So fresh and so clean: urban community engagement to improve the sustainability of drainage infrastructure

Chloë Fernandez[a], Marcus Holmlund[a], Tara Mitchell[b] and Carol Newman[b]

[a] DIME, World Bank
[b] Department of Economics and TIME, Trinity College Dublin, Ireland

VERY PRELIMINARY DRAFT – DO NOT CIRCULATE

Abstract

Rising sea levels and recurrent stormwater flooding threaten infrastructure, livelihoods, homes and lives in coastal cities around the world. Building resilience requires significant infrastructural investments but also requires the engagement of communities in the preservation and maintenance of infrastructure and public spaces. This is challenging as little is known about how best to engage communities in the preservation of public spaces, particularly in urban settings. In this paper, we use a randomized controlled trial to test the effectiveness of an intervention designed to motivate community members to keep their local area clean, thereby increasing the effectiveness of drainage infrastructure and reducing the risk of flooding in that area. Our sample consists of 160 randomly selected quartiers (communities). The program targets established community-based groups within treatment quartiers and provides them with a non-monetary incentives-linked "social contract", called "Operation Quartier Propre" (OQP), to maintain and preserve public spaces by keeping them trash free. We test whether community engagement is improved through OQP and also examine the impact of this intervention on outcomes relating to health, education and livelihoods. We find that the program had a significant positive effect on households' likelihood of receiving training, their perception of the cleanliness of their neighborhood and their vulnerability to flooding. There is also some evidence that this reduced their experience of flood-related illness and income lost due to flooding.

JEL Codes: O12, O13, O18,
Key Words: Community-Driven Development, Infrastructure, Public Goods

1. Introduction

Rising sea levels and recurrent stormwater flooding threaten infrastructure, livelihoods, homes and lives in coastal cities around the world. This is particularly the case in developing countries where drainage and other flood-related infrastructure is poorly developed or obsolete. Moreover, those most affected are the poor who tend to live in the most vulnerable locations within cities in poor living conditions (World Bank, 2010). Building resilience will require significant infrastructural investments but will also require the engagement of communities in the preservation and maintenance of infrastructure and public spaces. This is challenging as little is known on how best to engage communities in the preservation of public spaces, particularly in urban settings.

The setting for our study is two low-income peri-urban areas of Dakar in Senegal, Pikine and Guédiawaye, which, according to the latest estimates of the National Agency for Statistics and Demography (ANSD), have a population close to 1.3 million inhabitants – two-thirds of them in Pikine – which is 12% of the national population. These two low-income municipalities are highly prone to flooding, and approximately half of residents live in flood-prone areas. This is the result of rapid and unplanned urbanization; increased rainfall after a period of relative drought in the 1970s to late 1980s during which informal communities settled in areas that are now highly flood-prone; rising groundwater; and inadequate drainage infrastructure. This has important impacts on health, livelihoods, and assets, and disproportionately affects more vulnerable population groups.

Emergency solutions have been implemented in the peri-urban areas of Dakar to facilitate the drainage and storage of stormwater through the construction and rehabilitation of retention basins. However, historically, investments to decrease the risk and impact of flooding in peri-urban Dakar have been limited and uncoordinated, leading in particular to poor provisions for the maintenance of infrastructure. There has been little engagement of local populations in the planning and construction of drainage and water storage infrastructure, and consequently very little sense of ownership of these resources by their host communities. Provisions for operations and maintenance have been inadequate, and oftentimes the infrastructure has been inappropriately used to dump waste and also subject to vandalism. What was intended as a community good was therefore often converted to a source of disease and insecurity.

With this in mind, in 2012 the Government of Senegal launched the World Bank-assisted Stormwater Management and Climate Change Adaptation Project (Projet de Gestion Environnemental et d'Adaptation au Changement Climatique; PROGEP) to contribute in a sustainable and participatory way to the reduction of flood risks in the peri-urban areas of Dakar. The major investment under PROGEP is the construction of new drainage infrastructure in flood-prone areas. Such investments, however, may suffer from the "tragedy of the commons" – individuals have the incentive to abuse shared resources as they personally incur the benefits while the costs are shared by the whole community (Ostrom, 1990). In the absence of collective action or adequate institutions, individual users acting rationally and independently in their own self-interest do not fully internalize the costs of

their use of the public resource and will therefore tend to over-utilize (or incorrectly utilize) this resource. Ultimately, this leads to depletion of the common resources to the point at which it is of no use to anyone and may actually convert from a net "good" to a net "bad". In the context of peri-urban Senegal, the tragedy is that public spaces are often used to dispose of individual/household waste, clogging stormwater drainage systems and reducing their effectiveness, sustainability, and the return on this major investment. The mechanisms through which to achieve participation by community members in the operations, monitoring, and maintenance of public infrastructure are, however, not well understood, particularly in densely populated urban areas.

The main contribution of this paper is to fill this gap in the literature. We use an experimental (randomized controlled trial) method to test the effectiveness of targeting established community-based groups with a non-monetary incentives-linked "social contract". Our sample consists of 160 randomly selected quartiers (communities) located in the PROGEP intervention area. One half of these quartiers are randomly assigned to receive a treatment involving a non-monetary incentives-linked "social contract", called "Operation Quartier Propre" (OQP) to maintain and preserve public spaces by keeping them trash free.

We test whether community engagement is improved through OQP. It is envisaged the intervention will change the way that individuals view the benefit of cooperative action. Our aim is to examine the extent to which this is the case and to uncover some of the specific mechanisms at work. Our results will help to inform strategies through which similar infrastructure projects can achieve their community engagement objectives, which are integral to the sustainability and return on the investments.

We also examine the impact of this intervention on outcomes relating to health, education and livelihoods. Despite the policy focus in recent years (UNICEF, 2012) on infrastructure to improve water supply and sanitation in developing countries there is very little evidence on the direct causal effect on health outcomes or the underlying mechanisms at work. Literature on the link between stormwater management in particular and health outcomes is, to our knowledge, non-existent in developing country contexts. Moreover, only very recently has experimental evidence emerged of the health impacts of improved water quality. Kremer et al. (2011) provide evidence from a randomized impact evaluation of the health effects of a water quality intervention in Kenya and find improving the quality of source water reduces the presence of E.coli and leads to a fall in the incidence of diarrhea among children. Evidence of a link between improved water and sanitation and other non-health outcomes is even less common. Ruaniyar et al. (2011) finds evidence that improving access to water supply and sanitation reduced the time required to fetch water and also improved high school attendance for girls but does not find any effect on health outcomes or labor force participation. A key contribution of this study is that it adds to the very sparse body of evidence on the impact of improved water and sanitation, and in particular stormwater management, on health and other related outcomes.

The rest of the paper is structured as follows. In section 2 we present a conceptual framework to guide our analysis. Section 3 provides more background on the context of the study, provides more details on the interventions and describes the experimental setup. Section 4 describes the data collection and identification strategy. Section 5 presents the results and section 6 concludes.

2. Conceptual framework

The aim of Operation Quartier Propre (OQP) is to engage local Community Based Organizations (CBOs) to work with their community to improve and maintain the cleanliness of public spaces and drainage infrastructure. Not much is known about how to shift behavioral norms, particularly in densely populated urban settings, but we hypothesize that any lasting social change must be rooted in existing community structures. For this reason, OQP is targeted at existing, established CBOs, which have strong social connections and influence within the community. We hypothesize that some form of external stimulus will be needed to move away from the present equilibrium, and investigate whether or not OQP can provide this stimulus. We therefore assume that the combination of extrinsic motivation provided directly through OQP and the intrinsic motivation it leverages will be sufficient to overcome individual and group internal and external impediments to civic participation, and that CBOs will have the capacity to promote and manage activities targeting the preservation of public spaces.

