Kiamutisya*. I selected these groups in part because they provide diversity in size, gender composition, and duration of activity (*see Table 1 for specifics*). The village in which each group is situated is distinct in terms of ethnic make-up, relative deprivation, temporary or permanent residents, population size and composition, topography, infrastructure, housing density, history, and other factors. For example, Mabatini is located next to a commercial road and is considered more secure than Bondeni, a village where illegal beer is brewed. Kiamutisya is home to some of the settlement's oldest, long-term residents, while Kosovo is more planned than some of the other villages, with bigger houses that are lined up in rows, and a vibrant corridor where vendors operate late into the night. These distinctions likely influence the make-up of each group, the types of issues on which they focus and the impact the group is able to have on the broader community. While there are notable differences across villages that require further investigation, isolating the impact these differences have on groups and vice versa is beyond the scope of this study.

Data collection and sources

I used a number of data sources for this study, triangulating to understand how microsavings may help build health in Mathare (*see Table 2 for summary of data sources, collection methods, and sample size*).

I used *focus groups* to explore broader achievements of the groups, understand group processes, and learn about each group's community projects. I conducted 7 focus groups total, two with each microsavings groups (one with all women and one with all male) with the exception of the Kosovo group, where I conducted one focus group with women since it is an all female group. Each focus group had 5-8 members. I chose to do two groups, one with men, and one with women, in order to explore the experiences of each gender, with an aim to understand how men and women's experiences of participation might differ. In each focus group, I asked about the types and duration of group projects undertaken, benefits and challenges of participation, and community health issues (*see Appendix V for focus group guide*). While I sought members with a wide range of experiences and roles in these groups (new members, leaders, young and old, etc.), I primarily used convenience sampling to identify individuals who were willing and available to participate. In order to recruit participants, I

made announcements during microsavings meetings about the opportunity to participate in a focus group after the microsavings meeting the following week. I provided an overview of my research, described what focus group participation would entail, and articulated my interest in members from a wide variety of experiences. The next week, at the end of the microsavings meeting, I would remind members about the focus group and ask for 5-8 willing and available members to participate.

I also conducted 23 semi-structured *interviews* with female (n=17) and male (n=6) members of each group (4 females and 2 males from each group, with the exception of Kosovo, where I interviewed 5 females). I aimed to interview 6 participants from each group (4 females, 2 males) given my limited timeframe in the field, with the idea that 24 interviews across all groups may allow me to reach saturation and compare between groups as well. However, the number of interviews I conducted was primarily determined by time constraints. I determined that this would be a reasonable number of interviews to conduct within the timeframe I had to conduct my data collection. I purposively sampled a greater number of female members since I was particularly interested in their participation experiences. Lastly, I selected members with a wide range of roles (leaders, active members, inactive members). I asked interviewees about how they decided to join the group, what benefits and challenges they experienced, whether they had accessed loans, and if they had seen any direct health benefits as a function of participation (*see Appendix II for resident interview guide*).

Finally, I *observed 15* microsavings meetings in each of the 4 villages (Bondeni=4, Kiamutisya=5, Kosovo=3, Mabatini=3) over the study period. Once I selected the four groups to be included in the case study, I attended every meeting I was able to during my time in the field. A member of Kiamutisya savings group served as an interpreter for all focus groups, interviews, and observations where the individual(s) conversed in the local languages, Kiswahili or Kikuyu.

All focus groups and interviews were audio recorded with the permission of the research participants. For meetings, I took extensive notes with the assistance of a translator; when the group allowed it, I audio recorded the meetings.

Outside of data collection within the four microsavings groups, I conducted a great deal of additional fieldwork to enrich this case study. To get a better sense of Mathare, I visited Mathare villages and interviewed residents (*n=16; see Appendix II for resident interview guide*). In order to understand how Mathare's microsavings groups worked with MuST and fit into the broader structure of the Kenyan federation dwellers I attended one regional meeting, several network meetings (n=12), attended MuST staff meetings (n=12), and accompanied staff during field visits and forums, campaign events, and demonstrations. I also sought the expertise of MuST in understanding Mathare's microsavings groups. I interviewed MuST staff (n=7) who either worked in Mathare specifically or with microsavings groups in other Kenyan informal settlements as organizers, planners, surveyors or providers of technical support for financial systems (*see Appendix III for MuST interview guide*). Lastly, to gain insight into the health context in Mathare, I visited a variety of private, government and NGO run clinics (n=4) and talked with providers in each place (n=10), and interviewed village level community health workers (n=8; *see Appendix IV for health worker interview guide)*,

Data Analysis
Local translators translated and transcribed audio transcripts from the local language to English. My analysis was guided by grounded theory, which involves different levels and stages of coding: first applying *initial codes*, consolidating such codes into *focused codes*, and ultimately, developing broader *conceptual categories*.[91]

In conducting my analysis, I first reviewed transcripts from all interviews, focus groups, observations, and field notes to identify themes that came up across many of the transcripts. For example, in many interviews, members reported accessing loans for purposes indirectly or directly related to health. Since this emerged as a theme, during subsequent review of transcripts, I applied an *initial code* to all excerpts where a member mentioned receiving a loan for a specific purpose. These initial codes were highly detailed -- *accessed loan for school fees*, *accessed loan for emergency*, accessed *loans for hospitalization.* I developed a codebook based on these initial codes, with inclusion and exclusion criteria and an example for each code. I went through the same process for savings, identifying codes such as *saving for land*, *saving for housing*, *saving for Christmas.* These codes ultimately fell under larger *focused codes* (e.g. *saving* and *loans)*, which all ultimately fell under a broader category, *building financial strength*.

I undertook the same process for what ultimately became the five ways that microsavings builds health (as described in the Results section), first coding highly specific activities, grouping codes by focused codes, and ultimately establishing a broader category that encompassed these activities. I wrote memos at each stage of coding, which helped me to refine the initial codes, consolidate codes into focus codes, and ultimately identify broader conceptual codes. I triangulated data from all sources—residents, health workers, and field notes-- to enrich my understanding of the relationship between microsavings and health and to increase the validity of the data analysis.

Background
The Kenyan Alliance
I have extensively described Shack/Slum Dwellers International (SDI) history and approach to building inclusive cities in Paper 1. Here, I describe in detail one of the member federations of SDI, the federation of slum dwellers in Kenya. The *Kenyan Alliance* refers to the partnership between Muungano Wa Wanavijiji (Muungano) and their supporting non-governmental organizations Muungano Support Trust (MuST) and AMT (Akiba Mashinani Trust). The partnership of these three organizations is known as the *Kenyan Alliance*. The Kenyan federation of slum dwellers is made up of some 60,000 slum dwellers that participate in approximately 500 microsavings groups in slums across Kenya.[41] MuST supports the federation and is comprised of surveyors, planners, architects, and community organizers. It is the *social arm* that provides support for catalyzing interest in microsavings participation at the village level. Specifically, MuST initiates savings groups in villages, introducing members to the rituals of savings groups (e.g. weekly meetings, saving daily, discussion village priorities) and supports the group in establishing these rituals and practices.

Once MuST has helped establish a group, AMT, the *financial arm* of the organization, provides technical financial support, confirming that members are using savings books correctly or that the treasurer is documenting deposits and loans systematically. In this early

stage, any loans provided to members come from the group's own money. As the microsavings group expands its' membership and accumulates individual and collective savings, AMT assists them in building stronger financial systems and assesses the financial strength of the group by conducting external audits (e.g. examining savings, reviewing repayment rates, evaluating record-keeping). If a group is financially viable, they may be eligible to receive larger, partially subsidized loans through what is called the Muungano Development Fund (MDF), a community bank managed by AMT. The MDF includes resources AMT obtains from external sources: international donors, SDI, and interest from loan repayments throughout the entire federation. AMT and the MDF act as a small community bank for slum dwellers; they secure savings and allow the poorest of the poor to gain access to necessary capital.

Microsavings: an intentional design

A central feature of microsavings is building a community-based organization that can respond to the needs of slum dwellers and advocate with them to outside institutions, such as state bureaucracies. One of MuST's key tasks is to use community-organizing strategies to catalyze resident participation in savings groups. They do this, in part, by inviting savings group members from already established groups into a community to describe their experiences, and bringing potential members to other slums where micro-savings groups are more established and have completed loans and projects. As newly interested residents join a new group, MuST's community organizers describe the rules, practices, and rituals that guide microsavings. These rituals (daily savings, enumerations, weekly meetings) are described in detail in Paper 1 and are meant to accomplish short-term objectives while facilitating a longer-term social change process.

In addition to rituals, savings groups are supposed to have elected leaders and action teams that are responsible for carrying out particular responsibilities. Each savings group should elect a chairman, who is supposed to facilitate meetings and represent the group at network meetings, a secretary, who takes meeting minutes, and a treasurer, who manages the financial records and makes deposits into the bank. The SDI approach prioritizes the leadership of women as a means for shifting gender norms and empowering women; thus in every group there are supposed to be female leaders.[26] By design, the treasurer position is supposed to be filled by a female member, so that women are perceived as being trustworthy and capable of managing their neighbors money, while concurrently building the financial skills required to manage increasingly large sums of money.[29]

Each group should also have six teams: (1) Advocacy, (2) Welfare, (3) Auditing, (4) Savings and Loans, (5) Land and Housing/Projects, and (6) Youth. The tasks of the teams vary: the Advocacy Team is responsible for mobilizing the broader community, conducting household enumerations, and being involved in advocacy and lobbying efforts and creating awareness about Muungano activities.[31] The Loans and Savings Team is supposed to collect savings daily, keep records, keep members active, and manage loans (review applications, distribute loans, and follow up on repayment).[31] The Welfare Team is tasked with developing programs or projects that support the welfare of members, e.g. insurance or livelihood funds, training and education around health issues, etc. and the Auditing Team is responsible for conducting training and reviewing all group records (minutes, accounts, etc.) at least once a month.[31] The Land and Housing/Projects team facilitates projects for members, including

acquisition of land and housing construction, house modeling and planning, works with advocacy to lobby for secure tenure, as well as any additional projects the group had undertaken.[31] Lastly, the Youth team is supposed to focus on projects like economic empowerment, sports, promoting youth talent, and mentoring.[31]

A key element of the community-scale microsavings group is their organization into a larger *federation*. Village or neighborhood scale groups come together to form a *network*. Networks meet regularly, generally every week, as a group and tend to organize geographically, for example, by settlement. For instance, in Mathare, all of the local savings groups meet together weekly as a 'Mathare network.' While representatives (elected leaders and team leaders) from each microsavings group are supposed to attend, the meeting is open to any Muungano member. The network meetings are important for a variety of reasons. Here, representatives assess the financial 'health' of each microsavings group, share and receive information from the regional and national level which they bring back to their microsavings group, engage in advocacy efforts that are better suited to a larger scale, and design or discuss programs that should be initiated at the village level microsavings group. The network scale is also important because it is the level at which the MDF provides loans (it does not provide loans to individual groups, but rather creates efficiencies by providing loans to the network representatives, which are then distributed to individual groups).[31] Lastly, the settlement scale networks meet across a region (such as all of Nairobi) and the regional networks form the national federation. Federation at the international level can be referred to as the SDI federation.

Results

Microsavings members in Mathare shared many examples of how they had benefitted from participation—receiving small loans for boosting their business, learning how to save, or being more informed about community matters such as plans for evictions, pending developments, opportunities to attend workshops, the work of NGOs, etc. Members also articulated the successes of their group, highlighting projects like securing land for, building, and managing a functioning and clean public toilet, savings towards land, starting a childcare, or working collectively to maintain an urban garden. Each of these activities fits into five specific pathways through which microsavings improves community health:

(1) <u>Building household and community-level financial strength through savings and loans</u>

> *"I never realized I could be a millionaire by savings pennies."*
>
> *"I am saving for future use because I cannot do it on my own . . . We do not have a fixed amount to save per month. Whatever you manage to get is what you save. But the month should not end before you save anything."*
>
> *". . .My savings are well kept. In case I have an emergency, I can always get money from my savings."*

These excerpts from interviews with female members from Kosovo and Kiamutisya savings groups are illustrative of the multiple ways microsavings helps build financial strength through savings: microsavings appears to create a discipline or habit around savings, protect savings from personal or family needs by physically keeping it out of the household, and

allows individuals to build up a cushion for emergencies. As alluded to in the quote above, place-based microsavings allows residents to build savings on flexible terms, perhaps more so than formal financial institutions—who often deny the poor services—or the village lender—who charges high interest rates.[29] Microsavings appears to be able to meet the unique needs of the urban poor to both deposit and withdraw small amounts of money readily.[29]

While the microsavings design provides a set of guidelines for how to manage savings, in reality, each group managed their savings in vastly different ways. In Kosovo, they did not use savings books, save daily, or have an elected treasurer (or any leaders), nor did they work with formal financial institutions. Instead, the group decided to use M-Pesa, a mobile phone based money transfer and microfinancing service to hold their savings. The informal leader of the group managed the account in exchange for a fee of 50 Ksh for the year from each member. Members contributed money to the account every week until December, when the accumulated amount was returned to each saver. When I asked the members what they were saving for, they all said they wanted to keep the money aside so their families could celebrate Christmas at the end of the year (e.g. buying chapattis, or flat bread, taking their children out), get new school uniforms, and pay school fees, if needed. While the women were saving towards a specific goal, as the quote above illustrates, the savings were also available to the women in case of emergencies, which represents an important source of support for maintaining health. Emergencies can often be catastrophic for the poor, setting off a downward spiral of increasing debt, limited ability to meet basic needs, and poor health.[37] In one study conducted in Kenya, where poor people were offered the opportunity to start a savings account, found that it increased their ability to cope with such emergencies, simply by allowing them to physically keep the money aside (protecting it from friends, relatives and other expenditures).[92]

In contrast to the Kosovo group, Kiamutisya, Bondeni, and Mabatini groups had more ambitious, collective, and long-term goals for their savings, pooling their money together to buy land and improve housing. They adhered to many of the practices and rituals of the SDI approach, keeping savings books and using a formal financial institution where all members savings were deposited into one account (one account for savings, one for projects, one for loans) by an elected treasurer. At each meeting, the treasurer would update members of the value of the account, deposits, and loans. Mabatini was the most disciplined, with members saving daily, while the Kiamutisya and Bondeni groups contributed funds at the weekly meeting. The ability to save collectively enables individuals to secure assets they might not be able to otherwise, like land, or improved housing. While no group actually secured land during the course of this study, all three groups were steadily working towards it: Mabatini had invited an expert from a local NGO to discuss how cooperatives worked and had architects from the supporting NGO attend meetings to discuss house design. Kiamutisya had 600,000 Ksh saved (according to the chair) and had identified a plot of land outside of Nairobi which selected members of the group visited. Bondeni members were a part of Greenfields, a broader project where slum dwellers from multiple savings groups were saving to buy land with the support of AMT and the MDF. Securing land, or land tenure, has specific, positive implications for health. It builds confidence about the future, eases worries about eviction, and generally facilitates a sense of long-term stability.[88] People who own their land are more likely to invest in their housing or community, which can have health promoting effects (e.g. improving poor housing, investing in sanitation and water,

etc.).[88] Improved housing, particularly cement floors, warmth improvements, and provision of basic amenities have been linked to reduced illness and improved general, respiratory and mental health.[78,93]

While savings allows members to accumulate financial resources, build a financial cushion for emergencies, and work towards securing health building assets, loans secured through microsavings groups seem to offer a different type of financial strength, as demonstrated by these quotes from interviews with group members from Bondeni members, one of whom used loans for schools fees, while the other used loans to buy more inventory for her small business:

> *"Just for school fees when things were not so good. The good thing about Muungano is unlike a bank, this is your money, and they don't pressure you to pay back.*
>
> *"I've taken 4 times if I'm not wrong. . .to boost my job. I once took 1,000. I buy kales, spinach, carrots."*

While savings allow residents to work towards a future vision (and are only supposed to be withdrawn from in the case of catastrophic emergencies), loans allow residents to access funds for meeting daily needs, like being able to buy food, pay rent, or sustain their livelihood. As with savings, microsavings offers individuals a way to access loans that better meets their needs than other available alternatives, like the village moneylender or other models of microcredit. Microsavings is supposed to offer more flexible terms for repayment, lower interest rates, and less stipulations about how such loans should be used.[29] All of these factors combine to make financial resources more accessible for supporting daily needs, which supports health.