Collective action problems arise when incentives stop actors from producing something of value together that they could not produce alone. The free-rider problem means that without coordination private actors will have no incentive to privately contribute towards the provision of the public good since they bear all of the cost but only receive a fraction of the benefit. Besley and Ghatak's (2006) summary highlights the key theoretical insights that will lead to collective action solutions to this problem. First, where interactions are repeated, punishment or the threat of punishment will lead actors to act in a socially optimal way. Second, where the actions of individuals in assisting with public goods provision can be observed, others are more likely to engage in the provision of the good. Third, where there is a strong social structure it can be used to place pressure on individuals to engage in the provision of the public good.

Similar arguments apply in the case of the tragedy of the commons. This arises where each individual's use of a resource system reduces the units available to others leading to the over-exploitation of common property resources (Ostrom, 1990; Ostrom, 2008). Practical remedies that have been proposed to this situation include organizing and building appropriate institutions that specify the rights, duties and responsibilities of users, or centralizing control of common pool resources through legislation. Ostrom (2008), however, highlights the fact that there is no one best system of governance of common pool resources and that the way in which resources are managed should be context specific. Lab experiments, for example, show that simple communication can be effective in assisting groups of individuals in reaching the optimal use of common property resources (Ostrom et al., 1994). In contrast, Banerjee et al. (2010) find that providing information is not enough to improve community involvement in committees charged with the management of primary schools in India. They conclude that there may be significant constraints to individuals in participating in community projects even when they care about the issues of concern.

The 2004 World Development Report (World Bank, 2004) highlighted the need for community level engagement to solve collective action problems, in particular those relating to sanitation where free-riding and coordination problems cannot be solved through providing private incentives or motivating individuals alone. In general, the evidence on the effectiveness of community-directed approaches in the provision and maintenance of public goods is mixed. There are many examples of Community-Driven Development projects having a positive effect on access to water and sanitation. For instance, Beath et al (2013) find that the National Solidarity Programme, a Community-Driven Development program in Afghanistan that created local democratic councils and funded small development projects, had a positive impact on access to local infrastructure including drinking water and electricity. Similarly, Arcand and Bassole (2007) explore the impact of the Programme National d'Infrastructures Rurales Community-Driven Development project in Senegal and find positive effects on access to clean water and health services. Evidence on projects that aim to address the maintenance of public infrastructure is scarcer. As highlighted by Mansuri and Rao (2004), the success of such projects will depend on the specific context, the time horizon and the design of the community-based scheme. Moreover, recent evidence from randomized control trials of community-based interventions suggests that the mechanisms for effective collective action will also depend on the context and type of public good in question. In particular, consideration should be given to the way in which communities are engaged in terms of who is given responsibility for the intervention and also whether and how they are incentivized.

Support for grassroots community level engagement as opposed to involving local authorities is provided by Sheely (2010), who investigates the reasons why certain communities effectively manage local public goods while others do not, considering in particular the role of local norms and networks. He finds that collective action may be an effective substitute for formal enforcement of rules governing common property in the case of anti-littering in Kenya. In contrast, Jack and Recalde (2013) find that the involvement of elected authorities is more effective than randomly selected community members in the provision of education material for schools in Bolivia. This suggests that the type of public good may matter. They explain this finding by the fact that the involvement of local authorities acts as a signaling device on the quality of the public good and so involving local authorities may be important where there are information asymmetries. In contrast, where the problem is a coordination problem involving shifting or changing social norms – as is the case in this study – local community participation may be more effective (Sheely, 2010).

Mansuri and Rao (2012) distinguish between "induced" and "organic" forms of participation, where the former refers to external mobilization and facilitation of collective action and the latter to civic participation and collective action that arises endogenously. Most community-direct approaches rely on induced participation, i.e. they rely on external mobilization and facilitation to build the necessary structures for collective action, with the result that groups may be sustained solely by the resources provided by the program. For this reason, the present study does not attempt to create new structures, but rather examines a community-

centered approach which leverages existing community groups for the management and preservation of public spaces.

The second consideration relates to the extent to which members of groups should be incentivized. In this project, social contracts are used to motivate the community groups to engage with the rest of the community in the maintenance of local public goods. Both the social contract and other external rewards are used to motivate these individuals. Evidence for using non-financial rewards is provided by Ashraf et al. (2013) who investigate the role of incentives in the distribution of health goods in Zambia. They find that non-financial rewards are more effective than financial rewards and volunteering agreements. Similarly, Ariely et al. (2013) examine how image impacts on individuals' motivation to behave pro-socially and find that financial incentives crowd out the 'image motivation' in the provision of public pro-social activities. This suggests that monetary incentives are unlikely to improve the motivation of individuals to engage with their local community in the provision of public goods.[1]

[1] While there is some evidence to suggest that financial rewards can improve the impact of community-engagement projects (see for example, Kremer et al., 2009 and Cappelen et al., 2013), evaluating the extent to which compensating participants has an impact on the effectiveness of the Social Contract was beyond the scope of our study. As such we based the design of our incentive structure on the large and growing literature highlighting the importance of non-financial rewards.

3. Context, intervention and experimental design

Context

Our study takes place under the World Bank-assisted Senegal Stormwater Management and Climate Change Adaptation Project (Projet de Gestion des Eaux Pluviales et d'Aptatation au Changement Climatique, or PROGEP). PROGEP targets the periphery of Dakar, the capital, and entails the construction and rehabilitation of drainage infrastructure and community engagement activities to inform residents of project areas of flood risks and prevention strategies, and empower them to take action on flood risk prevention and mitigation. Specifically, the project is implemented in two cities, Pikine and Guediawaye, which represent about 12% of Senegal's population. Lack of urban planning and rapid dense population growth in the 1970s to 1990s has led to disastrous environmental consequences, such as desertification, trash accumulation and blockage of natural drainage systems. As a result, in the last decade, the region has suffered from the Sahelian Paradox, which takes the form of intense flooding during each rainy season.

In 2012, the Government of Senegal, alongside the World Bank, launched a Stormwater Management Project (PROGEP) with the objective of rebuilding the natural water basins and drainage pathways, but also of changing the local residents' behavior regarding public infrastructure. Our study hence aims at measuring the impact of the Operation Clean Neighborhood intervention or Opérations Quartiers Propres (OQP) – a sub-component of PROGEP - on a community's incentives to change behavior in the face of the tragedy of the commons. PROGEP and OQP are implemented by the Agence de Développement Municipal of Senegal (ADM).

OQP Intervention

OQP's objective is to intervene at the most local level of the cities – via community-based organizations (CBOs) - encouraging the community to improve and maintain the cleanliness of public spaces and drainage infrastructure. The intervention lasts 12 months and is implemented through a 3 stage incentive process: (i) an initial endowment package (brooms, wheel barrows, gloves etc.) to all participating CBOs supporting them in their task, (ii) a non-monetary incentive, i.e. public recognition, 6 months after OQP roll-out to neighborhoods that are grading above the passing threshold, and (iii) a final reward based on external assessment of the communities cleanliness 12 months after implementation.

Table 1: Initial Endowment Package

No	Endowment Type	Amount per *quartier*
1	Boots	15
2	Shovel	15
3	Wheel Barrow	05
4	Fork	10
5	Broom	25
6	Professional Gloves	15
7	Sifter	05
8	Rake	10
9	Machete	05
10	Shears	05

Alongside these incentives, CBOs are supported in the development of action plans, giving them guidance on how to innovate and implement the cleaning activities. Once the action plans are defined and the initial endowment, i.e. material, is delivered, the focal CBOs sign engagement letters with the commune mayors; this is the OQP intervention start date. The mid-term and final evaluations are an integral part of the intervention; the same grading scale applies to both. A quartier must past the 60 grade average threshold to be awarded the mid-line or final prize. The evaluation criteria are described in Table 2.