As with savings, groups chose to manage loans in different ways. Although rituals and practices guide how loans should be managed, in practice, each group managed loans in markedly different ways. In Kosovo, the ten members used what was called *merry-go-round*, a strategy strictly for *circulating money* rather than growing it. Each woman put in 100 Ksh each week, totaling to 1000 Ksh. This money was divided in half and given to two people each week (500Ksh for each person). To keep it fair, the group elected who received the money by randomly picking numbers each week (having removed those who have already gotten money). These *rounds* continued each week until all members received 500Ksh. With this format, money is not technically loaned as much as it is circulated, i.e. a woman who receives money does not return 500Ksh all at once to the group, instead, by continuing to contribute 100Ksh each week, she gradually repays what she received. The benefit of this is that each member receives a relatively large sum of money in a given moment in time that she might not have access to otherwise. Group members used this money for whatever they deemed appropriate. In fact, when I asked what women generally use the money for during a focus group, the first response from many of the women was that it was not their business what each person did with the money. When I probed further, they shared with me that some used money for school fees, food, and rent--all health-supporting purchases.

The Bondeni microsavings group used a different system for circulating money, which also leads to accumulation, or growth of the money. This system is called *table banking* because money contributed never "leaves the table." In table banking, each of the participating

members contributes 50 Ksh during a weekly meeting, and loans are given that day to members who request one. The loans have to be repaid within one or two weeks with 10% interest. As members repay loans with interest, the amount of money being distributed each week grows. Bondeni's records revealed that that the group started by circulating 2,050 Ksh (about $23). The treasurer estimated that in a period of 7 months, the amount being circulated had grown to 40,000 Ksh ($456). Members used loans from table banking for a wide variety of things, including starting a business (a local butchery), supporting an existing business during difficult periods (allowing the individual to buy inventory), paying school fees, and paying for hospitalizations.

The Kiamutisya group seemed to adhere most strongly to the guidelines put forth by SDI about managing loans, reviewing requests for loans through a committee and loaning only up to 75% of what members had in their savings with a 5% interest rate, while in Mabatini, the group had enacted a no loan policy in order to maximize the savings going towards lands.

The loans provided to microsavings participants fall somewhere between income, which is earned and requires no repayment, and loans given by other models of microcredit, which generally have more stipulations about use, less flexible repayment terms, and are not generally based on a recipient's ability to save or earn. Income has a well-established connection to health, protecting against mortality.[94] Income directly impacts health by allowing individuals to access material resources necessary for survival, improving access to water and sanitation, increasing food security, and reducing stress.[95] It may indirectly influence health by increasing people's ability to participate in society and control their life circumstances.[3,94–96] Loans have also been found to have positive impacts on health. One study examining the role of microcredit in informal settlements found that microcredit was able to offset poverty by supporting livelihood, indirectly shaping health.[97] Other studies examining microcredit suggest a more direct connection to health; in these studies loans to women were associated either with their own or their children's improved nutritional outcomes.[98,99]

In addition to building financial strength through savings and loans, microsavings seems to cultivate strategic thinking and creativity around money in ways that further protect their health and well-being. For example, during a microsavings meeting in Kiamutisya, the group had a lively debate about whether or not to purchase the plot of land they had found just outside of Nairobi: some members said it was better to buy land now before land prices went any higher, while others thought it was better to wait until they had saved more to buy a bigger plot of land. One of the key points made by those who thought it was best to buy the land was that their savings were not doing much for the group by sitting in the bank, a view eloquently summarized by the group treasurer, who during this debate stated, "*Land is becoming money.*" The group in Bondeni, too, had long term goals for building their financial strength; in an interview with the group chairman, he described a vision of expanding the table banking model to provide loans to the broader Bondeni community as a way to continue increasing the amount of money being circulated, thereby supporting the needs of the broader community.

While the preceding examples lend support to the idea that microsavings builds financial strength of individuals and groups, it is also undoubtedly imperfect, encountering challenges,

challenges that can negatively impact the health of members. In interviews, both Muungano members and MuST readily admitted that there are issues, cases where people did not or could not repay loans, or more concerning, cases where individuals misuse funds or steal the savings of people. This was demonstrated during group reports at a network meeting where representatives from each group summarized the ongoing activities of their savings group for that week:

> *"I would also like to bring to the network's attention that the group in Area 4B is disappointed with some of its members. It has been noted that some are dishonest with the way they use the group's funds allocated to them for various group expenses. For example, one was given some money to purchase a lock and fix it for the group. He disappeared with the money and is yet to account for it. Also, some overstate the price of items they are to purchase and do not furnish us with the necessary receipts. We demand an auditing to be carried out in our finances and transparency by the group members."*

This statement is important, because it highlights how some dishonest people can use microsavings to build their own financial strength to the detriment of others, while also showcasing the built-in systems that serve to counter those types of activities. Audits, reports to the network, accounting systems, and ongoing dialogue—are all supposed to reduce the occurrence of these types of activity. Similarly, with respect to the potential of microsavings contributing to individual debt rather than building financial strength, some of the processes around finances serve to counteract this threat—loans based on savings history (as in Kiamutisya) and flexible repayment terms. The discipline that microsavings builds around finances also seems to play a role, with many members themselves saying they would only take a loan they knew they would be able to repay. All the same, there is potential for loans to contribute to poor health: increased access to credit has been linked to increased stress and depressive symptoms, particularly in very poor men.[100]

Another limitation of microsavings groups is that certain demographics are often excluded from participating. According to an organizer at MuST, youth, single mothers, those who are physically disabled or have special needs are all underrepresented in groups, in part because they have limited time, ability, or interest in the groups. Such groups may also intentionally or unintentionally leave out the poorest of the poor. Building financial strength is not an option, for example, for the many community members who cannot pay the initial fee required to participate in groups (5,000 Ksh in Mabatini) or come up with the 100 Ksh that is required to participate in the weekly merry-go round in Kosovo. In many of these cases, however, ongoing efforts are being made to be more inclusive. Some groups, like Kiamutisya, allow individuals who cannot pay the entry fee allow individuals the option to pay incrementally, possibly creating the opportunity for even the very poorest to participate. MuST works to continue to build more inclusiveness also—the group of 10 women in Kosovo is unique because it exists in addition to another microsavings group in Kosovo that is comprised of male and female residents. The creation of this group was MuST's response to learning that mothers are often unable to participate in those savings groups, and have distinct financial needs to organize around (e.g., childcare, school fees, etc., discussed more later in this paper).

One last limitation of microsavings in building financial strength is related to the limited strength of communities. Groups of the urban poor can only save so much without the

support of external donors, government, or private stakeholders; without their support, projects are likely to remain small scale or have limited impact on health. For example, while individuals may be able to pay for water connections, without broader investment into trunk (main) infrastructure, the project may be stymied. This is one of the key reasons that the SDI network includes a funding structure to support the work of savings groups that are financially viable, in order to boost the ability of groups to engage in larger-scale projects.

(2) A network for sharing information, building knowledge, and taking action

"Habari ni nguvu"

This Muungano slogan, often repeated at village and network meetings, literally translated means "news is power," and 'news' or information dissemination, proved to be an important health promoting and protecting function of microsavings. Information sharing played an important role in protecting and promoting health through multiple pathways. It operated by building individual or collective knowledge that could improve health or by serving as a catalyst for taking health protective action. Weekly meetings at the village level serve as a venue for many types of information sharing: members sharing information with each other informally, groups discuss village or national news, and external institutions (e.g. banks, NGOs, universities, local and international experts, etc.) attend meetings to do workshops, presentations, or make opportunities known. The network structure also served to disseminate information even more broadly either through the mechanism of network meetings or through exchanges, where member(s) from one group visit another to learn their strategies, lessons learned, and activities.

> *Interviewer: Have you experienced any changes, good or bad, as a member of Muungano?*
>
> *Member: Just good. We attend seminars, and network meetings. We benefit a lot from such.*
>
> *Interviewer: Which seminars? What kind of seminars?*
>
> *Member: There is one we were taught about health by people from MuST was it? They were actually asking similar questions. Also seminars about water and health . . . When we attend these seminars we learn about health. For example we learned you can eat beans in place of meat. I used to think meat was very important in the diet. Also we learnt you don't have to buy store maize meal. You can take maize to the grinders, it's cheaper. Also, the way to eat a balanced diet."*
>
> *Interviewer: How did you get to attend the workshops or anyone could go?*
>
> *Member: You know, it depends on how active you are. Some people only attend seminars where you get money. But for me, the lessons I acquire are more important.*

The exchange above, from an interview with a woman in Bondeni, illustrates how microsavings can be the source of information that can improve health. In another example, while the women of the Kosovo group were waiting for the weekly meeting to start, they offered advice to one of the women, whose baby was obviously ill about what it could be (tonsillitis), and what she should do (see a doctor).

In other cases, the information may not be specific to health, but may have indirect links to health. For example, a Kiamutisya member who learned about table banking during an exchange introduced it to another (non-Muungano), all-female savings group she was a part of, while another member from Bondeni introduced table banking to his Muungano group. Both of these actions likely served to build their access to financial resources, potentially promoting health. Similarly, some members reported taking advantage of a course being offered by a university to settlement residents, an opportunity which had been announced in savings groups. AMT also supported education of a different sort, teaching slum residents about the history of land in Mukuru, another slum in Nairobi, during a forum they organized. Presenters provided an overview of the fact that much of the land belonged to the wealthiest Kenyans, how it had been issued by the government, and on what terms. AMT also highlighted that while slum dwellers are characterized by as non contributing members of society, they generate 24 billion dollars in revenue in the form of rent paid to structure owners, an amount equivalent to that used by the Ministry of Education on primary and secondary education. Formal education has a large and persistent association with health, by providing access to better livelihood opportunities and greater income, supporting healthier behaviors, and better decision making.[101] AMT's form of education was reminiscent of popular education as used by Freire, which has also been studied for helping people collectively feel more empowered.[102,103]

In other cases, meetings or networks serve to facilitate information sharing that serves as the basis for taking collective action, action that has the potential to indirectly or directly support population health. For example, at one network meeting, a member reported that there had been a fire in Bondeni where 60 houses had burnt. The representatives discussed what Muungano could do, and afterwards, the group went to visit the site of the fire. The network chairman was tasked with going to the Red Cross to try and secure clothing to support those who needed help, potentially helping individuals begin to rebuild some of the assets they had lost in the fire. Beyond facilitating the spread of information, networks have also been studied for their ability to influence health through other mechanisms. Social networks are thought to exert influence on health by shaping norms that may positively impact health (e.g. creating a norm around saving, a norm around women's participation, etc.).[104] Social networks are also thought to facilitate greater participation in civil society, also known as social integration; many of these examples highlight how the microsavings network fosters collective action.[104] Social integration has been associated with reduced mortality as well as reduced feelings of alienation and symptoms of depression.[104]

While microsavings serves as a *node for information and building knowledge and action*, it can also be an efficient way to spread rumors, engage in power play, or exploit opportunities. During this study, a drama unfolded in the network meetings as different members vied for the opportunity to attend a regional meeting in Mombasa, Kenya. The culmination of this drama was a network meeting where two members almost ended up having a physical altercation because one of them, who was not elected as the network representative, attended the meeting. This example serves to demonstrate that not all leadership is honest or interested in the collective benefit of the group. There were other less dramatic examples of how the network contributed to a negative outcome. Since only groups that meet certain criteria can have a network representative (they must be saving, must be meeting regularly), some members would deliberately withhold information about the status of their groups because they wanted to continue attending network meetings to get access to the

opportunities afforded there. Such findings are consistent with the findings of other public health studies, which have found that networks do not always influence health positively.[105,106] The network structure could impact health either positively or negatively, depending on the type of network. Instead of support, individuals could experience pressure or stress, instead of learning positive health behaviors, individuals can be influenced by health damaging norms (e.g. drinking more, smoking more, stealing other members funds, etc.).[105]

However, there were systems in place to deal with these types of challenges. For example, when it became clear that an individual who had not been elected by the network had unfairly gone to Mombasa for the regional meeting there was a robust discussion by network meeting attendees about what to do, about the role of leaders, about the need for honesty, and again, a call to revisit the rules that guide how microsavings operate, illustrated by this dialogue between two participants at the meeting:

> ***Member:*** *"In my opinion, I find that it is important to adhere to the network rules by all. Also, we need to have proper, united leadership for the onward movement of the general network. In the meeting we held prior to the Mombasa trip where we selected our officials, it is likely that the pressure of the trip influenced our hasty elections. I propose that we have the selection of officials afresh, now that the trip is past. (Murmuring in the crowd as divisions in opinion are expressed.) It has also been noted that many of the misunderstandings we have as a network arise from lack of proper communication. I propose that we have a proper flow of information among the leaders and even with all other members."*
>
> ***Member:*** *(Jumps to his feet to address the group before others who want to also speak.) "I agree with those sentiments. But we are also to blame since many do not show up for the network's weekly meetings. When we had that meeting to elect officials, we were only a handful. Today, look around. (Gestures to the group to look around. Some chuckling by the audience.) Because of the issues we were discussing today, many have turned up for the meeting. We are not usually this many at the network's meetings. We need to be loyal in meeting attendance and not show up only when we have unresolved issues."*
>
> ***Member:*** *"We also need to have unity among the groups themselves so that the entire network can be strengthened. A while back you would easily know what project each group was undertaking, even though you were not a member. We had unity as members of the various groups under the network and we had the interests of each other at heart. Today, we don't even know what each one is doing. Some of the group reports presented at the network meetings each week are also inaccurate as they do not truly reflect what is on the ground."*

(3) Empowerment: A transformative process for women

> *"In many families, the women suffer. But in the group, you learn 'Oh, so I can claim my rights, as a woman, my children's rights.' Before the group, I was just an ordinary woman. But now I know things can be done to move forward."*

The SDI approach prioritizes the participation of women, as savers, but particularly as leaders, as a way to shift their perceptions about themselves, and as a way to shift broader community attitudes towards women.[26] And indeed, the process of participation seems to

empower women, as illustrated by the quote above, from a female member of a microsavings group in Mabatini. *Empowerment* is an umbrella term used to describe a number of social changes at many levels, including increased self-confidence and self-esteem in individuals, increased access to social networks and social capital, or shifting power dynamics and challenging institutional forces.[107–109] Empowerment can be an important health promoting process, because while powerlessness is a broad-based risk factor for disease, empowerment approaches to health have been described as a potentially powerful vehicle for improving health.[110,111]

The relationship between participation and empowerment seems to be a complicated one. My findings point to something akin to a *dose-response* relationship in epidemiological studies. In this admittedly small study, women who participated primarily as savers, without going to meetings or engaging in the broader community projects, articulated benefits associated with building financial strength. Women who participated more actively, attending meetings regularly, becoming interested in community issues, etc. in addition to saving reported benefits beyond financial strength, such as social support (one dimension of empowerment highlighted above). Only women who participated as leaders seem to report experiencing benefits that touched on the multiple dimensions of empowerment highlighted above.

Across the four groups I studied, there were three women in particular who participated as very active members and played leadership roles in Muungano. I highlight the profile of one woman's participation whose history I am most familiar with to illustrate what I mean by active. In her years as a member, she had been on the advocacy team, facilitated enumerations, and volunteered to collect daily savings. Now, she regularly attended meetings and always participated in group discussions. She was also a part of broader federation activities: in the past, she had attended network meetings, marched to support the Mabatini group in protecting their land against private development, and went on exchange visits to Tanzania, South Africa, and Malawi. During the course of this study, I saw her gather signatures for a petition to support a lawsuit being filed on behalf of slum dwellers in Mukuru by MuST (discussed below), sign up for a committee to deal with issues related to water that many of the groups were dealing with (unexpectedly high bills, leaking water, etc.), and attend a forum for female slum dwellers to discuss the impact of inadequate sanitation organized by AMT. She also helped coordinate or conduct various research studies on which MuST was a partner—bringing residents together to discuss food security on one occasion, gathering community health workers to talk about health on another. During the period of this study, she also went to multiple workshops and forums to represent the interests and experiences of slum dwellers, working with development and human rights agencies like UN Habitat and Amnesty International. She seemed to be an active member of her community, exhibiting not only an awareness, but a concern about the news in her village—during my time there, she mentioned in passing that she had been raising money for someone's whose home had burnt down, had worked with others to help an old man who had hurt his shoulder get to the hospital, and argued with a man she had seen beating his wife. While she highlighted the benefits of learning how to save and being able to save or getting to know her community in my interview with her, she also alluded to something more, a process of transformation:

> *Interviewer: "Have you noticed any changes, good or bad, in yourself from being part of this group?*

Respondent: "Some good…I had some changes, because now, because right now I'm so independent, I know my rights. I have the confidence to stand in any meeting, but before, I couldn't. I couldn't stand even in front of 5 people and talk . . . I don't know what happened, even my mom asks me, 'What happened to you?'…I couldn't talk even in front of my brothers and sisters I was so quiet, but right now I can't…. I just find myself talking."

Interviewer: "Is it from the exchanges or . . ."

Respondent: "Yeah, from empowering now, from just being given chances. There was a time I went to another meeting and I was told to moderate. I stood there…I stood there wondering what to do next (laughs), but I found myself doing it and I was so happy. Even some people didn't know that it was my first time; they were telling me if I had a baby like yours I will be happy. Little did they know, I had some butterflies, eeeeeh, running all over my body. The eyes, I couldn't even look at people like this [makes eye contact], but right now I can look at even the president, I don't care (laughs) . . ."

The other two women leaders also talked about the benefits of saving, etc., but also highlighted access to greater opportunities and information that facilitated bigger changes during their interviews:

"There is benefit because a long time ago I used to stay just like a common woman or a local woman, but right now no, I joined others, we are doing some work together. I'm empowered now because a long time ago, I used to stay in the house—cook, wash…."

"When I came into Muungano I was a bit naïve, now I'm enlightened. What else…. I can save now, I can save better than I used to before I was in Muungano, I can associate with people from many different cultures. . .Like my rights, I know more of my rights, mostly in Mathare, people don't know about rights, they take their chief like he's the end of the road. . . you know about the administration, how it works?. . . Now I know it's not a must you use the chief, you can go to the police station, you can go to the D.O.[district officer] if the chief cannot hear you, because sometimes they intimidate people. . ."

The second quote is referring to the village level administration that is a holdover from colonial days where a village chief used to report back to the colonial government about the activities ongoing at the village level. While these structures have technically been replaced by government officials, they still exist and many residents go to village chiefs to resolve internal issues. D.O. refers to district officer, a member of government.

In parallel with experiencing greater benefits, female leaders seem to experience greater challenges than other women who do not participate as actively, or as visibly, in microsavings groups. Microsavings is theoretically designed so that gender norms are shifted in ways that do not generate opposition from men, but as women become more empowered, they seem to push the boundaries of what is considered acceptable and encounter challenges.[26] The woman whose participation I profiled above shared many of those challenges during an interview, some of which were frustrating (e.g. members who tried to sabotage her opportunities to go on exchanges, men who did not seem to want her to express her opinions in network meetings) and some were truly frightening (young men from her community who knew her as a member of Muungano were looking to attack her

because they felt the toilet they managed was being threatened, she ended up avoiding any confrontation). While this example is on the extreme end of the spectrum, the other two members also highlighted the two sides of empowerment during interviews:

> *"Are there challenges to knowing your rights? Yes, because you find some husbands—because we know the truth—you find some husbands beat their wives because they come to tell them about women's rights. You find that that man says you don't deserve to tell me [about your rights] so those challenges are there, and you find even the family you are married to doesn't understand."*

Such experiences of participation may be very likely to impact health negatively; though the fact that all women continued to participate seems to indicate that the benefits outweigh the challenges of participation.

In addition to finding that women who are empowered by participation also experience challenges associated with this empowerment, I also found that despite SDI's commitment to encouraging women's participation, they still confronted barriers to participating or acting as leaders—due to family responsibilities, internal perspectives that limited them from truly taking leadership positions, or having to navigate men's participation, as illustrated by these quotes from MuST staff and female leaders during interviews:

> *"Women can't go every week, they must go every month, sometimes they are told not to go to group—and they have to understand because they don't want to break their family. Single mother have to put the interests of their family ahead of the group's."*

> *"The majority of women are members, but [they are] not key position holders in a group. These groups---however much you say democracy, decision-making through groups, I've seen a lot spoken very well in documents and constitutions--but in reality, because of the factors that affect many of the members differently, women. . . most of them are disadvantaged. They are majority shareholders, but they don't hold the stake. They are not stakeholders, they are shareholders. . .the person who holds the "steak" determines the size to be eaten [referring to men being the decision makers even if women are leaders]."*

> *"In these savings schemes, we have men, a few of them who are ruthless--and we have a couple of them who are cruel and ruthless-- who take advantage of poor women. Poor in the sense that they are busy, doing other important matters like taking care of the children and the family, and also contributing to the savings scheme, trying to keep it going while these poor men who don't contribute are the people determining everything."*

> *"Like for men, when they are in leadership, they just want to show off the power they have…like for women, you are humbled to lead, and to see people looking at you to help them achieve their goals, you get humbled, at least you see you can help your community, and you get satisfied with that. Men cannot lead anything, they are only fighting for power. If it were women, they would be having projects. Men only want to see themselves leading, being up there, commanding people."*

Thus, while my findings indicate that participation facilitates empowerment, particularly for women, a potentially health building process, the accompanying shift in gender norms does not seem to come without challenges that may also negatively impact health.

(4) Building Community: In the abstract and in the concrete

"Muungano? Nguvu yetu"

The Muungano slogan above means "*unity, our strength*," and is connected to another way that microsavings promotes and protects health: through building community, both in the abstract and concrete sense. Microsavings practices such as meeting regularly, saving together, and discussing communities are designed to build trust between groups and facilitate community cohesion.[29]

> *"When we were able to come together as Muungano we were able to know each other because when we united as Muungano were able to know each other. Before that we didn't know each other. Like me, I didn't know this one (pointing to someone next to her), this one I didn't know her name, and this one I didn't know where in the village she lived. But now I can take you to this one's house with my eyes closed."*

> *"First, before I didn't know people, but now we are close in the community. I also was able to listen to other people's viewpoints. And also, I didn't have friends but now I have many, many friends, whom I can tell when I have problems. I didn't think that was possible."*

> *"You know we saw no need of people living so far away [from each other] and that's when we came together so that we can help one another those issues because now if I say my sister or my brother will come if there is a fire here [but] they are far away. But that neighbor of mine is now my sibling because now we are together."*

These quotes from focus groups and interviews with microsavings group members highlight the kinship that group members feel with each other, and the support that group members provide to each other. While the quote above highlights helping each other in the event of a fire, members articulated many ways that members help each other, frequenting each other's 'hotels' (small restaurants), loaning each other money, or visiting each other during illness. Such acts point to social support and community cohesion, which have been found to mitigate the effect of stress and provide access to material and emotional resources, potentially improving health.[96] Social support has even been linked to reduced mortality in observational studies.[104]

> *"As members of the group, we are ready to help anyone that is sick, or when someone loses a family member in death."*

> *". . .We have lost many people, around 3 loved ones in Muungano, and we supported the family. Some members accompanied them to the funeral."*

In addition to the informal means of supporting each other, many groups also had more concrete ways of helping each other, especially in the event of family illness or death, as highlighted above. This was most formalized in Mabatini, where the group had a welfare fund to help each other in the case of hospitalization or death: each member was supposed to participate and put in about 10 Ksh/day. This fund was used to support members and their families in the event of hospitalization or death, and a member was eligible only if they had contributed 2,000 Ksh to the fund. There were general rules around benefits, but these

seemed flexible: if a child of a member died, the member received 5,000 Ksh, if an adult in a member's family died, they received 10,000 Ksh, and if a member died, the family received 20,000 Ksh. In the event of a member's hospitalization for 5 or more days, they received 10,000 Ksh. In Bondeni and Kiamutisya, while there was no official fund, but group members reported chipping in to support each other when such events happened, each giving 100-300 Ksh in such a circumstance. While such funds were often not enough to cover the cost of a funeral or hospitalization, they likely buffered the shock to income the families experienced, perhaps allowing them to still meet basic needs during difficult times. During these times, Muungano members often visited each other in the hospital, or attended funerals, also providing emotional support to each other.

While the Kosovo group did not have any formal means of members' supporting each other financially, the idea of supporting each other was what drew the small group of women together in the first place. They had all come together based on a need for childcare, which was unaffordable and out of reach for many of them. While they received help from MuST to get the childcare started (renting a space, getting initial equipment, etc.), the group pulled out of their personal savings to maintain the childcare, indicated by notes in their records *('savings to rent,' 'each member removed 150 Ksh for wall covers and carpet'*), and they dreamed of being able to improve it in the future, by having nutritious meals for their children or renting a better space (the space they were in was a one room shack). For the women of Kosovo, this connection seemed to extend beyond the childcare to a shared concern for each other, as articulated by one member whose children had outgrown the childcare:

> *"Even though my children are not young enough so as to be under the daycare center, they are still cared for well. For example, it could be raining after school. They will not be left out in the rain. Or I may get back late. I will find them at the daycare center that the group runs."*

Having an affordable and trusted space for childcare may have direct and indirect connections to health. The woman who managed the childcare and watched the children described how three of her children had died in a fire when she had to leave them in the house to conduct some business in town; having a space devoted to the care of children can protect children from such devastating events. Children of the urban poor have a higher risks of fatal disease than those who are not poor; moreover, children under one year with working mothers are two times more likely to get sick than those whose mothers do not work.[82] Childcare could potentially be health protective on both fronts, ensuring the presence of a female caretaker and potentially reducing children's exposure to dirt or feces, injury, or accidents. Indirectly, childcare may impact the health of the whole family, allowing the women (many of whom worked washing clothes or selling vegetables in a neighboring area) to earn an income, an activity that further supports the health of the family.

Not only do members support each other, this notion of building community extends to the broader community in a very tangible way, with group members working collectively to physically build their community through improvement projects. The group in Mabatini had built a public toilet with a water tank in their community (the building has toilets, water, showers, and a small space for growing vegetables in sacks), engaging in a process that involved many steps. First, the group decided where the toilet blocks were going to be located (in a commercial corridor where many vendors did their business, specifically in a place where an existing toilet block had sat closed for 20 years). Then, they determined who

owned the existing toilet structure and obtained permission from the Nairobi City Council to demolish the existing toilets and construct new ones. They secured the materials to build a new toilet block and physically constructed the toilets themselves. Lastly, they determined how to manage and maintain the toilets, employing group members to take fees from residents per use and used those fees to keep the facilities clean and operational. They had encountered a number of challenges along the way: securing permission had involved a long process of negotiation with local authorities. Work had stopped for a year when they ran out of money for construction materials. And, there was a lot of laughter during the focus group when the members told me about how difficult it had been to construct the building during the rainy season. The group had just dug out the foundation when the rainy season started, leaving a big gaping hole in the ground. After one heavy rainfall, the group had needed to work together to empty water from the area one bucketful at a time. The members described how things had changed in that area since building the toilet. Before the toilet was built, both residents and vendors would use toilets in public locations, like a nearby church, which was not always available, private toilets within clusters of housing which were often dirty (I visited one and it was quite filthy), or openly urinate and defecate. For the residents of Mabatini, this toilet has positive health implications, as illustrated by this member's statement in a focus group:

> *"We say that in our area there weren't public toilets and also when people passed by, you found men urinating everywhere because they have no place to stand. But when the toilet was built, that habit of standing anywhere stopped and they started to enter in the toilet."*

In their opinion, the toilet was cleaner than previously available options, was more accessible, and had reduced the amount of open urination and defecation, all pointing to improved community health in that area.

> *Interviewer: Is it clean?*
> *Respondent: Very clean.*
> *Respondent: When you get in, you have no desire to get out.*
> *Respondent: We'll take you to see.*

After the focus group, we visited the toilet, and it was indeed quite clean, with more updated and safer materials than many of the other toilets I had seen in the settlement (not made out of sharp or rusting metal and connected to sanitation infrastructure rather than dropping sewage straight into a river).