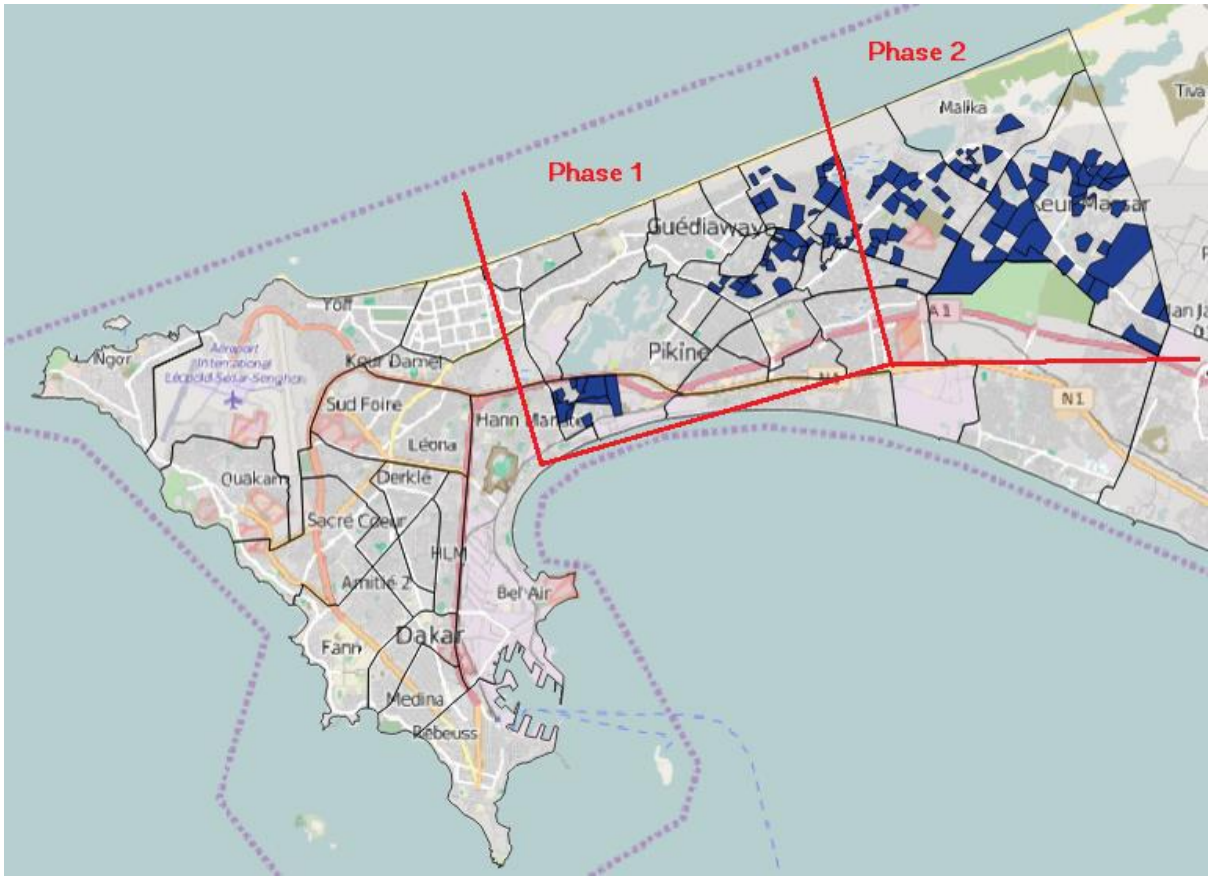
Table 2: Assessment Criteria

CRITERIA	RATIONAL	WEIGHT
1. Lack of dumping grounds in the streets	This criterion verifies if populations are dumping household waste in public spaces.	20 %
2. Cleanliness of public spaces	The cleanliness of social and collective spaces is a fairly strong indicator of the level of community awareness of sanitation	10 %
3. Cleanliness of abandoned houses and lands	The phenomenon of abandoned houses is very striking in the flood zones as they are often transformed into garbage dumping grounds.	20 %
4. Lack of water on streets and house fronts	The absence of an adequate sanitation system does not justify poor wastewater management (gray or flooded). Thus, the traditional practice of discharging domestic wastewater into streets is prohibited.	10 %

5. Non-obstruction of natural drainage structures and waterways	Localities are often flooded due to waterway obstruction from solid waste.	30 %
6. Innovative initiatives taken by the CBO	Due to the dynamism of the focal CBOs a number of community initiatives are being developed. To this end, it will be necessary to note the most innovative in the context of flood control and stormwater management.	10 %

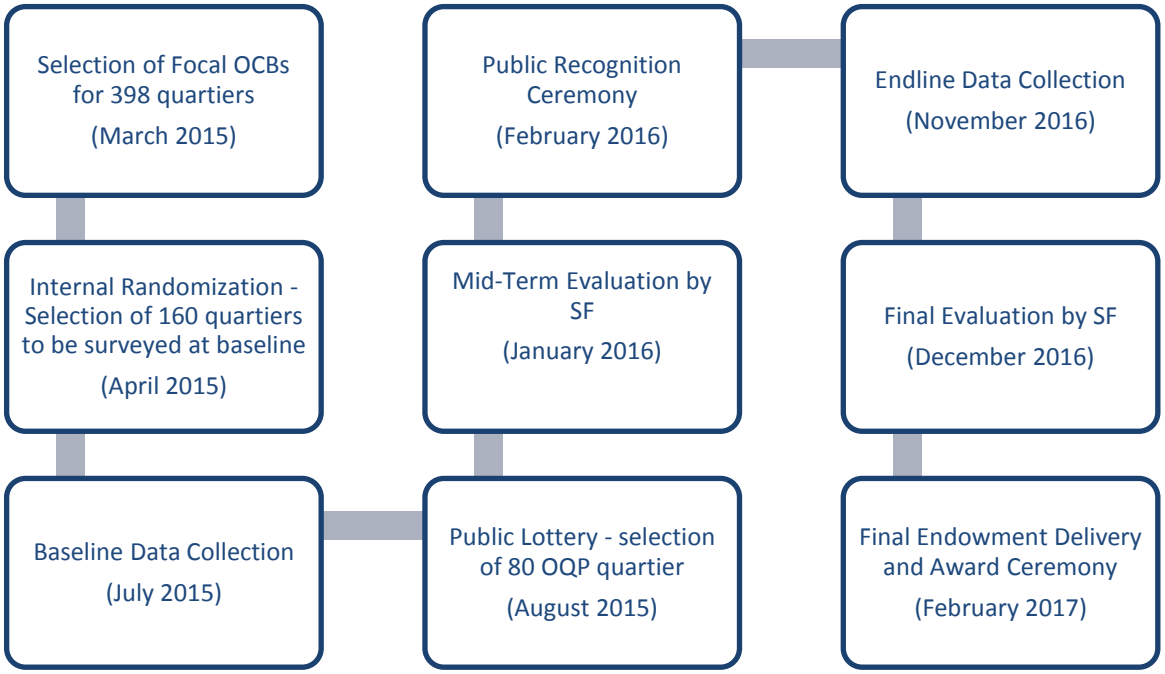
The cities of Pikine and Guédiawaye are divided into respectively 16 and 5 *communes de plein exercice*; which are themselves disaggregated at a neighborhood or *quartier* level. The project affects 8 of these communes which includes a total of 398 *quartiers*. With the PROGEP being rolled-out in two phases, the covered area is divided into two geographical zones: phase 1 Dalifort-Thiouorour and phase 2 Yeumbeul-Mbeubeuss. PROGEP's infrastructure component (rehabilitation of old water basins, implementation of new drainage pipelines etc.) was first implemented in phase 1 of the covered area. It can thus be expected that the Dalifort-Thiouorour zone will benefit from reduced flooding levels before Yeumbeul-Mbeubeuss.