The Bondeni group also managed a public toilet and water point within their village; in fact, securing a toilet had been one of the first successes of the group. Their process was also complicated, involving negotiating with the village chief, working to secure community development funds (a government initiative), and most challenging, taking the toilet over from Mungiki, a local gang. Mungiki, whose presence has slowly diminished in Mathare, has had a complicated role in Mathare—the gang provides security while also contributing to violence and crime, increases access to services not otherwise available, but does so illegally (which often means unsafe water or electricity connections) and at high cost to residents, particularly when there are shortages. According to one newspaper article, Mungiki charged the following fees: 3 Ksh for a 20 liter gallon of water, 300-1000 Ksh for electricity depending on the size of the house, 300-500 Ksh for businesses to operate, and 100-200

Ksh for security.[81] The fees are non-negotiable and paid on-demand, with "failure to pay resulting in harassment, making it impossible to live in the area or operate a business."[81] This narrative is consistent with a recent Amnesty International report that highlights toilets as unsafe spaces, where women in particular are vulnerable to violence.[46] In contrast to Mungiki run toilets and water, the toilets and water managed by the Muungano group in Bondeni have predictable costs since water is legally procured (2 Ksh/20 L of water, 5 Ksh/use for toilet), but more than that, they are likely safer and better maintained, all of which have health implications for Bondeni's residents—access to cleaner, safer water and cleaner toilet facilities, reduced violence, and reduced exposure to infectious disease. Lastly, the groups in Mabatini, Kiamutisya, and Bondeni outlined a number of ways they were involved in physically improving their community, voluntarily cleaning up trash and unplugging clogged sanitation pipes, which all have the impact of improving community health by reducing exposure to infectious disease and injuries. This idea is supported by studies that have found positive health outcomes connected with slum upgrading (improvement to the physical and social environment, usually around water, sanitation, and housing. Studies have found that slum upgrading generally improved living conditions, and reduces the rate of waterborne and mosquito related illness. [112–114] Improved (and legal) access to safe water and sanitation can also have indirect effects on health, leading to reduced expenditure on water and toilets, as well as reduced expenditure on treatment for illness.[3] Lastly, if facilities are better located, then women may spend less time collecting water, which may give them more time to generate income.[3]

As with other aspects of microsavings, there are challenges in the area of building community. While many members expressed a sincere interest in supporting each other and improving their community, this was not consistently true for all members-- some individuals were simply involved because they wanted to get land or access to loans, and they did not regularly attend meetings or contribute money when a member was in need. As described elsewhere, leaders in positions of power did not always have the interest of the group or the community in mind, or more frequently, there was conflict between various members of the group. As with other challenges, the design of microsavings is intentionally developed to counter such threats. Retaining members who are invested and engaged is a constant focus for the advocacy team, whose role is to build and sustain membership. According to MuST staff, some group members only become invested and active after experiencing a success like getting land or building a toilet. Systems of accountability and transparency, where every member can question leadership, are in place to protect against leaders who do not have the group's best interest in mind. And when these structures fail, which does happen, there is still hope: according to one MuST staff member I interviewed, groups that go through a specific challenge—losing many members, a leader who is not interested in the best interests of the groups, embezzlement of funds, etc.—and come out on the other side intact often go on to become stronger and achieve great success.

One the opposite end of the spectrum, there are those members who become so invested and active with the groups that they are seen as "authorities on development" by external agencies (as labeled by a MuST staff member) and are frequently sought by NGOs to participate in forums, workshops, and for their expertise on community level issues. This work is often unpaid, leaving them with little space to find paying jobs while taking up precious time.

Lastly, groups were sometimes seen in a negative light by their community because they challenged the status quo and threatened limited resources. For example, in Bondeni, members shared that when they tried to get water legally (for their water kiosk,) other "*water vendors looked at us like the enemy*;" a leader in Kiamutisya reported a similar reaction in his community. A female member from Bondeni provided additional insight into the politics of this situation during an interview:

> *Interviewer: "Do you experience any bad changes, any stresses from participating?"*
>
> *Member: "Stresses sometimes from the community, they perceive us like we are here to take their land, maybe like we are here to object to the administration, even the administration itself [has issues with the microsavings groups]… because we are trying to enlighten the people and they don't want people to be enlightened."*
>
> *Interviewer: "Why would people think you're trying to take their land?"*
>
> *Member: ". . .when we wanted to build a toilet, the community said 'Next time you'll want to build something else and you'll take our land.' Even our water kiosks, because we wanted maybe a small space for the water kiosks, [the community said]'Now you want us to demolish our rooms so you can build a water kiosk' . . .because they work together-- the community plus the administration."*
>
> *Interviewer: "So they don't see it as a positive thing?"*
>
> *Member: "They don't see it as a positive thing, but we struggle, we struggle. They may….like the administration…. they were blocking the building of the kiosks, and they know the importance of water, but because they are paid by the people who own those shacks, so they block you from building."*

This exchange highlights that since groups challenge the village level administrative structure—chiefs, or other officials—these formal leaders sometimes did not look favorably upon groups. The interview excerpt also highlights that in many cases this reaction is a function of groups working to challenge corruption or looking to create something new and unfamiliar. Interviews with MuST staff and Muungano members seem to indicate that as groups strengthen and residents begin to see the type of work they are doing, they begin to be seen as legitimate forces for change in the community, that even if they are disliked, they win the grudging respect of village chiefs and residents.

(5) <u>Amplifying the voice of the poor: building political power</u>

Poor urban residents are often marginalized by the government or catered to via clientelistic relationships, which means they continue to lack the basic amenities and social services that the government is often best positioned to provide.[1,27,115] Microsavings provides support for individual political participation and a venue for collective political action, potentially improving health in slums by advocating for more pro-poor policies, programs and initiatives in slums. I encountered numerous examples of how microsavings supports political participation and raises the voice of both individuals and the urban poor as a group. This pathway was particularly salient since I conducted this case study shortly before Kenya's 2013 elections, subsequent to a new constitution, in conjunction with devolution and a new

way of voting. In Kiaumutisya, a female member facilitated a discussion called '*Are Kenyans ready for the 2013 elections?'* that covered what the new ballot would look like, the electoral process, voter registration, and the confidential nature of votes, etc. A lively dialogue ensured, including the following excerpts about clientelism in Mathare:

> *Member: "Those leaders we elected last time have not done anything to make sure we elect them again."*
>
> *Member: "In this area, we have 32 leaders to select from. To choose 1 leader, and all of them have money, so we eat the money [take what they offer], and then we leave them. Our MP[member of parliament], she has been in office for 5 years, what has she done for us? Nothing."*
>
> *Member: "X [referring to MP by name] was coming with food last time, and all the people, children were pushing, almost dying for 1 bag of rice or 1 bag of flour."*
>
> *Member: "There are so many people to choose from, now it is better we choose our own poor person."*
>
> *Facilitator: "If elected leaders come back with money, blankets, food, etc., we will take those things, but the vote will be a secret. . . any leader who comes, let us come and eat anything and vote for the one you want—the one who is right."*

The discussion even touched on the sensitive issue of tribalism and the post-election violence from 2007, much of which occurred in slums. The quote below is from the discussion facilitator:

> *"As Kenyans, we never had a healing process. People were not healed and the government didn't take a good step to heal people . . .a leader can't have enmity towards a tribe."*

While that discussion was focused on getting *individuals* to cast an informed vote, which could lead to government hearing and responding to the demands of the poor, there was simultaneously ongoing work to prevent election-related violence in the community: at one network meeting, students from a local university came to do a skit and subsequently facilitated a discussion on tribalism and how it harms communities; on another occasion there was a gathering for peace organized by the network. Such activities had the potential to reduce violence in communities during the next election, an important health protective outcome.

> *"I started… people were talking about eviction. So people decided to come together since it's hard for the government to evict a group of people. They would think twice. But if you are alone it's easy to be displaced. The government might think about settling us in a different place . . . Now that we are in a group, I am not troubled by eviction. We are strong now. If anyone wants to evict us, he'll think twice because he'll be up against a group of people."*
>
> *"We no longer receive notices of eviction . . . We got a lawyer, now; she's a judge. We took the notices to her; she would get us a court order to bring to the chief. The letter indicated that the sender of the notices needed to bring a court summons, not hand out notices.*"

The quotes above from interviews with microsavings group members in Kiamutisya emphasize how, in addition to encouraging members to vote and keep peace through elections, microsavings also provide the support for groups to fight against eviction and secure the legal rights to their land. Land titling in slums is often notoriously complicated, often with multiple individuals or groups coming forward to claim the same plot of land.[88] In some cases, village chiefs will "sell" land to new residents, land to which they have no claim. MuST provides groups with both resources and technical support to fight these claims: enabling residents to question claims to land, connecting them with lawyers to fight false titles, and working with them to archive critical documents that show their work to secure land. During the course of this study, the Mabatini group was in the process of trying to secure the rights to the land they were on, involving a seemingly endless labyrinth of meetings and visits with the Ministry of Lands, the Nairobi City Council, court summons and court dates. It is not clear what the outcome of these negotiations were, and truthfully, much of the process was difficult to follow, but what is clear is that microsavings provides groups with the skill set to respond to threats and the confidence to challenge claims. It is clear too that the groups are able employ these skills in a way that is recognized as a legitimate by the government (members from many groups highlighted that one of their achievements was being recognized as a group by the government), giving them greater political voice and potentially forging the way for secure land rights. While insecure tenure is associated with injuries, respiratory problems, infectious diseases and mental health problems, secure tenure can pave the way for improved health. Those who own their own house enjoy better health than those who do not; psychosocially, secure tenure can promote a sense of security, control, continuity, and attachment.[116] Secure tenure also creates the space for other interventions to be more effective, e.g. residents may be more likely to invest in upgrades, or use microcredit funds to start businesses if they know they have legal rights to their land.[97] In addition, preventing displacement also has potential health impacts. Displacement can affect the health of people, by leaving them without shelter or other basic amenities, and by disrupting their social networks, networks which potentially support their health.[117]

Perhaps the most powerful example of the ways microsavings amplifies the demands of the urban poor was a landmark lawsuit filed by Jane Weru, a lawyer and the founder of MuST on behalf of slum dwellers. In the lawsuit, slum dwellers from Mukuru, another informal settlement in Nairobi, assert their rights to the land on which they live and call for an end to evictions.[69] The land on which slum dwellers reside has a complicated history—much of it was issued to wealthy individuals who generally had connections to the government during the 1980s with the requirement that the land be used for business development. Instead huge plots remained vacant and were used as collateral for loans. During the period of this study, MuST and Muungano used the federation structure to get thousands of signatures for petitions. They successfully won an injunction preventing any further evictions in an area of Mukuru. Concurrently, Muungano and MuST mounted a campaign highlighting the realities of living without sanitation, and the particular hardships for women in Mukuru ---which was the prelude to another lawsuit being filed on behalf the women residents of Mukuru. Female residents of many of Nairobi's slums came together at MuST offices to work on the campaign and discuss the realities of living without sanitation—from having children who had to clean sewage at school, to keeping menstruation pads and urine in a container under their beds. All left with petitions to get signed and ideas of next steps (community forums, flyers, etc.). Much of this work was publicized through a documentary produced and shown

by MuST, on the nightly news, and in the print media, also amplifying the realities and demands of the poor. In addition to preventing displacement and increasing tenure security, such action may be may be the impetus for government action in slums, action that could improve population health in slums. Dramatic shifts in health have often been attributed to changes in policy: declines in mortality rates in the U.S. were in large part a result of policy changes around sanitation, water supply, and food quality.[118]

Discussion

There were a number of limitations to this study, which I did my best to address. I spent a total of 6 months in the field, a relatively short period of time to understand how microsavings and health might be connected. Though my time in the field was limited, I worked in the intervening periods to read as much as possible about Kenya, informal settlements, and microsavings. During the time I was in the field, I did extensive work to triangulate my findings—spending long hours in Mathare, visiting people, having informal conversations, visiting other savings groups people were a part of, walking through each village multiple times to observe, all while taking extensive field notes. I also looked to local experts to guide me, benefitting from the advice and expertise of MuST staff who informed my selection of groups, shared with me the history of villages and groups, and oriented me to other aspects of Mathare.

As an outsider to the setting who is not fluent in the local language, culture, or social rules, my understanding of events may have been distorted. In an effort to reduce such distortions, I worked with a local interpreter who was a member of a savings group. She helped me gain entrée to groups, served as a translator, and helped me navigate social and cultural rules. In addition, I have previous experience working in Kenya and was familiar with some aspects of the culture, social norms, and language. I felt that my identity as a young woman of color went some way in helping study participants feel comfortable with me. I studied Swahili and while not fluent, even some knowledge of the language helped in establishing rapport.

Lastly, since my study employed primarily qualitative methods and worked with a small number of individuals and groups, I was not able to actually assess the impact of microsavings on health. Though I was unable to assess actual impact on health, my main research question was to better understand how microsavings might help build health, and my methods were appropriate to the task at hand. Future research on a larger scale is needed to better understand actual impact on health. Prospective studies that follow microsavings groups and their communities, as well as controls, over time would be particularly useful in this regard.

Overall, I found that microsavings promoted and protected health in Mathare through five pathways: building community, amplifying the voice of the poor, facilitating empowerment, creating a network, and building financial strength. The pathways between microsavings and health manifested in different ways in each group, with certain pathways to health dominating in each group. In Kosovo, the most distinct from the other groups because of its size and composition (all women, and only ten members), the health benefits seemed to exist only within the group and did not extend to the broader community. This may have been a function of the fact that the group was drawn together based on a specific identity (motherhood), and a specific need (childcare) instead of being composed of a broader group of community residents like the other groups. At the same time, the group may have met

more of their individual needs than some of the other groups--the childcare allowed them to leave home to do work, possibly supporting the health of their family through increased income. In Bondeni, the only group to do table banking, more members discussed loans as a benefit of microsavings participation. In fact, it seemed like the table-banking approach was perceived more like a merry-go-round then a loan, where everybody had the opportunity to participate and use a sum of money at one point in time. This approach seemed to encourage more of Bondeni's members to take loans, which generally seemed to be used in ways that supported health, whether the individual used it to start a new business, sustain an existing one, or pay for school fees. In Bondeni, the *build financial strength pathway* seemed to predominate. According to the chair, table banking had renewed the Bondeni group and attracted more members; thus table banking may also be responsible for spreading the benefits of microsavings to more individuals. In contrast, Kiamutisya seemed to have the most vibrant culture of discussion—it was the only group to discuss politics so explicitly (perhaps because its' members were primarily one tribe), adhere to an agenda, entertain visitors (a representative from Equity, a local bank, and the chair of the network visited while I was conducting this study) and share news from the network. In other words, in Kiamutisya, the *network pathway* was quite strong. The group seemed to increase members' knowledge about politics and village news as well as their awareness about opportunities. In addition, the Kiamutisya group was perhaps the most intergenerational of the groups, with a large number of older residents. When I asked these members about the benefits of participation, many of them discussed how important it was for them to attend meetings, talk with others, and not "*get behind*." For older residents, the social support function of microsavings may have been an important way of maintaining their health— reducing isolation and alienation while they saved for housing that their children's children could live in. Lastly, Mabatini was the largest group, with 260 participants. As one member said, it was like they "*captured the whole community*." There seemed to be less reports of friction with the community in this group, perhaps because of their larger membership, or because of the group's highly visible work building a toilet in a highly trafficked commercial corridor. Such presence, through shear numbers and the nature of their work may have increased their ability to do more work to benefit the community, i.e. exert influence on health through the *build community pathway*. Mabatini was also the group with a no loan policy, so that they could maximize the amount of money going into saving towards housing. They were saving daily (unlike other groups) and working with architects to design housing during the course of this study. So, while Mabatini members were perhaps less likely than Bondeni members to get the sort of financial support, they may have been closer to securing improved housing and experiencing the health benefits associated with that.

Regardless of the predominant pathway through which microsavings supported health in each group, the ability to build health seemed to be rooted in microsavings orientation as a community organizing approach. Organizing aims to create change by both facilitating social *processes* and achieving tangible *outcomes*.[119] In this paper, I have emphasized both social *processes and outcomes* connected to microsavings participation can build health. By mobilizing large numbers of the urban poor to manage money together, microsavings ultimately facilitates a process that builds trust between community members, increases their capacity to work together, address problems, and resolve conflict.[28] I make the case that this increased sense of community, improved community capacity, and an extensive network to tap into builds social capital and social support, both of which have been connected to improved health outcomes, while amplifying the voice of the poor is connected to greater

participation, also important from a health perspective.[3,104] Concurrently, federation, or the extensive network of savings groups create the infrastructure for coming together to negotiate with authorities, external agencies, or relevant stakeholders on behalf of its members, building political power for slum communities.[28] Women talked about a process of transformation, or empowerment, which has been associated with a wide variety of positive health outcomes.[110,111,120] I have also provided myriad examples of material *outcomes* connected to organizing that are intimately and broadly connected with the social determinants of health. By being able to accumulate savings and access credit, residents are able to support their livelihood, increase food security, and increase their children's access to education, all of which have been linked to improved health.[3,94,95,98,101] In saving collectively for housing and land, microsavings members were en route to improved housing and tenure security, which too have been connected with better health.[1,3,34,121] In addition to meeting the immediate, tangible needs of individual slum dwellers for financial resources and physical infrastructure, microsavings grappled with the more difficult aspects of social and political exclusion. Groups also worked together on projects to improve community, increasing access to safe water and sanitation, and in the process reducing poor health in their community.[112–114]

Many of my findings about how microsavings exerts its' influence on health are consistent with theories about how organizing effects change. Within the community organizing paradigm, change is thought to occur be increasing communities' ability to identify priorities, by extending and building networks, facilitating empowerment, and increasing community capacity.[119] Microsavings takes this *theory of change* and builds on it, creating an organizing approach that caters to the specific needs of the urban poor—slum dwellers can access financial resources they do not otherwise have access to in the immediate—while participating in longer term social process that affect political, social, and physical change in their communities. Like 'conventional' organizing, this approach simultaneously juggles process and outcome, but it also addresses both the *immediate*, *material* needs of the poor while working towards *social* change in the *future*. This multi-pronged approach to organizing makes microsavings uniquely positioned to address the social determinants of health in slums, as slum dwellers confront immediate threats to their survival on a daily basis, but also experience poor population health as a function of social and political exclusion. It is possible that by working to address the more immediate needs of the urban poor, this community organizing approach allows for more sustained participation, a fact that may ultimately allow microsavings to achieve more health benefits.

At the same time, I highlight real challenges with microsavings, challenges that, in the best-case limit microsavings ability to impact health, and in the worst case, negatively affect health. These challenges are wide ranging—individual's building debt or losing hard won savings, women members confronting family conflict as a result of participation, and group members being shunned by the broader community. The type of work that microsavings groups are engaged in—building economic, social, political and physical capital—is inherently challenging, and it is bound to be messy and imperfect. There are going to be failures. However, my observations tell me that in many cases, the structures put in place by microsavings can mediate these challenges.

There are a number of opportunities for microsavings to be an even more powerful force for addressing poor health in slums. While microsavings is built to address a number of

upstream factors that shape health—housing, land, finances, and social and political exclusion---factors, which, if addressed should prevent many poor health outcomes from occurring in the first place, it is not currently explicitly addressing many of the more immediate health related issues that slum dweller confront. Health is not discussed in groups and there is not much intentional support for individual health aside from the welfare fund, which is more reactive than proactive when it comes to health issues (i.e. funds are available in the event of hospitalization or death). In other words, there exists a middle ground between preventing illness by responding to factors upstream of health and addressing health emergencies like hospitalization and death. If microsavings groups did more to address this middle ground, it could potentially provide major health benefits for slum residents. There are numerous ways this could take place: microsavings may be able to address the stigma associated with HIV/AIDS, or groups may be able to create a fund to support members to pay for coverage under the National Health Insurance Fund (NHIF). Microsavings groups could do more work to encourage slum dwellers to access preventative care, which seemed to be virtually unheard of in informal settlements. In addition, groups or networks could partner with public health organizations to make interventions more effective. For example, using the extensive microsavings structure may be highly effective method for disseminating health related information or materials (like bed nets). Lastly, public health funds could be used to support the ongoing work of microsavings groups. If global health practitioners supported and partnered with microsavings groups to *lift up what is already working*, microsavings could become a powerful force for building population health in informal settlements.

Figure 1. Embedded Case Study Design

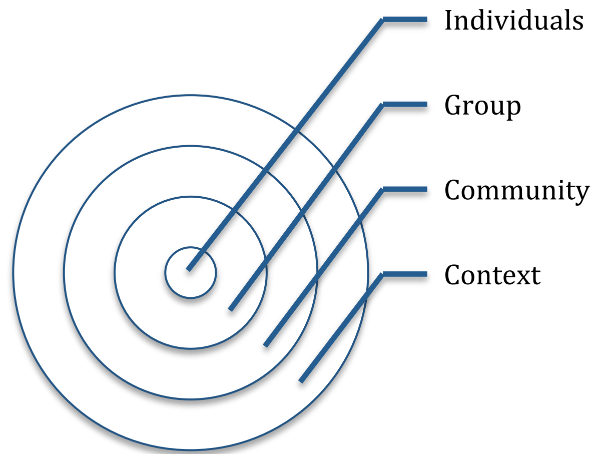


Figure 2. Map of Mathare Valley

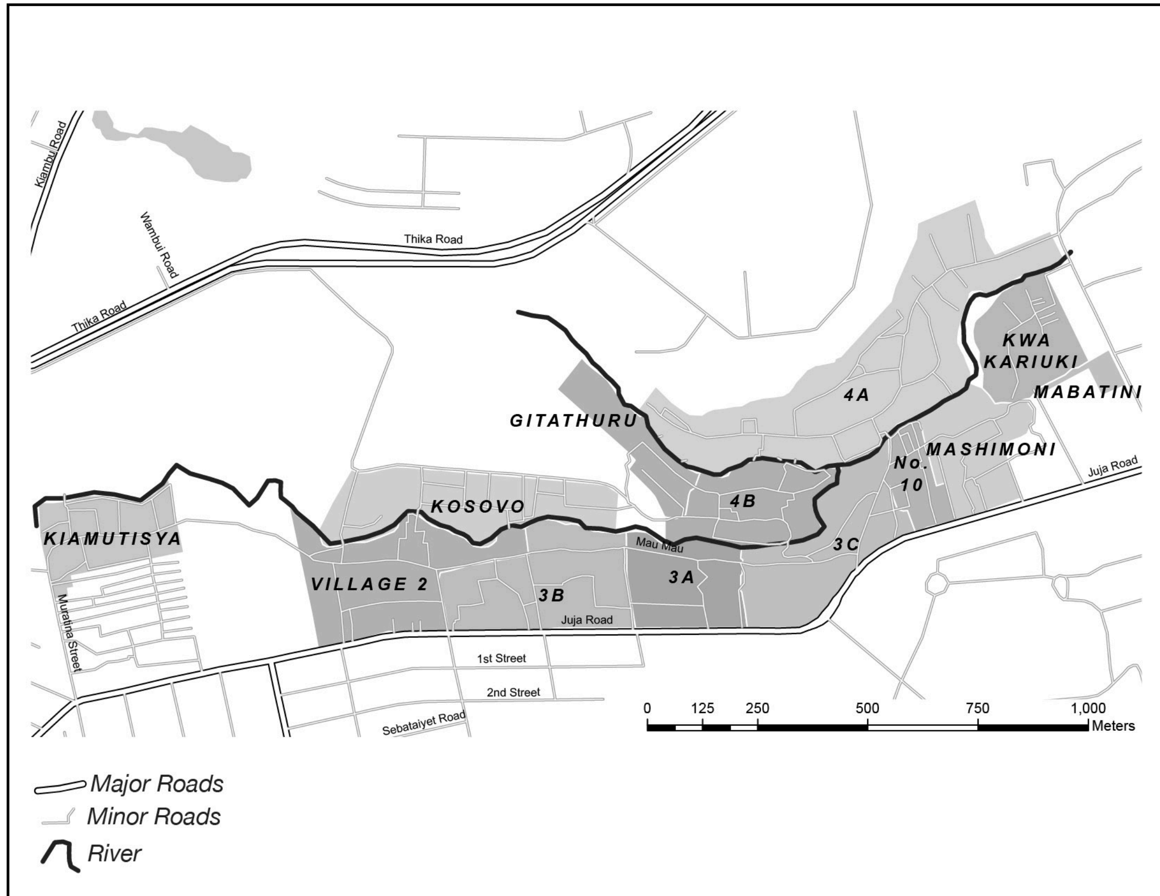


Table 1. Group Profiles as of November 2012

	Bondeni	Kiamutisya	Kosovo	Mabatini
Established	2007	2007	2010 (not registered)	2007
Members	100 members 38 active	200 members 58 active	10 members 5 active	260 members 100 active
Elected Leaders	Chairman: female (acting chairman is male) Secretary: male Treasurer: Female	Chairman: male Secretary: male Treasurer: female	N/A	Chairman: male Secretary: female Treasurer: female, treasurer of welfare: female
Team leaders	Advocacy: female Welfare: male Audit: female Savings/Loans: male MDF: N/A Land/Projects: female	Advocacy: female Welfare: male Audit: male Savings/loans: male MDF: female Land/projects: male	N/A	Advocacy: female Welfare: male Audit: male Savings/loans: female MDF: male Land/projects: male
Gender composition	30 female, 8 male	more females than males	all female	more males than females

Table 2. Embedded Case Study Design

	Bondeni	Kiamutisya	Kosovo	Mabatini
Focus Groups	1 female group 1 male group	1 female group 1 male group	1 female group	1 female group 1 male group
Interviews	4 females 2 males	4 females 2 males	5 females	4 females 2 males
Observation	4 meetings	5 meetings	3 meetings	3 meetings

Conclusion

Taken together, these papers present a complex and nuanced picture of how health might be shaped in informal settlements. The relational framework connects health to the economic, physical, and social conditions within slums, but not always in the expected ways. Toilets might be responsible for some of the poor health we see in informal settlements, not because they facilitate the spread of infectious disease, but because they are spaces of potential violence against women. It may be a well-documented fact that income and health are correlated, but this framework highlights the myriad ways that it might be related to health. Income not only allows people to access health-supporting resources like food, shelter, and safe water, it sustains small businesses that bring in income for families, and protects women from having to engage in risky sex work that might make them more vulnerable to violence and sexually transmitted infections. Poor quality and overcrowded housing does not only facilitate the spread of infectious disease, it seems to fuel the rapid spread of fires in informal settlements, another route through which population health may be impacted. With this emerging picture of health in Mathare, I examined how microsavings might be able to promote and protect health. I found that microsavings built health through five processes facilitated by organizing communities of the urban poor: building financial strength, building community, amplifying the voice of slum dwellers, creating a network and facilitating the empowerment of women. Both the process facilitated and the outcomes achieved by groups were important for building health. I provide a number of examples of how this happens in Mathare, from innovative approaches like table-banking that allow for circulating large amounts of money to advocating for the rights of slum dwellers through legal approaches.

If the relational framework urges us to conduct better *analyses* of health in informal settlements, then it could be said that microsavings is a call for us to do better in *responding* to health in informal settlements. The relational approach involves analyzing health both proximally and distally, at multiple levels, treating health as a process and as an outcome, doing research 'with' not 'on', and addressing the economic, social, physical, and political determinants of health. Microsavings seems to do the same—it works on multiple levels (individual and collective), responds to multiple factors (economic, social, and political, physical), and is focused on both process and outcome. This approach is distinct from other interventions, like cash conditional transfers or microcredit that have been celebrated for reducing poverty and found to improve health. Cash conditional transfer programs provide money to an individual based on doing a specific activity, like keeping a child in school or going to the doctor; while microcredit programs generally give loans to individuals to support or start a business. In contrast to microsavings, these interventions focus on one or two determinants of health in isolation (primarily economic, but also social, discussed more below) rather than as interrelated factors (in a "fixed variable or static" way), and focus on outcome rather than process. Perhaps the most important distinction is that microsavings works with, rather than on, by organizing communities of the urban poor to create broader change. While (like cash conditional transfers and microcredit) microsavings works within the current structure to address immediate needs, *it also aims to change the conditions that make people poor in the first place.* Both through facilitating social processes to build the capacity and knowledge of the urban poor, but also by advocating for broader political change that changes the way that the government engages with the poor.

This is not to say that the other interventions are not important or necessary. Cash conditional transfers and microcredit are often life changing for those who participate. And a number of these programs have been associated with improved health. Perhaps the best example of cash conditional transfers is Bolsa Familia, a cash conditional transfer program implemented by the Brazilian government. The programs has provided 11 million poor families with money in exchange for keeping their children in school and taking them for regular health check-ups and vaccinations.[122,123] Recipients report using the money they receive for food, school supplies and clothes for children.[122] An evaluation found that the program reduces inequality, reduces extreme poverty, increase school attendance, and reduces stunting in very young children.[124] Microcredit, as popularized by the Grameen Bank has also been found to have impact on health, increasing knowledge and reducing the risk of HIV/AIDS and intimate partner violence when combined with education.[125–127] Microcredit has also been linked to improved nutritional outcomes for women and increased food security for children when the loan recipients are women.[98,99] Another reason such interventions are important is that microsavings alone is not a panacea for populations of the urban poor. As I have pointed out, microsavings is messy and may sometimes even negatively influence the health of participants. People steal money, men exploit the structure for personal gain, and women become empowered but may also unfairly be held responsible for facilitating development in their communities. Perhaps even more important, the work of microsavings is sometimes incredibly slow, taking over 10 years to bring public toilets to slum communities in India. Moreover, many would argue that bringing such infrastructure to a community is really the responsibility of the state in the first place.

But such protracted timeframes are a function of the fact that federations of the urban poor are attempting to do difficult work: renegotiating relationships with the government, addressing social and political exclusion, and changing the way the poor are viewed. Such hard work is necessary to change the health of urban, poor populations in the long-term. Because while Bolsa Familia was associated with a wide variety of health and developmental outcomes, the children whose families received cash were still four times more likely to fail than other students. This statistic points to the fact that there is something more profound at play. Even with the additional financial resources that cash conditional transfers provide, many of these families do not have other resources that allow them to succeed or be healthy in society as it exists. In the end, we need all of these interventions: microcredit that helps individuals and larger social government programs like Bolsa Familia that help poor families. But there are far too few interventions that think as big as microsavings, which aim to change the structures that create poverty. This is unfortunate, because our bigger challenge is not to help the poor, but to create a world where there are no poor.