Figure 1: Map of intervention area



Each zone is covered by a Social Facilitator (SF), Enda Ecopop and MSA, in charge of mediating with the local community and, in the OQP case, running the intervention on the field. The SF are responsible for: mapping out the area, creating communal sub-groups of *quartiers*, selecting the focal CBOs; assisting in developing the action plans, distributing the initial endowments and assessing the communities cleanliness at each evaluation.

Figure 2: OQP Timeline



Experimental Design

Pikine and Guediawaye are comprised of a set of *communes de plein excercice* and *quartiers* (neighborhoods). Communes are formal political structures with an elected local government. Quartiers are primarily informal geographic groupings; though there are often local governance structures and community leaders, these are informal institutions which vary across quartiers. Quartiers were organized into groups on the basis of geography and social ties. Randomization was done within these groupings with the number of treatment and control quartiers proportional to the size of the group. The distribution of communes, groups and quartiers in Pikine and Guédiawaye is summarized in Table 3.

Table 3: Communes, groups and neighborhoods in the study area

	Communes	Groups	Quartiers
Pikine	6	42	349
Guediawaye	1	5	47
Dakar*	1	1	2
Total	8	48	398

Within each neighborhood, OQP targets community-based organizations (CBOs) whose activities are mainly confined to a single neighborhood. CBOs were identified by PROGEP's "social facilitators", local NGOs contracted to carry out all community engagement activities under the project. CBOs selection was carried out on the basis of capacity to implement OQP and influence within the community[2]. Selection of CBOs was finalized in March 2015.

Our study uses a randomized controlled trial (RCT) design, with the quartier as the unit of randomization. Due to budget constraints, the number of intervention quartiers was fixed at 80. Using Stata, we therefore conducted an initial random assignment of quartiers into the study sample, stratified by groups, selecting a total of 160 quartiers.

Random assignment into treatment and control quartiers was carried out through a public lottery held with representatives of all study area CBOs, stratified by grouping, in which the representatives themselves drew their CBO's treatment status. A public lottery was selected for maximum transparency and to avoid allegations of corruption or clientelism to the maximum extent possible. While not ideal from a research design perspective, operationally a public lottery was considered essential, especially as the proximity of quartiers and the population density make it highly unlikely that control quartiers would not eventually find out about the intervention regardless (no negative reactions were reported during the lottery). As part of the lottery, CBO representatives were informed that this was a pilot intervention.

4. Data collection and identification strategy

Data collection

Data were collected at the individual, household and CBO level. 15 households were randomly chosen to be surveyed in each quartier, giving a total sample size of 2400 households. The household questionnaire collected information on household demographics, livelihoods and income sources, socioeconomic characteristics, health outcomes, exposure to flooding, knowledge of risk mitigation methods, and attitudes towards community participation and one's general responsibilities vis-à-vis the community (and vice-versa), including behavioral questions designed to measure willingness to contribute to a public good. The direct observation of the enumerator regarding the cleanliness of the area in which the household was located was also recorded. Within each household, data relating to certain variables (education, health, etc.) were collected for all household members.

A CBO level questionnaire was also administered, to both "treatment" CBOs, participating in the social contract intervention and "control" CBOs. This survey focused on basic group characteristics, their motivations for participating, their attitudes towards civic participation, and the nature of activities carried out. The endline survey differed slightly for treatment and control CBOs as it aimed to collect data to allow us to gauge the awareness of control CBOs

[2] If presence of a flood management CBO in the quartier, it is automatically selected as the focal CBO. This is the case for 3% of the CBO sample.

about OQP and whether or not this had influenced their activities, in order for us to get a measure of potential spillovers.

The baseline survey was carried out in July, 2015. The endline survey was carried out during November, 2016. The attrition rate was low. Out of the 2400 households surveyed at baseline, only 115 could not be included in the endline survey. These households were replaced in the endline survey by households which were randomly chosen from the same quartier. As the endline data was collected after the rainy season of 2016, questions related to flooding were asked about the rainy season in 2016 and 2015.

Identification strategy

Because our treatment was randomly assigned, a direct comparison of outcomes between our treatment and control groups should give us a causal estimate of the impact of the program on those outcomes. The basic specification that we will use is as follows:

$$Y_{ij1} = \alpha + \beta_T T_j + \beta_P Phase1_j + \delta Y_{ij0} + \varepsilon_{ij}$$

Y_{ij1} represents our outcome of interest which is measured at either the household or individual level, *i*, in quartier *j*, at endline. T_j is a dummy variable indicating treatment at the quartier level. Y_{ij0} is a measure of the outcome variable of interest from baseline, which will be included when available. $Phase1_j$ is a dummy variable equal to 1 if the quartier is located in the Phase 1 area.

Phase 1 quartiers benefited from PROGEP drainage infrastructure before OQP roll-out whereas Phase 2 had yet to receive infrastructure at the end of the intervention. In addition, the OQP intervention was implemented by different social facilitators in each of the two phases. Hence, there are a number of reasons why we might expect the impact of the treatment to be different in the Phase 1 and Phase 2 areas. Therefore, we also include an interaction term in a number of specifications:

$$Y_{ij1} = \alpha + \beta_T T_j + \beta_P Phase1_j + \gamma_T Phase1_j * T_j + \delta Y_{ij0} + \varepsilon_{ij}$$

5. Results

Baseline characteristics

We begin by describing the characteristics of the households and individuals in our sample at baseline and, in particular, examining the extent to which balance was achieved across treatment and control groups.

Table 4 presents the average values for a range of baseline household and individual characteristics for the treatment group and the control group, along with the difference between groups and the p-value of a t-test of whether this difference is statistically significant (p-value < 0.10; this is identifiable by the presence of one or more stars next to the difference indicator).

The first set of variables relates to the characteristics of the household head. Approximately 70% of household heads are male and the vast majority (96%) are Muslim. Most are married (around 80%), either in monogamous or polygamous marriages. The average age of household heads is 55 and the average household size is 10 people. For household heads for whom data are available on education and salary, the average education level achieved is grade 5 and the average daily salary in FCFA is around 11,000 (approximately USD 19). There are no statistically significant differences between the mean head of household characteristics across treatment and control households at baseline.

The second set of variables relates to the perceptions of households in terms of the cleanliness of the neighborhood, whether they were victims of flooding, and whether they received any training in relation to flood prevention. Around 30% of households rate their neighborhood as clean , 50% have been a victim of flooding in the past and around 14% have received training on flood prevention. There are no statistically significant differences between the mean of these variables across treatment and control households at baseline.

The third set of variables relates to the individuals within the households. There is almost the same amount of males as females in the sample and the average age is 28. The average years of education for those individuals where information is available is 4.5. Of those attending school, the average number of days missed is around a half of a day while for those that work the number of working days missed in the last 30 days is on average 0.29. Of the adults, 14% are members of a CBO. Average salary is approximately 6,100 FCFA per day (approximately USD 10).

The only variable where there is a statistically significant difference between treatment and control groups is the number of days of school missed in the last 30 days, which is statistically significant at the 10% level. All of the results presented in what follows are robust to the inclusion of controls for baseline characteristics.

Table 4: Baseline household and individual characteristics

	n	Control	Treatment	Difference	p-value
Characteristics of household head					
Male	2,285	0.70	0.68	0.02	0.40
Muslim	2,285	0.96	0.95	0.01	0.44
Married	2,285	0.80	0.78	0.03	0.17
Age	2,285	55.45	55.31	0.15	0.83
Highest level of education	1,310	5.02	5.10	-0.08	0.59
Salary (FCFA per day)	1,062	12,656.05	9,139.47	3,516.59	0.21
Household size	2,285	10.14	10.21	-0.07	0.84
Cleaning and flooding related characteristics					
Cleanliness of neighborhood	2,285	0.29	0.30	-0.01	0.70
Ever a flood victim	2,285	0.50	0.51	-0.01	0.87
Received training about flood prevention	2,285	0.16	0.13	0.03	0.25
Characteristics of individual household members					
Male	23,227	0.49	0.49	-0.01	0.42
Age	23,227	28.01	28.21	-0.20	0.43
Highest level of education	13,224	4.60	4.52	0.08	0.34
School missed in last 30 days	6,129	0.60	0.40	0.20*	0.10
Salary (FCFA per day)	4,864	6,582.08	5,743.04	839.04	0.36
Member is part of a CBO	14,896	0.14	0.14	-0.00	0.82
Illness in last 30 days	22,749	0.22	0.21	0.01	0.45
Last winter had no impact on work	5,489	0.71	0.73	-0.02	0.55
Number of working days missed over the last 30 days	23,227	0.26	0.31	-0.05	0.27

Standard errors clustered at the quartier level for tests of difference in means.
*** p<0.01, ** p<0.05, * p<0.1

Table 5 presents descriptive statistics on the characteristics of the CBOs at baseline focusing again on the balance between treatment and control groups. The first set of characteristics relates to the flood prevention and cleaning activities of the CBO. A number of CBOs (approximately 70%) undertook some action in the fight against flooding in the 12 months prior to the baseline survey. Many are also engaged in activities to counteract flooding including raising awareness and providing financial assistance for victims of flooding. Around 19% of CBOs have as their objective raising awareness on flood-related issues or organizing cleaning events. The average number of days per year spent on flood communication or cleaning activities is 12 and approximately 49 members engage in these activities.

We achieve balance on almost all of these measures with the exception of whether the CBO engaged in cleaning activities where we find a marginal statistically significant difference in the proportion of CBOs engaged in cleaning activities at baseline between treatment and control. All of the results presented in later sections are robust to the inclusion of these baseline CBO controls.

We also present baseline statistics for other characteristics of the CBO. The average number of members is around 177 with around 39 members present at the previous meeting. On average, around 94 of their members engage in the activities of the CBO. On average members engage in CBO activities for 12 hours per week. This suggests that individuals in our study area are indeed very actively engaged with CBOs. The majority of members of CBOs are women (around 60%). The proportion of members that are youths is small at around 5%. Around two thirds of CBOs vote in their leaders by election.

There are some differences across the treatment and control groups in these characteristics at baseline. In particular, CBOs in the control group report more active engagement of their members. We also find that the CBOs in treatment quartiers are less likely to vote in their leaders by election. All of our results presented in subsequent sections are robust to the inclusion of baseline controls.

The final set of CBO characteristics we consider relates to the engagement of CBOs with CBOs in other quartiers. This is important given the close physical distance between quartiers in our sample and the likelihood that the activities of CBOs in the treatment area might affect the activities of CBOs in the control areas, potentially contaminating our findings. We find that while there is some degree of collaboration between CBOs within the quartier and with CBOs in neighboring quartiers, there is no statistically significant difference between the treatment and the control groups.

Table 5: Baseline CBO characteristics

	Control	Treatment	Difference	p-value
CBO Flood prevention and cleaning activities				
CBO has taken action in relation to flooding in last year	0.72	0.66	0.06	0.42
Flood activities: raising awareness	0.30	0.30	0.00	1.00
Flood activities: financial assistance for victims	0.28	0.20	0.08	0.27
Flood activities: cleaning of canals and lakes	0.11	0.11	0.00	1.00
Flood activities: surveillance of canals and lakes	0.04	0.05	-0.01	0.70
Flood activities: cooperation with other stakeholders	0.25	0.28	-0.03	0.72
Flood activities: small works to avoid flood	0.15	0.14	0.01	0.82
Objective of CBO: raise awareness on flood-related issues/organize cleaning activities	0.19	0.19	0.00	1.00
Number of days spent on flood communication or cleaning activities	10.32	14.30	-3.98	0.38
Number of members engaged in flood communication or cleaning activities	59.38	38.76	20.61	0.17
CBO engaged in flood communication campaign	0.24	0.20	0.04	0.57
CBO engaged in cleaning activities	0.64	0.50	0.14*	0.08
CBO Characteristics				
Number of members	200.01	155.22	44.79	0.54
Number of members present at the last meeting	38.48	39.67	-1.20	0.83
Number of members engaged in activities of CBO	117.55	71.36	46.19*	0.07
Average hours a week members engage in CBO activities	11.93	12.56	-0.64	0.83
Proportion of members that are women	0.59	0.62	-0.02	0.63
Proportion of members that are young	0.06	0.04	0.01	0.46
CBO is the head quarters	0.85	0.95	-0.10**	0.04
CBO votes in leaders by election	0.69	0.53	0.16**	0.04
Most important benefit of membership of CBO are benefits for the community	0.14	0.07	0.06	0.20
Collaboration between different CBOs				
CBO only intervenes in this neighborhood	0.65	0.65	0.00	1.00
CBO collaborates with other CBOs in the quartier	0.65	0.71	-0.06	0.40
CBO collaborates with other CBOs in other quartiers	0.69	0.63	0.06	0.41

N=160

*** p<0.01, ** p<0.05, * p<0.1

Impact on CBO behavior

Since the OQP program was implemented via the CBOs, we will start by looking at the impact that treatment had on their behavior. The key outcome that we are interested in is whether or not the CBO carried out cleaning events as part of its activities. The results for this outcome are presented in Table 6. We can see that CBOs in treatment quartiers are 26.3 percentage points more likely to undertake cleaning events as part of their activities compared with control quartiers. We do not find a significant difference in treatment effect between Phase 1 and Phase 2 areas.

Table 6: CBO listed cleaning events among top 3 main activities

VARIABLES	Cleaning events
Treatment	0.263***
	(0.0836)
Phase 1	0.00261
	(0.0880)
Constant	0.507**
	(0.206)
Observations	159
R-squared	0.296

Standard errors clustered at the CBO level in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Includes controls for full range of CBO characteristics described in

Impact on household behavior and attitudes

In the next set of tables we consider the impact of treatment on household-level variables. The only controls included in these regressions are baseline values of closely related variables. The results are robust to the inclusion of other CBO and household level controls. In all cases, tests of statistical significance are based on standard errors that are clustered at the quartier level.

The first two columns of Table 7 present the results for a regression investigating the impact of the OQP program on whether or not households had heard of OQP. The quartiers selected for OQP were chosen via public lottery so we would expect that some households in control areas would have heard of the OQP. However, we would be concerned if there was no difference between control and treatment areas in terms of their awareness of the program as this would suggest either that it was not implemented effectively or that spillovers were very high. We do find a statistically significant difference in the awareness of the program between treated and control households. The coefficient on the treatment indicator in column 1 shows that treated households were almost 17 percentage points more likely to have heard of OQP than control households. The coefficient on the Phase 1 dummy is also statistically

significant and positive suggesting that households in Phase 1 areas are generally more likely to have heard of the program. Column 2 includes an interaction effect and these results demonstrate that the treatment had a different effect on household awareness in quartiers in the two different phases. The effect for Phase 2 quartiers is now stronger as treated households are 23 percentage points more likely to have heard of OQP than control households. However, the coefficient on the interaction term with the Phase 1 dummy is negative, significant and quite large in magnitude (16.5 percentage points) implying that the effect of the treatment was smaller in Phase 1 areas, although it is still the case that in general households in Phase 1 areas are more likely to be aware of OQP but this effect is across both treatment and control quartiers.