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Appendices

Appendix I. Mathare Household Survey

ENUMERATI

ON FORM

INTRODUCTION

No.	Question	Response
1	**Project brief** *This form will be used for capturing data for the purpose of preparation of Mathare Zonal plan.*	
2	**Jina la mwenye kufanya shughuli ya kuhesabu** *(Name of enumerator)*	
3	**Jina la kijiji** *(Name of village)*	
4	**Jina la sehemu** *(Name of cluster)*	
5	**Nambari ya nyumba** *(House Number)*	
6	**Jina la mwenye kujaza hii fomu** (*Name of the respondent)*	**a. Mume** *(Male)* ___________________________________
		b. Mke *(Female)* ___________________________________
7	**Type of structure owner** *(Aina ya mwenye nyumba)*	a) **Naimiliki** *(Owned)* b) **Mpangaji** *(Rented)*
8	**Mwenye kujibu hii fomu?** *(Who is the respondent)*	a) **Kiongozi wa nyumba** *(Head of household)* b) **Bibi wa kiongozi wa nyumba (***Spouse of household head)* c) **Mtoto wa kiongozi wa nyumba** (*Child of household head)* d) **Jamii ya kiongozi wa nyumba** (*Relative of household head)* e) **Jirani** *(Neighbour)* f) **Mwingine, taja** *(Other specify)*______________________
9	**Kitambulisho cha mwenye kujibu** (*ID number of respondent)*	

OWNERSHIP AND TENURE

No.	Question	Response
10	**Jina la mwenye nyumba** *(Name of structure owner)*	**a) Mume** *(Male)*_______________________________________
		b) Mke *(Female)*_______________________________________
11	**Nambari ya kitambulisho cha mwenye nyumba** *(ID of structure*	
12	**Uhusiano wa mkaaji wa hii nyumba na mwenye nyumba ni upi?** *(Relationship of the occupant with the structure owner)*	**a) Mimi ni mwenye hii nyumba** *(Structure owner)*
		b) Mpangaji *(Tenant)*
		c) Mpangaji wa mpangaji *(Sub tenant)*
		d) Jamii ya mwenye nyumba *(Relative of the owner)*
		e) Ingine, taja *(Other, specify*_____________________________
13	**Mwenye nyumba huishi wapi?** *(Where does the structure owner live?)*	a)**Kwenye hii ploti** *(In this plot)* b) **Hapa kwa kijiji hiki** *(In this village)* c) **Kwingine Nairobi** *(Elsewhere in Nairobi* d) **Nje ya Nairobi** *(Not in Nairobi)* e) **Sijui** *(I don't know)* **f) Kwingine, taja** *(Other, state)*______________________
14	**Jina la mkaaji wa hii nyumba** *(Name of occupant)*	
15	**Nambari ya kitambulisho cha mkaaji** *(ID of occupant)*	

No.	Question		**Aina ya matumizi ya nyumba** *(Type of use) e.g. business- (grocery, shop, hotel, bar), institution etc)*	**Jina la kanisa, shule, Biashara, taasisi ama kanisa** *(Name of business, church, school, hotel, bar, institution etc)*
16	**Matumizi ya nyumba** *(Structure use)*			
		a)Nyumba ya kuishi *(Residential)*		
		b) Nyumba ya Biashara *(Business)*		
		c) Chumba cha Biashara na pia kuishi *(Business cum residential)*		
		d) Taasisi *(Institution)*		
		e) Taasisi za kidini *(Religious institution)*		
		f) Kifaa cha uma *(public utility)*		

17	**Hii nyumba ina ukubwa upi?** *(How big is this structure?)*	**Ukubwa wa urefu na upana** *(Dimensions of length and width)*
18	**Ikiwa wewe ni mpangaji, wewe unalipa kodi pesa ngapi kila mwezi?** *(if you are a tenant, how much do you pay as rent (per month))*	**a)Chini ya mia tano** *(Below Ksh 500)* **g. Ksh 3001-3500** **b) Ksh 501-1000** **h. Ksh 3501-4000** **c) Ksh 1001-1500** **i. Ksh 4001-4500** **d) Ksh 1501-2000** **j. Zaidi ya Ksh 4500** **e) Ksh 2001-2500** *(Above Ksh 4500)*

19	**Vifaa vya ujenzi** *(Building materials)*	**Paa** *(Roof)*	**Ukuta (***Wall***)**	**c) Sakafu** *(Floor)*
		a. Mabati *(Iron sheets)* **b. Wood** *(Mbao)* **c. Plastiki (***Plastic***)** **d. Nyasi** *(Grass)* **e. Vyuma** *(Scrap metal)* **f. Nyingine, taja** *(Other Specify)*__________	**a.Mawe** *(Stones/Concrete)* **b. Matope** *(Mud)* **c.Mabati** *(Iron sheets)* **d. Mbao** *(Wood)* **e. Matofali** *(Bricks)* **f. Plastiki** *(Plastic)* **g.Vyuma** *(Scrap metal)* **h. Nyasi** *(Grass)* **i.Nyingine,taja** *(Other Specify)*	**a. Simiti** *(Cement)* **b. Mbao** *(Wood)* **c. Mchanga** *(Earthen)* **d.Nyingine, taja (***Other specify***)**
20	**Umeishi hapa kwa muda gani (kwa miaka na miezi)?** *(How long have you lived here (In years and months)*	**Katika hiki kijiji** *(In this village)*	**Katika hii nyumba** *(In this structure)*	

21	**Uliishi wapi kabla uje hapa?** *(Where did live before you came here?)*	**a)Nimezaliwa kwa hii kijiji** *(Born in this village)* **b|) Kwa kijiji kingine hapa mjini** *(In another settlement informal settlement in Nairobi)* **c) Hapa mjini lakini si kwa kijiji** *(Another area of Nairobi which is not an informal area)* **d) Nje ya mji** *(Out of Nairobi)* **e) Kwingine, taja** *(Other, specify)*
22	**Je Kwanini uliamua kukuja kuishi hapa?** *(What made you come and reside here?)*	**a) Kodi ni bei nafuu** *(Affordable rent)* **b) Kikazi** *(Employment)* **c) Ndoa** *(Marriage)* **d) Kufurushwa kwa kijiji kingine** *(Evictions)* **e) Ingine taja** *(Other, specify)*
	FACILITIES AND SERVICES/UTILITY	

23	**Je hii nyumba hupata maji kutoka wapi?** *(What is the water source for the household?)*	**Unapotoa maji** *(Water source)*	**Umbali kutoka kwa nyumba** *(Distance from the house (In metres)*	**Mnatumia maji kiasi gani kwa siku** *(Amount of water used in a day)(In litres)*	**Gharama** *(Cost per 20 litres jerican)*
		a)Maji ya mfereji kwa nyumba *(Piped water connected to the*			
		b) Maji ya jamii *(Yard tap)*			
		c) Maji ya kisima *(Well)*			
		d) Maji inayouzwa na wachuuzi *(Buying from water vendors)*			
		e) Duka za kuuza maji *(Water kiosk)*			
		f) Ingine, eleza *(Other, state)*			
24	**Maji mnayotumia ni ya kutegemewa?** *(How reliable is your water source?)*	**a) Siku yote** *(Throughout/reguraly)* **b) Asubuhi na jioni** *(Morning and evening)* **c) Mchana peke yake** *(Daytime only)* **d) Usiku peke yake** *(Night time only)* **e) Mara kwa mara** *(Now and then)* **f) Ingine, taja** *(Other specify)*			
25	**Kimaa La, Mnakumbana na changamoto gani kwa**		**Masaa yanayotumika** *(Time spent)*		

	kuyapata maji? *(If No, what challenges do you face in getting water)*		**a) Chini ya saa moja** *(Less than 1 hour)* **b) Kama saa moja** *(about 1 hour)* **c) Masaa mbili 2 mpaka sita** *(2-6 hrs)* **d) Zaidi ya masaa sita** *(More than 6hrs)* **e) Ingine, taja** *(Other specify)* _

26	**Aina ya choo unachokitumia ni kipi?** *(What type of toilet do you use?)*	**Choo cha kibinafsi** *(Individual toilet)*	**Choo cha jamii** *(Public toilet)*	**Umbali** *(Distance in metres)*	**Gharama** *(Cost)*	
					Kwa mwezi *(Per month)*	**Kwa matumizi** *(Per use)*
		a) Hakuna *(No facility)*	**a) Hakuna** *(No facility)*			
		b) Choo cha shimo cha kawaida *(Ordinary pit latrine)*	**b) Choo cha shimo cha kawaida** *(Ordinary pit latrine)*			
		c) Choo cha shimo kilichoimarishwa *(VIP pit latrine)*	**c) Choo cha shimo kilichoimarishwa** *(VIP pit latrine)*			
		d) Choo cha maji kiliounganiswa na bomba la taka *(WC connected to public sewer)*	**d) Choo cha maji kilichounganiswa na bomba la taka rasmi** *(WC connected to formal sewer)*			
		e) Ingine, taja *(Other, specify)*___	**e) Choo cha maji kiliounganiswa na bomba la taka lisilo rasmi** *(WC connected to informal sewer)*			
		) Choo cha maji	**f kinachomwagwa maji taka kwa mtaro/mto** *(Water closet draining to drains/rivers)*			
			g) Ecosan toilet			
			h) Ingine, taja *(Other, specify)*			
27	**Nirjmii ngapi zingine zinazotumia choo mnachotumia?** *(About how many other households share the same public toilet with your household?)*					

28	**Mnakumbana na changa mo gani katika utumizi wa choo?** *(What challenges do you face in accessing toilets?)*	**toGharama** *(Cost)*	**Usalama** *(Safety)*	**Kuwepo** *(Availability)*	**Kutumika na kila mtu kama watoto** *(Efficiency e.g used by children)*	**Usafi** *(Hygiene)*

29	**Jinsi ya kutupa taka** *(Methods of solid waste disposal)*	**Kwa mpangilio** *(Organised methods)*	**Gharama** *(Cost per month)*	**Njia zisizo na mpangilio** *(Disorganised methods)*
		a) Kuokotwa na manispaa *(Collected by the council)*		**a)Tupa kutoka kwa nyumba** *(Throw outside the house)*
		b) Kuokotwa na vikundi vya kibinafsi *(Collected by private waste collectors)*	**Kutupa kweny**	**e shb)imo la taka** *(Dispose in waste pit)*
		c) Kuokotwa na wanakijiji waliojiunga *(Collected by organized local community members)*		**c) Kutupa kwa mto** *(Dispose into the river)*
				d) Kuzika *(Bury)*
				e) Kuchoma *(Burn)*
		d)Ingine, taja *(Other, specify)*_______		**e) Ingine** *(Other method)*

30	**Changamoto kwa utupaji wa taka** *(Challenges in solid waste disposal)*		
31	**Jinsi ya kutupa maji chafu** *(Means of waste water disposal)*	**Jinsi** *(Methods)*	**Changamoto** *(Challenges)*
		a) Mwaga nje ya nyumba *(Pour outside the house on the roads/street)*	
		b) Mwaga katika mahali pa taka *(Pour t the garbage disposal area)*	
		c) Mwaga kwa mto au mtaro *(Pour in the river or drains)*	
		d) Mwaga kwa choo *(Pour in pit latrines)*	
		e) Ingine *(Other method)*	
32	**Aina gani ya stima imeunganishwa kwa hii nyumba** *(What type of electricity connection is in this house)*	a) **Rasmi** *(Formal)* b) **Isiyo rasmi** *(Informal)*	

33	**Kwa matumizi yenu ya kupika na Mwangaza nyinyi hutumia nini?** *(What is the source of energy for cooking and lighting?)*	**Mwangaza** *(Lighting)*	**Gharama** *(Cost per month)*	**Kupika** *(Cooking)*	**Gharama** *(Cost)*
		a) Stima *(Electricity)*		**a) Makaa** *(Charcoal)*	
		b) Mafuta ya taa *(Paraffin)*		**b) Stima** *(Electricity)*	
		c) Miale ya jua *(Solar)*		**c) Kuni** *(Firewood)*	
		d) Battery *(Portable battery)*		***d) Sawdust***	
		e) Ingine *(Other method*		***e) Briquettes***	
				f) Biogas	

34	**Je watoto wako huenda shule za aina gani?** *(What type of schools do your children attend?)*	**Aina ya shule** *(Type of school)*	**Umbali** *(Distance)*	**Sababu ya kuchagua hii shule** *(Reason for choice of school)*
		a) Shule ya msingi iliyoidhinishwa *(Formal primary schools)*		
		b) Shule ya msingi isiyoidhiniswa *(Informal primary school)*		
		c) Shule ya upili iliyoidhinishwa *(Formal secondary schools)*		
		d) Shule ya upili isiyoidhinishwa *(Informal secondary school)*		
		e) Taasisi za kulea watoto *(Daycare centres/Nursery/Kindergarten)*		
		f) Ingine, taja *(Other, specify)*____________________		
35	**Changamoto z inazohusiana na shule** *(Challenges faced in accessing schools)*			

36	**Unaweza eleza nini kuhusu hali ya afya yako?** *(In general how would you rate your health?)*	**a) Bora kabisa** *(Excellent)*
		b) Njema sana *(Verygood)*
		c) Njema *(Good)*
		d)Sawa Kiasi *(Fair)*
		e) Mbaya *(Poor)*
37	**Ukilinganisha na mwaka jana, ungesemaje kuhusu afya yako sasa** *(Compared to one year ago, how would you rate your health now?)*	**a) Bora zaidi kuliko mwaka jana** *(Much better now than one year ago)*
		b) Ni kama tu mwaka jana *(About the same as one year ago)*
		c) Mbaya zaidi kuliko mwaka jana *(Much worse than one year ago)*

38	Mnapata vifaa vya huduma za afya wapi? *(Where do you access health facilities?)*	Wapi *(Where)*	Ni huduma gani mnapata *(Type of services obtained)*	Aina ya kifaa *(Nature of the facility)* a) Dispensary b) Health centre c) Clinic run by NCC d) Clinic run by NGO e)Public hospital f) Private hospital g) Herbalist	Umbali *(Distance)*
		a) Katika hiki kijiji *(Within this village)*			
		b) Nje ya hiki kijiji, lakini ndani ya Mathare *(Outside this village but within Mathare Valley)*			
		c) Nje ya Mathare *(Outside Mathare Valley)*			

39			Mtu mzima *(Adults)*	Watoto miaka tano na chini *(Children 5 years or younger)*	Watoto zaidi ya miaka tano *(Children more than 5 years)*
40	Magonjwa gani husumbua sana hii jamii yako? What health *conditions are prevalent in this household?)*	a) Malaria			
		b) Homa ya tumbo *(Typhoid)*			
		c) Kipindu pindu *(Cholera)*			
		d) Kuhara *(Diarrhoea)*			
		e) HIV/AIDs			
		f) Matatizo ya kifua *(Chest problems)*			
		g) Matatizo ya kupumua *(Breathing/Respiratory*			
		g) Ingine *(Other)*			

41	Watoto wa chini ya miaka tano wanashikwa na magonjwa ya homa, kutapika na kuharisha kwa muda gani? *If you have children under 5yrs, how frequently do they get sick with a fever, vomiting or diarrhoea?*	a) Mara moja kwa wiki ama zaidi *(Once a week or more)*	b) Kila wiki mbili *(About every 2 weeks)*	c) Mara moja kwa mwezi *(Once a month)*	d) Mara moja kila miezi kadhaa *(Once every few months)*	e) Mara moja kwa mwaka *(Once a year or infrequently)*
42	Unaweza sema hali ya afya kwa nyumba yako ikoje? *How would you rate the quality of health services for your household*	a) Njema sana *(Very good)*	b) Njema *(Good)*	c) Nimetosheka *(Satisfactory)*	d) Sijatosheka *(Unsatisfactory)*	e) Mbaya zaidi *(Extremely poor)*
43	Changamoto z inazohusiana na huduma za afya *(Challenges associated with health facilities)*	a) Gharama (Cost)	b) Ujuzi wa hivi vifaa (Knowledge)	c) Umbali (Distance)	d) Uaminifu (Trust)	e) Uoga (Fear)

44	Usafirishaji *(Transportation)*	Mahali/huduma *(Place/Facility)*	Hali ya Usafirishaji *(Mode of transport)* 1. Kutembea *(Walking)* 2. Baiskeli *(Bicycle)* 3. Piki piki *(Motorcycle)* 4. Matatu *(Public matatu)* 5. Ingine, taja *(Other (specify)*	Hali ya barabara *(Nature of the roads)* 1. Nzuri *(Good)* 2. Wastani *(Fair)* 3. Mbaya *(Poor)*
		a) Mahali pa kazi *(Place of work)*		
		a) Shule ya msingi *(Primary schools)*		

		b) Shule ya upili *(Secondary schools)*		
		c) Vifaa vya afya *(Health facilities)*		
		d) Vyumba vya mikutano ya jamii *(Community halls)*		
		e) Sokoni *(Markets)*		

45	**uKmekuwa na miradi yeyote ya kuinua maendeleo katika hiki kijiji?** *(Has there been any project targeted at improving the physical condition of the settlement*	**a. Ndio** *(Yes)*	**b. La** *(No)*	**Kama Ndio, ni miradi gani?** *(If Yes, please identify such projects)*
46	**Je,waona kijiji hiki kina usalama wa kutosha?** *(Do you consider this village secure enough?)*	**a. Ndio** *(Yes)*	**b. La** *(No)*	**Maoni kuhusu usalama** *(Opinions on security)*
47	**Unaweza sem a kwam ba barabara za hiki kijiji zinawatosha kwa watu na magari?** *(Would you say the internal roads in this village are adequate for people and vehicles?)*	**a)Ndio** *(Yes)* **b) La** *(No)*		
48	**uKa mtu yeyote kwa jamii yako amewahi kuhusika kwa ukosefu wa usalama kwa mwaka moja uliopita?** *(Have you or anyone in this household been a victim of crime in the past*	**a. Ndio** *(Yes)* **b. La** *(No)*		
49	**Kuna usalma katika kijiji hichi?** *Do you feel safe in this community?*	**a) Salama sana** *(Very safe)* **b) Hivihivi** *(Neither safe nor unsafe)* **c) Kumekosa usalama kiasi** *(Somewhat unsafe)* **d) Kumekosa usalama sana** *(Very unsafe)* **e) Siko na uhakika** *(Not sure)*		

	INCOME AND EXPENDITURE HOUSEHOLD			
50	**Mnatoa pesa wapi? (***What is the Households source of income***)**	**Mapato ya nyumba hutoka wapi?** *(Source of Income)*	**Unapofanya kazi** *(Place of work)*	**Kiwango cha pesa cha kila mtu kwa jamii (***Approximate income per month from all household members)* a. Below 2500 b. 2501-5000 c. 5001-10000 d. 10001-15000 e. Above 15000
		a) Kibarua *(Casual laboring)*		
		b) Biashara za jua kali *(Informal business / Small business (e.g. kiosks, doing small repairs, etc)*		
		c) Kazi ya mshahara wa mwezi *(Salaried employee)*		
		d) Biashara iliyosajiliwa *(Medium size business/ Large Business (Formal business))*		
		e) Kutumiwa pesa na jamaa/marafiki *(Relatives/friends outside HH (remittances and payments)*		
		f) Nyingine, taja *(Other, specify)*__________		
		g) Sina kazi *(Unemployed)*		

51	**Matumizi ya nyumba** *(Household expenditure)*	**Matumizi** *(Expenditure)*	**Gharama kwa mwezi** *(Kshs per month)*	
		a) Karo *(School fees)*		
		b) Kutuza Afya *(Health care)*		
		c) Chakula *(Food)*		
		d) Nauli *(Transport/Fare)*		
		e) Stima *(Electricity)*		
		f) Usalama *(Security)*		
		g) Mengine, taja *(Other, specify)*		
		h) Jumla ya matumizi *(Total expenditure)*		
52	**Unashiriki ka tika kiundi gani**	**Jina ya Kikundi** *(Name of Group)*	**Sababu ya kujiunga** *(Reasons for joining)*	*Activities of the group*
	Mathare, Taja jina ya kikundi *(Are you a member of any group in Mathare?)*	a)__________________________________		
		b)__________________________________		
		c)__________________________________		
		d)		

Appendix II: Interview Guide for Residents

Script: *First, I want to ask you some general questions about you and your daily life.*

1. How did you find yourself living here?
2. Please describe for me a typical day.
3. What would you say are the 3 top issues that are a concern or cause of stress for you at this point in time?
   a. Are there things you find yourself struggling with regularly? What are they?
   b. What do you worry about most?

Script: *As you know, I'm particularly interested in learning more about health. Now I want to talk with you all about your health. We know health is not just something that happens in a doctor's office, clinic, hospital, but is also from your everyday living and working conditions. The next couple of questions will be more related to health.*

4. What does it mean to you to be healthy?
   - When I mentioned the word "health," what comes to mind?
5. What would you say makes it harder for you or those in your family to stay healthy?
6. What would you say makes it easier or helps you or those in your family to stay healthy?

Script: *Now, I want to ask you some very specific questions related to your health.*

7. In the last month, have you sought any health care for your family? **If yes:**
   a. For whom?
   b. For what type of care?
8. When you or someone you care about gets ill, is there someone you turn to for help or support? **If yes:**
   a. Who is it?
   b. What kind of support does he/she provide?

Script: *Now, I want to switch topics for a bit to talk with you about the issue of savings and finances.*

9. Do you save money? Why or why not? **If yes:**
   a. What are you saving for?
   b. Where do you keep your savings?
   c. Have you ever taken out of your savings?
   d. Do you save with a group or on your own?
   e. How much money have you saved?
   f. Do you ever save for your health? How?

*__End here if non-Muungano participant__

Script: *Now, I know you are a member of Muungano, and I want to talk to you a little bit about your experience participating in Mungaano.*

10. Tell me the story of how you started participating in this microsavings group.
11. We have already talked a bit about your savings. Now, can you tell me about any experiences you have had taking any loans?
    a. For what purpose did you take a loan?
    b. What, if any challenges, have you had with repayment?
12. What do you see as the benefits of being a part of this group?
13. What has been important to you about being in this group?
    - What makes it worthwhile for you to keep coming back to this group?

14. What have been the challenges for you in being a part of this group?
15. Have you noticed any changes, good or bad, in yourself from being part of this group? If so, what kind of changes?
16. Earlier, we talked about the types of things that make it harder or easier for you to stay healthy. Are there ways that being a part of this group has helped you or made it harder for you to stay healthy?

Script: *Thanks so much for your time. I have learned a lot today and I really appreciate all that you've shared. If you have any questions or want to follow up with me in the future, here is my contact information.*

Appendix III: Interview Guide for MuST Staff

Note to IRB: Questions asked will be similar to the questions below. Related follow-up questions will be generated depending on responses elicited and direction of the discussion, as per the modified grounded theory approach outlined elsewhere in this application

Script: *I want to talk to you about microsavings groups in Nairobi informal settlements. I'm particularly interested in learning more about the how microsavings participation may impact health, both in positive and negative ways. First I want to ask you some general questions about microsavings group.*

1. Tell me about your work with microsavings groups.
   - How long have you worked with MuST? The microsavings groups?
   - In what capacity do you work with them?
2. Based on your observations and experiences, what do you think are the benefits of microsavings participation? For slum residents? What about communities?
   - Can you give me an example of a time when you've really seen a community benefit from the work of a microsavings groups?
   - Can you give me an example of how you've seen an individual benefit?
3. Based on your observations and experiences, what, if anything do you think are the negative implications of microsavings participation? For slum residents? What about communities?
   - Can you give me an example of a time where the community has experienced something negative as a function of microsavings.
   - Can you give me an example of a negative result for an individual.
4. What do you think are some of the main challenges that microsavings groups in Nairobi slums (e.g. Mathare) confront? Do you think these are different than the challenges that microsavings groups in other areas confront?

Script: *We've been talking generally about microsavings and the positive and negative aspects of microsavings slums in Nairobi (e.g. Mathare). Now I want to talk more specifically about health—health not in terms of clinics, hospitals, and healthcare, but in terms of day-to-day health.*

5. Based on your experience working in informal settlements, and in Nairobi slums, like Mathare, in particular, what do you think are the health challenges of living in slums?
   - Can you give me some examples?
6. Can you talk about any examples of health benefits of microsavings participation that you've observed or heard about?
7. Can you think of any examples of negative consequences of participating in microsavings, in relationship to health?

Script: *Now I want to talk more about how gender might color the experience of a microsavings participant.*

8. How, if at all, do you think women in particular benefit from microsavings participation?
9. How, if at all, do you think women in particular struggle with microsavings participation?
10. Do you think there are ways to make microsavings better with particular regard to health? How?

Script: *Thanks so much for your time today—I've learned a lot. Is there anything you would like to add as we finish?*

Appendix IV: Interview Guide for Health Providers

Note to IRB: Questions asked will be similar to the questions below. Related follow-up questions will be generated depending on responses elicited and direction of the discussion, as per the modified grounded theory approach outlined elsewhere in this application

1. How long have you been working here?
2. In what capacity do you work?
3. What are the types of services you provide?
4. How many individuals might you provide care for on a given day?

Script: *As you know, I'm particularly interested in learning more about health in this community. I want to ask you some questions about health related to the community more generally.*

5. Can you tell me about some of the common illnesses you see as a provider in this community?
    - What type of care do you commonly provide for individuals who come to seek care?
6. What would you say some of the challenges are for people to stay healthy in this community?
7. What would you say makes it possible for people to stay healthy in this community?
8. What are some of the common places people go to seek care in this community?
9. If you could change anything about this community in order to make it healthier, what would you change?
10. How do you think people make decisions about when to seek care in this community?
11. How do they decide where to go given the number of options available to them?

Script: *Now, I want to ask you specifically about your experience of providing care in this setting.*

12. What are some of your daily challenges in providing care?
13. What are some of the difficult parts of your job, either logistically and emotionally?
14. Can you think about a case that was particularly challenging for you?
15. What makes your work easier?
16. Is there anything you would like to add?

Script: *Thanks so much for your time. I have learned a lot today and I really appreciate all that you've shared. If you have any questions or want to follow up with me in the future, here is my contact information.*

Appendix V: Focus Group Guide for Residents

Script: *First, I want to ask you a little bit about living here in this community.*

1. If someone who didn't live here asked you to describe where you live, what would you tell them?
2. What are the strengths of this community?
3. What are the weaknesses of this community?
4. What do you like about living here?
5. What do you dislike about living here?
6. I want to ask you to think about the challenges you think this community confronts:
    a. What are the challenges that come to mind?
    b. When you think about friends or neighbors that live here, are there some common challenges they confront?
7. If you were given the chance to change one thing in this community, what would you change?
8. Are any of you involved in any community-based groups? Tell me about them.

Script: *Now I want to talk with you all about your health. We know health is not just something that happens in a doctor's office, clinic, hospital, but is also from your everyday living and working conditions.*

9. Do you think health is a major concern here in this community?
10. What would you say are common health issues among your friends who live here, or among the community members?
11. What do you find helps members of this community to stay healthy?
12. What makes it challenging for members of this community to stay healthy?
13. Can you think of and describe to me a situation where something in your community seemed to have an influence on your health or the health of someone you know?
14. Can you think of and describe to me a time when you supported someone in your community who was ill?
    a. How did you support them?

***End here for non-Muungano participants**

Script: *I know you are involved in the participatory planning efforts as a part of Muungano, and a member of a savings group. First I want to learn more about what your group does, the types of things you've achieved as a group.*

15. Tell me about this microsavings group.
    - When did it start?
    - What types of issues do you focus on?
16. Can you tell me about a time when this group came together about an issue that was important to you?
    a. What was the issue?
    b. How did you decide it was an important issue?
    c. What did you do about it?
    d. How did you decide what to do about it?
17. What, if anything, do you consider the major accomplishments of your group?
    - What would you say were the 3 most important things this group has accomplished?
18. What are the major challenges this group confronts or has confronted in the past?
    - How do you confront these challenges?
19. Can you tell me about some of the negative consequences of being part of this group? Either for you as a member or on your community?

17. Can you think of any ways that the group has helped its members stay healthy or cope in times of illness? I would be interested in hearing specific examples.

Script: *Thanks so much for your time. I have learned a lot today and I really appreciate all that you've shared. If you have any questions or want to follow up with me in the future, here is my contact information.*