Households who reported that they were aware of OQP were then asked what they thought would be the most likely effect of the program. These results are reported in columns 3-6. Households in the treatment area were more likely to say that they believed OQP would lead to the area being cleaner. Once again, when the interaction term is included we can see that these results are being driven by Phase 2 areas. Treated households in Phase 2 areas are 16 percentage points more likely than control areas to report that OQP will result in the area being cleaner. The coefficient on the interaction term is negative, significant and of similar size to the coefficient on the treatment dummy which suggests that there was no effect of the treatment on this outcome in Phase 1 areas. It does not seem to be the case that treated households were more likely than control households to report that the program would reduce flooding. When the interaction term is included in column 6, the coefficient on the treatment indicator is positive but it is not statistically significant. However, just over 20% of households in both treatment and control areas believed that the program would reduce flooding.

Table 7: Household Awareness of OQP and opinion of impact

VARIABLES	(1) Heard of OQP	(2) Heard of OQP	(3) AREA CLEANER	(4) AREA CLEANER	(5) REDUCED FLOODING	(6) REDUCED FLOODING
Treatment	0.168***	0.233***	0.0892**	0.159**	-0.00185	0.0482
	(0.0394)	(0.0461)	(0.0446)	(0.0640)	(0.0409)	(0.0508)
Phase 1	0.0878**	0.170***	-0.0421	0.0458	0.109**	0.172***
	(0.0419)	(0.0538)	(0.0446)	(0.0629)	(0.0425)	(0.0565)
Phase 1*Treatment		-0.165**		-0.150*		-0.107
		(0.0826)		(0.0870)		(0.0825)
Constant	0.319***	0.286***	0.351***	0.306***	0.217***	0.184***
	(0.0276)	(0.0279)	(0.0403)	(0.0465)	(0.0342)	(0.0380)
Observations	2,400	2,400	1,051	1,051	1,051	1,051
R-squared	0.036	0.043	0.011	0.016	0.015	0.019

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Column (1) of Table 8 shows the estimated impact of being in a treatment area on the probability of receiving a training related to managing the risks of flooding. There is a positive and significant effect of the treatment. Treated households are 4 percentage points more likely to have received training than control households. This is a substantial effect relative to the constant of 7%. The coefficient on the Phase 1 dummy shows that households in Phase 1 areas were 5.4 percentage points more likely to have received training than households in Phase 2 areas.

Column 2 presents the results related to the household's perception of the cleanliness of their neighborhood. Households were asked to rate the cleanliness of their neighborhood on a 5 point scale ranging from 'Very Clean' to 'Very Dirty'. A 'Clean' dummy was created which is equal to 1 if the household rated their neighborhood as 'Clean' or 'Very Clean'. Households in treatment areas are 7 percentage points more likely give their neighborhood one of the higher cleanliness ratings than households in control areas and this difference is statistically significant. Phase 1 areas are 6 percentage points less likely to give their neighborhood a high cleanliness rating. Households who responded that they believed their areas were not clean were then asked who they believed was responsible for this lack of cleanliness. A dummy was created equal to 1 if their response indicated a group or individual from within the neighborhood rather than an external body. The results for this outcome variable are reported in column 3. Households in the treatment area are less likely to say that groups from within the neighborhood are responsible for the lack of cleanliness than households in treatment areas. There was no differential effect of treatment between Phase 1 and Phase 2 areas for any of the outcomes presented in Table 8 so these results are not reported.

Table 8: Training and impression of cleanliness of neighborhood

VARIABLES	(1) Training	(2) Clean	(3) Responsible
Treatment	0.0421**	0.0729**	-0.0727**
	(0.0189)	(0.0321)	(0.0357)
Phase 1	0.0541**	-0.0689**	-0.0497
	(0.0213)	(0.0323)	(0.0357)
Benefited from training in baseline	0.0361		
	(0.0219)		
Clean Baseline		0.156***	-0.00501
		(0.0296)	(0.0331)
Constant	0.0717***	0.340***	0.729***
	(0.0127)	(0.0261)	(0.0270)
Observations	2,285	2,285	1,381
R-squared	0.012	0.034	0.009

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Impact on household outcomes related to flooding

Households were asked questions about their experience of flooding in the most recent rainy season and in the previous season. Both of these seasons were during the period of time covered by the OQP intervention, although we might expect any effects to be stronger in the most recent season as OQP had been running for longer.

The results for the impact of flooding in the most recent year are presented in Table 9. Columns 1 and 2 present results for the incidence of being a victim of flooding. Columns 3 and 4 and columns 5 and 6 present results for the incidence of a household having goods damaged by flooding or the house under water, respectively. The coefficients on the treatment indicator are all negative but when the interaction term with Phase 1 is not included, they are not statistically significant and are quite small in magnitude. However, when the Phase 1 interaction is included the magnitude of the coefficient on the treatment dummy increases for all outcome variables and becomes statistically significant for the incidence of being a flood victim and for having the house under water. This suggests that for treatment households in Phase 2 areas, OQP reduced the probability of experiencing flooding in the most recent year by 3.4 percentage points and the probability of the house being under water by almost 2 percentage points. Given that the average probability of experiencing flooding in control households in Phase 2 areas in this time period is 8.5%, the magnitude of this effect is quite large. While the coefficients on the interaction term in each of these regressions are not statistically significant, they are all positive and of similar magnitude to the coefficient on the treatment dummy which suggests that OQP was not effective at reducing flooding in Phase 1 areas.

Table 9: Vulnerability to Flooding Most Recent Year

VARIABLES	(1) Flood victim	(2) Flood victim	(3) Damaged goods	(4) Damaged goods	(5) House under water	(6) House under water
Treatment	-0.0161	-0.0335*	-0.00602	-0.0133	-0.00719	-0.0194*
	(0.0156)	(0.0179)	(0.00823)	(0.0101)	(0.00972)	(0.00989)
Phase 1	0.0393**	0.0178	0.00836	-0.000590	0.0233**	0.00817
	(0.0163)	(0.0257)	(0.00839)	(0.0127)	(0.0106)	(0.0140)
Phase 1*Treatment		0.0431		0.0179		0.0302
		(0.0327)		(0.0169)		(0.0213)
Flood victim baseline	0.0258	0.0261	0.0173	0.0174	-0.00292	-0.00272
	(0.0206)	(0.0204)	(0.0119)	(0.0119)	(0.0121)	(0.0120)
Flood victim last year baseline	0.0216	0.0209	0.00232	0.00205	0.0442***	0.0437***
	(0.0218)	(0.0217)	(0.0138)	(0.0138)	(0.0143)	(0.0142)
Flood victim present year baseline	0.0666***	0.0676***	0.0211	0.0215	0.0297*	0.0303**
	(0.0224)	(0.0222)	(0.0141)	(0.0141)	(0.0152)	(0.0151)
Constant	0.0448***	0.0534***	0.0151**	0.0187**	0.0114	0.0174**
	(0.0132)	(0.0141)	(0.00666)	(0.00747)	(0.00834)	(0.00858)
Observations	2,285	2,285	2,285	2,285	2,285	2,285
R-squared	0.030	0.032	0.010	0.011	0.026	0.027

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Vulnerability to Flooding Previous Year

VARIABLES	(1) Flood victim	(2) Flood victim	(3) Damaged goods	(4) Damaged goods	(5) House under water	(6) House under water
Treatment	-0.0192	-0.0213	-0.0198	-0.0263	-0.00823	-0.0256
	(0.0208)	(0.0232)	(0.0163)	(0.0168)	(0.0158)	(0.0175)
Phase 1	0.102***	0.0995***	0.0611***	0.0531**	0.0557***	0.0341
	(0.0225)	(0.0338)	(0.0179)	(0.0245)	(0.0171)	(0.0250)
Phase 1*Treatment		0.00518		0.0160		0.0431
		(0.0445)		(0.0355)		(0.0336)
Flood victim baseline	0.0761***	0.0762***	0.0349	0.0350	0.0404*	0.0407*
	(0.0283)	(0.0283)	(0.0223)	(0.0223)	(0.0227)	(0.0226)
Flood victim last year baseline	0.0700**	0.0699**	0.0597***	0.0594***	0.0771***	0.0764***
	(0.0270)	(0.0270)	(0.0222)	(0.0221)	(0.0222)	(0.0221)
Flood victim present year baseline	0.0834***	0.0835***	0.0580**	0.0584**	0.0386	0.0395
	(0.0309)	(0.0308)	(0.0262)	(0.0261)	(0.0260)	(0.0259)
Constant	0.0714***	0.0724***	0.0399***	0.0431***	0.0245**	0.0332**
	(0.0157)	(0.0167)	(0.0120)	(0.0123)	(0.0123)	(0.0138)
Observations	2,285	2,285	2,285	2,285	2,285	2,285
R-squared	0.077	0.077	0.050	0.051	0.057	0.058

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for similar regressions for flooding in the previous year are presented in Table 10. They follow a similar pattern to the results in the previous table. The coefficients on the treatment dummy are all negative and of similar magnitude to those presented in Table 9 and, in fact, many of them are slightly larger. However, none of these estimates are statistically significantly different from zero. The coefficients on the Phase 1 dummy are positive, large and statistically significant, suggesting that Phase 1 areas experienced significantly more flooding in this season than Phase 2 areas.

Since we have a number of different measures for vulnerability to flooding, indices were created to combine these outcomes and get one overall measure of the experience of flooding. The index is constructed by averaging across the measures already presented, giving each measure equal weight. This should give an indication of the intensity of the household's experience of flooding as it will have a higher value if their house was under water and goods were damaged due to flooding than if they just experienced one of these events. A separate index was created for each year and then a combined index was created that accounts for the experience of flooding in both years. The results for these indices are presented in Table 11. These results support the findings in the previous tables. OQP reduced the vulnerability of flooding for households in treatment quartiers located in the Phase 2 area but it does not seem to have had a similar effect in the Phase 1 quartiers. The results also suggest that quartiers in the Phase 1 area are in general more vulnerable to flooding.

Table 11: Flooding index

VARIABLES	(1) Flooding index This year	(2) Flooding index This year	(3) Flooding index Last year	(4) Flooding index Last year	(5) Flooding index Both years	(6) Flooding index Both years
Treatment	-0.00977	-0.0221*	-0.0158	-0.0244	-0.0128	-0.0232*
	(0.00984)	(0.0115)	(0.0159)	(0.0173)	(0.0119)	(0.0134)
Phase 1	0.0237**	0.00846	0.0729***	0.0622**	0.0483***	0.0353*
	(0.0102)	(0.0153)	(0.0173)	(0.0250)	(0.0126)	(0.0188)
Phase 1*Treatment		0.0304		0.0214		0.0259
		(0.0206)		(0.0341)		(0.0250)
Flood victim baseline	0.0134	0.0136	0.0505**	0.0506**	0.0319**	0.0321**
	(0.0119)	(0.0118)	(0.0220)	(0.0220)	(0.0147)	(0.0146)
Flood victim last year baseline	0.0227*	0.0222*	0.0689***	0.0686***	0.0458***	0.0454***
	(0.0131)	(0.0130)	(0.0210)	(0.0210)	(0.0147)	(0.0146)
Flood victim present year baseline	0.0391**	0.0398***	0.0600**	0.0605**	0.0496***	0.0501***
	(0.0152)	(0.0152)	(0.0258)	(0.0257)	(0.0184)	(0.0183)
Constant	0.0238***	0.0298***	0.0453***	0.0496***	0.0345***	0.0397***
	(0.00840)	(0.00907)	(0.0121)	(0.0132)	(0.00957)	(0.0105)
Observations	2,285	2,285	2,285	2,285	2,285	2,285
R-squared	0.030	0.032	0.077	0.077	0.071	0.072

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Impact on individual outcomes related to flooding

The results relating to an individual's experience of illness are reported in Table 12. While all of the estimates of the impact of treatment are negative, they are not statistically significant and are all close to zero. From these results, we cannot say that OQP had any impact on the incidence of illness of individuals in treatment quartiers. However, when individuals are specifically asked about whether or not their illness was related to flooding, individuals in treatment areas are less likely to say that their illness in the previous rainy season was due to flooding than individuals in control areas. These results are presented in Table 13.

Table 12: Prevalence of Illness

VARIABLES	(1) Illness Last 30 days	(2) Illness This rainy season	(3) Illness Last rainy season
Treatment	-0.00970	-0.0120	-5.53e-05
	(0.0165)	(0.0203)	(0.0228)
Phase 1	0.0339**	0.0325	0.0348
	(0.0169)	(0.0211)	(0.0240)
Illness baseline	0.133***	0.138***	0.0774***
	(0.0103)	(0.0112)	(0.0111)
Constant	0.196***	0.235***	0.143***
	(0.0146)	(0.0173)	(0.0177)
Observations	20,526	20,536	20,391
R-squared	0.019	0.019	0.010

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The impact of treatment on the effect of flooding on work is investigated in Table 14. The outcome reported on in columns 1 and 2 is the number of work days missed in the previous 30 days. While the coefficients for the treatment dummy are negative, they are small and not statistically significant. This is perhaps not surprising since we would only expect the treatment to affect this variable through the impact on flooding and the 30 days prior to the survey coincided with the end of the rainy season when rains were at most moderate. The following columns present results for income lost due to flooding in the most recent year and the previous year. The coefficients on the treatment dummy are negative in all the regressions and again become stronger once the interaction term is included, suggesting a reduction in the amount of income lost due to flooding. The result is only statistically significant for the previous year, although the estimate for the most recent year is of similar magnitude. Once again, the results suggest that OQP had an impact on treatment quartiers located in the Phase

2 area but not in Phase 1 as the coefficients on the interaction term are of similar magnitude and of the opposite sign to the treatment coefficient. However, they are not statistically significant. It is important to note that most respondents (97.5%) reported no income lost for these periods and so these results are being driven by a small proportion of individuals and further analysis is ongoing. However, the results are interesting and consistent with the results related to vulnerability to flooding.

Table 13: Prevalence of illness due to Flooding

VARIABLES	(1) Illness due to flooding this year	(2) Illness due to flooding last year
Treatment	-0.0184	-0.0557*
	(0.0224)	(0.0314)
Phase 1	-0.0500**	-0.0236
	(0.0225)	(0.0316)
Illness baseline	-0.0726***	-0.139***
	(0.0159)	(0.0221)
Constant	0.333***	0.496***
	(0.0215)	(0.0277)
Observations	5,369	3,458
R-squared	0.010	0.021

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, the impact of treatment on education outcomes is reported in Table 15. None of the results for these outcomes are statistically significant and they are very small in magnitude. This is perhaps not surprising as most flooding happens outside of the school year.