Appendix VI. Living Conditions in Mathare ,by Village

	Kiamutisya	*Kosovo*	*Village 2*	*3B*	*3A*	*3C*	*4B*	*Gitathuru*	*No 10*	*Mashimoni*	*Mabatini*	*Kwa Kariuki*	*4A*	*Total*
Basic Amenities														
Reliability of Water Source, #(%)														
Not reliable throughout day	35 (64)	60 (91)	58 (88)	53 (87)	36 (100)	43 (98)	42 (100)	23 (100)	14(61)	39 (100)	10 (100)	40 (91)	83 (64)	541 (84)
Reliable throughout day	20 (36)	6 (9)	8 (12)	8(13)	0 (0)	0 (0)	0(0)	0 (0)	9 (39)	0 (0)	0(0)	4 (9)	46 (36)	102 (16)
Location of Water Source, #(%)														
Away from Household	24 (45)	25 (38)	27 (40)	46 (75)	14 (39)	28 (62)	30 (71)	9 (32)	0 (0)	30 (77)	10 (100)	27 (63)	48 (37)	318 (49)
At or Near Household	29 (55)	41 (62)	40 (60)	15 (25)	22 (61)	17 (38)	12 (29)	19 (68)	23 (100)	9 (23)	0 (0)	16 (37)	83 (63)	326 (51)
Water Collection Time, #(%)														
< 1 hour	31 (80)	43 (73)	46 (85)	29 (66)	20 (77)	22 (100)	21 (60)	17 (85)	10 (100)	23 (72)	4 (40)	28 (100)	81 (89)	375 (80)
> 1 hour	8 (21)	16 (27)	8 (15)	15 (34)	6 (23)	0 (0)	14 (40)	3 (15)	0 (0)	9 (28)	6 (60)	0 (0)	10 (11)	95 (20)
Distance to water source, meters; mean (SD)	26 (30)	57 (69)	52 (73)	100 (105)	66 (42)	65 (97)	66 (92)	45 (48)	37 (28)	42 (31)	43 (28)	28 (17)	45 (45)	**---**
Shared toilet														
Private toilet	0 (0)	10 (15)	13 (19)	21 (34)	11 (31)	10 (22)	1 (2)	7 (25)	3 (14)	3 (8)	2 (20)	10 (23)	16 (12)	107 (17)
Shared toilet	55 (100)	56 (85)	54(81)	41 (66)	25 (69)	35 (78)	41 (98)	21 (75)	19 (86)	37 (93)	8(80)	34(77)	113(88)	539 (83)
Distance to toilet, meters; mean (SD)	70 (105)	62 (64)	42 (63)	58 (64)	45 (43)	70 (56)	47 (41)	53 (71)	37 (31)	39 (33)	278 (520)	39 (28)	71 (80)	---
Electricity in the House, #(%)														
No	22 (40)	5 (8)	21 (31)	21 (34)	7 (19)	17 (38)	9 (21)	5 (18)	2 (9)	4 (10)	4 (40)	5 (11)	23 (18)	145 (22)
Yes	33 (60)	61 (92)	46 (69)	41 (66)	29 (81)	28 (62)	33 (79)	23 (82)	21 (91)	36 (90)	6 (60)	39 (89)	108 (82)	504 (78)
Organized Waste Disposal, #(%)														
No	52 (96)	65 (98)	43 (65)	37 (60)	30 (83)	36 (80)	41 (98)	24 (86)	6 (26)	27 (68)	5 (56)	29 (66)	67 (52)	462 (72)
Yes	2 (4)	1 (2)	23 (35)	25 (40)	6 (17)	9 (20)	1 (2)	4 (14)	17 (74)	13 (33)	4 (44)	15 (34)	61 (28)	181 (28)
Adequate Internal Roads, #(%)														
No	50 (94)	58 (89)	58 (89)	58 (95)	28 (78)	43 (98)	37 (88)	28 (97)	20 (91)	35 (90)	10 (100)	39 (89)	93 (73)	557 (87)
Yes	3 (6)	7 (11)	7 (11)	3 (5)	8 (22)	1 (2)	5 (12)	1 (3)	2 (9)	4 (10)	0 (0)	5 (11)	34 (27)	80 (13)
Social Services														
Satisfied with quality of healthcare, #(%)														
Not satisfied	24 (44)	27 (41)	31 (46)	33(53)	17 (47)	22 (49)	16 (38)	14(48)	7 (30)	16 (40)	7 (70)	18 (41)	59 (45)	291 (45)
Satisfied	31 (56)	39 (59)	36 (54)	**29 (47)**	19 (53)	23 (51)	26 (62)	15 (52)	16 (70)	24(60)	3 (30)	26 (59)	72 (55)	359 (55)
Accessed formal healthcare, #(%)														
No	5 (9)	9 (14)	23 (35)	22 (36)	4 (11)	17 (38)	15 (36)	10 (35)	9 (41)	19 (48)	3 (30)	16 (36)	46(36)	198 (31)
Yes	48 (91)	56 (86)	43 (65)	39 (64)	32 (89)	28 (62)	27 (64)	19 (66)	13 (59)	21 (53)	7 (70)	28 (64)	83 (64)	444 (69)
Distance to health facility, kilometers; mean (SD)	13 (73)	2 (5)	2(4)	2 (4)	1 (1)	23 (136)	6(31)	1 (1)	.5 (.3)	.8 (1)	20 (63)	.4 (.3)	.5 (.6)	----
Type of school child(ren) attend, #(%)														
Informal	3 (10)	1 (3)	7 (20)	2 (5)	0 (0)	4 (14)	2 (6)	5 (25)	3 (14)	2 (8)	0 (0)	3 (12)	13 (15)	45 (11)
Formal	26 (90)	38 (97)	28 (80)	39 (95)	28 (100)	25 (86)	33 (94)	15 (75)	18 (86)	24 (92)	5 (100)	22 (88)	75 (85)	376 (89)
Distance to school, kilometers; mean (SD)	247 (495)	45 (124)	55 (199)	69 (199)	192 (634)	401 (727)	24 (78)	179 (360)	175 (293)	13 (61)	300 (273)	316 (563)	141 (355)	----

	Kiamutisya	*Kosovo*	*Village 2*	*3B*	*3A*	*3C*	*4B*	*Gitathuru*	*No 10*	*Mashimoni*	*Mabatini*	*Kwa Kariuki*	*4A*	*Total*
Land tenure & Housing Conditions														
Type of Structure Owner, #(%)														
Rent	39 (71)	49 (74)	62 (93)	57 (92)	33(92)	38 (84)	37 (88)	26 (90)	22 (96)	34 (85)	8 (80)	39 (89)	93 (71)	537 (83)
Own	16 (29)	17 (26)	5 (7)	5(8)	3(8)	7(16)	5(12)	3 (10)	1 (4)	6 (15)	2(20)	5 (11)	38 (29)	113 (17)
House Size, #(%)														
≤ 100 sq. feet	19 (35)	20 (30)	33 (49)	31 (50)	21 (58)	19 (42)	34 (81)	18 (62)	15 (65)	26 (65)	4(40)	31 (70)	78 (60)	349 (54)
> 100 sq. feet	36 (65)	46 (70)	34 (51)	31 (50)	15 (42)	26 (58)	8 (19)	11 (38)	8 (35)	14 (35)	6 (60)	13 (30)	53 (40)	301 (46)
Type of Household Floor, #(%)														
Cement/wood	0 (0)	41 (62)	37 (55)	29 (48)	26 (72)	9 (20)	23 (55)	25 (86)	17 (74)	22 (56)	6 (60)	17 (39)	55 (42)	307 (48)
Earthen	55 (100)	25 (38)	30 (45)	31 (52)	10 (28)	46 (80)	19 (45)	4 (14)	6 (26)	17 (44)	4 (40)	27 (61)	75 (58)	339 (52)
Type Wall Materials, #(%)														
Not Permanent	53 (96)	59 (89)	52 (78)	44 (72)	27 (75)	43 (96)	41 (98)	13 (45)	17 (74)	36 (92)	10 (100)	34 (77)	88 (68)	517 (80)
Permanent	2(4)	7 (11)	15 (22)	17 (28)	9 (25)	2(4)	1 (2)	16 (55)	6 (26)	3 (8)	0 (0)	10 (23)	42 (32)	130 (20)
Type of Cooking Energy, #(%)														
Clean	22 (41)	38 (58)	38 (57)	42 (69)	18 (50)	21 (49)	20 (49)	21 (75)	13 (59)	31 (78)	6 (60)	28 (65)	75 (59)	373 (58)
Unclean	32 (59)	28 (42)	29 (43)	19 (31)	18 (50)	22 (51)	21 (51)	7(25)	9 (41)	9 (23)	4 (40)	15 (35)	52 (41)	265 (42)
Income & Livelihood														
Income, #(%)														
<10,000Ksh	44 (80)	29 (44)	44 (66)	32 (52)	22 (61)	33 (73)	21 (50)	13 (45)	3 (13)	21 (53)	6 (60)	27 (61)	80 (61)	375 (58)
≥10,000Ksh	11 (20)	37 (56)	23 (34)	30 (48)	14 (39)	12 (27)	21 (50)	16 (55)	20 (87)	19 (48)	4 (40)	17 (29)	51 (39)	274 (42)
Type of Employment, #(%)														
Informal	49 (89)	58 (92)	57 (90)	55 (92)	28 (80)	43 (96)	37 (95)	21 (75)	15 (79)	33(87)	10 (100)	42 (95)	116 (91)	564 (90)
Formal	6 (11)	5(8)	6(10)	5 (8)	7 (20)	2(4)	2(5)	7(25)	4(21)	5(13)	0 (0)	2(5)	11 (9)	62 (10)
Community & Safety														
Perceives village to be safe, #(%)														
No	46 (84)	41 (63)	54 (82)	51 (85)	33 (92)	42 (95)	25 (61)	14 (50)	12 (55)	27 (69)	7 (70)	33 (75)	97 (74)	482 (75)
Yes	9 (16)	24 (37)	12 (18)	9 (15)	3 (8)	2(5)	16 (39)	14 (50)	10 (45)	12 (31)	3(30)	11 (25)	34 (26)	159 (25)
Victim of crime in past year, #(%)														
No	39 (74)	47 (71)	58 (88)	44 (72)	32 (89)	25 (57)	34 (83)	28 (97)	17 (74)	31 (79)	8 (80)	40 (91)	110 (85)	513 (80)
Yes	14 (26)	19 (29)	8 (12)	17 (28)	4 (11)	19 (43)	7 (17)	1 (3)	6 (26)	8 (21)	2 (20)	4 (9)	20 (15)	129 (20)
Participates in a community group, #(%)														
No	34 (63)	47 (71)	53 (79)	47 (78)	21 (58)	24 (53)	22 (52)	21 (75)	19 (83)	22 (56)	7 (70)	26 (59)	98 (75)	441 (68)
Yes	20 (37)	19 (29)	14 (21)	13 (22)	15 (42)	21 (47)	20 (48)	7 (25)	4 (17)	17 (44)	3 (30)	18 (41)	33 (25)	204 (32)
Health Outcomes														
Self Report Good Health, #(%)														
No	21 (38)	11 (17)	27 (42)	27 (44)	7 (19)	16 (36)	8 (19)	8 (29)	6(27)	9 (23)	6 (60)	12 (27)	50 (38)	208 (32)
Yes	34 (62)	54 (83)	38 (58)	34 (56)	29 (81)	28 (64)	34(81)	20 (71)	16 (73)	31 (78)	4 (40)	32 (73)	80 (62)	434 (68)
Self-Report low frequency of childhood illness, #(%)														
No	10 (43)	30 (65)	21 (78)	23 (68)	7 (44)	15 (54)	14 (48)	7 (47)	6 (67)	11 (50)	2 (25)	13 (45)	54 (56)	213 (56)
Yes	13 (57)	16 (35)	6 (22)	11 (32)	9 (56)	13 (46)	15 (52)	8 (53)	3 (33)	11 (50)	6 (75)	16 (55)	42 (44)	169 (44)

Appendix VII. Results from Univariate and Multivariable Regression Models Examining Living Conditions and Health

	Self-Report Good Health				Self-Report Low Frequency of Childhood Illness			
	OR (95% CI)	*p- value*	*aOR (95% CI)*	*p- value*	*OR (95% CI)*	*p- value*	*aOR (95% CI)*	*p- value*
Basic Amenities								
Reliability of Water Source								
Not Reliable throughout the day	1.00 (ref)				1.00 (ref)			
Reliable throughout the day	1.02 (0.63-1.65)	0.935			1.26 (0.73-2.20)	0.403		
Location of Water Source								
Away from household	1.00 (ref)				1.00 (ref)		1.00 (ref)	
At or Near Household	1.50 (1.06-2.14)	0.023			1.85 (1.20-2.86)	0.005	2.52 (1.39-4.55)	0.002
Water collection time								
< 1 hour	1.00 (ref)				1.00 (ref)		1.00 (ref)	
≥1 hour	1.02 (0.60-1.76)	0.928			2.06 (1.15-3.70)	0.015	2.61 (1.34-5.10)	0.005
Distance to water source (meters)								
Per 10m	0.96 (0.94-0.99)	0.008			0.97 (0.93-1.00)	0.071		
Shared Toilet								
Private Toilet	1.00 (ref)				1.00 (ref)			
Shared Toilet	1.05 (0.67-1.66)	0.827			0.79 (0.45-1.41)	0.429		
Distance to toilet (meters)								
per 10m	1.00 (0.98-1.02)	0.810			0.98 (0.95-1.01)	0.221		
Electricity in the House								
No	1.00 (ref)				1.00 (ref)			
Yes	1.56 (1.04-2.32)	0.030			1.70 (0.98-2.96)	0.061		
Adequate internal roads								
No	1.00 (ref)		1.00 (ref)		1.00 (ref)			
Yes	0.60 (0.36-0.99)	0.045	0.32 (0.15-0.67)	0.002	1.32 (0.74-2.36)	0.346		
Organized Waste disposal								
No								
Yes	1.05 (0.71-1.57)	0.799			1.08 (0.67-1.74)	0.754		
Social Services								
Satisfaction with Healthcare Quality								
Not Satisfied	1.00 (ref)		1.00 (ref)		1.00 (ref)		1.00 (ref)	
Satisfied	6.70 (4.58-9.79)	<0.001	7.80 (4.52-13.44)	<0.001	1.61 (1.06-2.42)	0.024	2.25 (1.25-4.06)	0.007
Accessed formal healthcare								
No	1.00 (ref)				1.00 (ref)			
Yes	1.18 (0.82-1.70)	0.372			0.67 (0.43-1.05)	0.079		
Distance to health facility (kilometers)								
per 10km	1.01 (0.96-1.05)	0.733			1.09 (0.84-1.42)	0.499		
Type of School Child(ren) attend								
Informal	1.00 (ref)		1.00 (ref)		1.00 (ref)		1.00 (ref)	
Formal	2.48 (1.30-4.74)	0.006	3.70 (1.69-8.08)	<0.001	2.48 (1.06-5.78)	0.036	3.33 (1.18-9.45)	0.023
Distance to school (kilometers)								
per 10km	1.00 (1.00-1.01)	0.347			1.00 (1.00-1.01	0.342		
Land Tenure & Housing Conditions								
Type of Structure Owner								
Rent	1.00 (ref)				1.00 (ref)		1.00 (ref)	
Own	1.28 (0.81-2.04)	0.292			2.27 (1.28-4.02)	0.005	2.13 (1.05-4.35)	0.037
House Size								
≤ 100 sq. feet	1.00 (ref)				1.00 (ref)			
>100 sq. feet	0.88 (0.63-1.24)	0.482			1.40 (0.91-2.15)	0.124		
Type of Household Floor								
Cement/wood	1.00 (ref)		1.00 (ref)		1.00 (ref)			
Earhen	0.45 (0.31-0.65)	<0.001	0.38 (0.23-0.65)	<0.001	0.78 (0.52-1.19)	0.252		
Type of Wall Materials								
Impermanent	1.00 (ref)				1.00 (ref)			
Permanent	1.79 (1.13-2.84)	0.013			1.30 (0.78-2.17)	0.307		
Type of Cooking Energy								
Unclean	1.00 (ref)		1.00 (ref)		1.00 (ref)			
Clean	0.51 (0.36-0.72)	<0.001	0.61 (0.36-1.01)	0.056	0.95 (0.62-1.44)	0.805		
Livelihood & Income								
Income								
<10,000Ksh	1.00 (ref)		1.00 (ref)		1.00 (ref)			
≥10,000Ksh	2.30 (1.60-3.31)	<0.001	1.91 (1.11-3.27)	0.019	1.29 (0.86-1.96)	0.220		
Type of Employment								
Informal	1.00 (ref)				1.00 (ref)		1.00 (ref)	
Formal	2.10 (1.08-4.09)	0.028			2.03 (0.92-4.49)	0.079	2.52 (0.91-6.92)	0.074
Community & Safety								
Perceives village to be safe								
No								
Yes	1.26 (0.79-2.00)	0.329			1.10 (0.65-1.87)	0.729		
Victim of crime in the past year								

No						
Yes	0.91 (0.60-1.39)	0.674			0.92 (0.55-1.55)	0.767
Participates in a community group						
No						
Yes	0.82 (0.57-1.18)	0.284			0.93 (0.60-1.44)	0.741
Village Level Exposures						
% Income above 10,000 Ksh	1.01 (1.00-1.03)	0.096			0.99 (0.97-1.01)	0.270
% Formally employed	1.02 (0.98-1.07)	0.251			1.00 (0.96-1.04)	0.948
% Reporting secure village	1.02 (1.00-1.04)	0.084			1.18 (0.98-1.42)	0.084
%Participating in community group	1.02 (1.00-1.05)	0.068	1.04 (1.01-1.07)	0.011	1.03 (1.01-1.05)	0.009
% With Household water Source	1.01 (0.99-1.01)	0.397			0.99 (0.98-1.00)	0.184
% With quality health care	1.05 (1.02-1.09)	0.002			0.99 (0.95-1.03)	0.554
% With earthen floors	0.99 (1.98-1.00)	0.119			1.00 (0.99-1.02)	0.442