Table 14: Impact on Work

VARIABLES	(1) Work days missed last 30 days	(2) Work days missed last 30 days	(3) Income lost this year	(4) Income lost this year	(5) Income lost last year	(6) Income lost last year
Treatment	-0.0534	-0.590	-1,676	-2,108	-2,098	-2,680*
	(0.316)	(0.455)	(1,388)	(1,588)	(1,414)	(1,568)
Phase 1	0.233	-0.368	335.6	-208.7	1,753	1,021
	(0.312)	(0.470)	(1,508)	(2,781)	(1,552)	(2,715)
Phase 1*Treatment		1.217**		1,099		1,478
		(0.616)		(2,997)		(3,089)
Work days missed baseline	0.0514	0.0528				
	(0.0351)	(0.0346)				
Constant	2.426***	2.688***	3,682***	3,900***	3,386**	3,678**
	(0.294)	(0.343)	(1,287)	(1,471)	(1,319)	(1,506)
Observations	5,296	5,296	4,905	4,905	4,951	4,951
R-squared	0.001	0.003	0.000	0.000	0.001	0.001

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Impact on education outcomes

VARIABLES	(1) School year begin on time	(2) School year begin on time	(3) School days missed	(4) School days missed
Treatment	-0.00171	0.00248	0.0219	-0.0149
	(0.00550)	(0.00502)	(0.0953)	(0.134)
Phase 1	-0.0210***	-0.0160*	-0.0715	-0.116
	(0.00620)	(0.00881)	(0.0928)	(0.122)
Phase 1*Treatment		-0.0103		0.0901
		(0.0124)		(0.187)
School days missed baseline			0.0129	0.0130
			(0.0168)	(0.0168)
Constant	0.990***	0.988***	0.360***	0.377***
	(0.00399)	(0.00402)	(0.0805)	(0.0915)
Observations	7,240	7,240	4,214	4,214
R-squared	0.006	0.006	0.001	0.001

Robust standard errors clustered at the quartier level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Conclusions

This paper investigated the impact of an intervention designed to motivate community members to keep their local area clean in order to increase the effectiveness of drainage infrastructure and therefore reduce the risk of flooding in that area. This was a light-touch, bottom up intervention: OQP engaged existing community-based organizations and empowered them to use their local knowledge and networks to work towards improved community cleanliness, while providing minimal guidance and only basic materials. Importantly, however assessment of neighborhoods to see if they would qualify for the "Clean Neighborhood" designation following the intervention, and the related recognition and incentives, was carried out by external parties on the basis of pre-defined criteria. This was an important element of transparency, to guard as much as possible against the allegations by non-qualifying quartiers of favoritism or corruption.

Our results show that OQP, which engaged established community-based groups with a non-monetary incentives-linked "social contract", can be effective at improving community engagement for the upkeep of public spaces. We find that the program had a significant positive effect on households' likelihood of receiving training, their perception of the cleanliness of their neighborhood and their vulnerability to flooding. We find, furthermore, that the positive results on vulnerability to flooding are due to OQP impacts in PROGEP Phase 2 areas, where the infrastructural component of the project had not yet been implemented. This suggests that an OQP-type intervention could be considered as an interim substitute while waiting for such investments to catch up with the needs of communities living in peri-urban areas that are at risk of flooding. It should be noted, however, that Phase 1 areas were found to be more prone to flooding overall, according to results from the household survey. Thus, OQP can be effective in preventing flooding, even in the absence of infrastructure, but perhaps more so in areas that are relatively less prone to flooding to begin with. This is logical: as flood-risk increases, drainage infrastructure becomes increasingly important. The clear lesson that emerges, however, is that flood risk mitigation should go hand-in-hand with waste management.

More broadly, the OQP impact evaluation provides lessons for other projects and initiatives aiming to engage communities in the upkeep or provision of public goods. First, the intervention relies almost wholly on local knowledge, and gives participating CBOs full autonomy in determining the types of activities to implement. Second, CBO rewards are not based exclusively on the activities they conduct (this is only one of six evaluation criteria), but primarily on an external assessment of the cleanliness of their neighborhood. This is therefore an example of a "results-based" intervention at the very local level. Third, such light-touch, non-interventionist approaches can be effective at shifting community-level behaviors, which is fundamental to achieving sustainability and returns on other types of community investments (drainage infrastructure in the PROGEP case, but perhaps also roads, schools, health facilities, parks, etc.).

References

(1) Arcand, J. and Bassole, L. (2011) ‘ Does community driven development work? Evidence from Senegal.’ Draft. CERDI-CNRS, Université d’Augergne and EUDN.

(2) Ariely, D., Bracha, A., and Meier, S. (2013) ‘Doing good or doing well? Image motivation and monetary incentives in behaving prosocially.’ Working paper No. 07-09, Federal Reserve Bank of Boston.

(3) Ashraf, N., Bandiera, O. and Jack, J. (2013) ‘No margin, no mission? A field experiment on incentives for public service delivery.’ Mimeo.

(4) Banerjee, A., Banerji, R., Duflo, E., Glennerster, R. and Khemani, S. (2010) ‘Pitfalls of participatory programs: Evidence from a randomized evalution in education in India.’ American Economic Journal: Economic Policy, 2(1), pp. 1-30.

(5) Beath, A., Christia, F. and Enikolopov, R. (2013) ‘The National Solidarity Programme: Assessing the effects of community-driven development in Afghanistan.’ UNU-WIDER Working Paper No. 2013/112.

(6) Besley, T. and Ghatak, M. (2006) ‘Public goods and economic development.’ In: Understanding Poverty (ed.) Banerjee, A., Benabou, R. and Mookherjee, D. (eds.), New York: Oxford University Press.

(7) Cappelen, A., Reme, B.A., Sorenson, E.O. and Tungodden, B. (2013) ‘Leadership and incentives.’ Working Paper Norwegian School of Economics, ISSN0804-6834.
Jack, K. and Recalde, M.P. (2013) ‘Local leadership and the voluntary provision of public goods: field evidence from Bolivia.’ Mimeo.

(8) Kremer, M., Leino, J., Miguel, E. and Peterson Zwane, A. (2011) “Spring cleaning: rural water impacts, valuation and property rights institutions.” Quarterly Journal of Economics, 126, pp. 145-205.

(9) Kremer, Michael, Edward Miguel, Sendhil Mullainathan, Clair Null, and Alix Peterson Zwane. "Making Water Safe: Price, Persuasion, Peers, Promoters, or Product Design." Working Paper, Harvard University, August 2009.

(10) Mansuri, G. and Rao, V. (2004) Community-based and –driven development: a critical review.’ World Bank Research Observer, 19(1), pp. 1-39.

(11) Mansuri, G., & Rao, V. (2012). Can Participation Be Induced? Some Evidence from Developing Countries. Washington, DC.

(12) Ostrom, E. (1990) Governing the commons: the evolution of institutions for collective action. New York: Cambridge University Press.

(13) Ostrom, E. (2008) 'Tragedy of the Commons.' In: Durlauf, S. and Blume, L (eds.) The New Palgrave Dictionary of Economics, Second Edition.

(14) Ostrom, E., Gardner, R. and Walker, J. (1994) Rules, games and common-pool resources. Ann Arbor: University of Michigan Press.

(15) Ruaniyar, G., Orbeta, A. and Sugiyarto, G. (2011) "Impact of water supply and sanitation assistance on human welfare in rural Pakistan." Journal of Development Effectiveness, 3(1), pp. 62-102.

(16) Sheely, R. (2010) 'Community governance, collective action and the maintenance of local public goods: qualitative and experimental evidence from rural Kenya.' Mimeo.

(17) UNICEF (2012) UNICEF Water, Sanitation and Hygiene Annual Report 2011. UNICEF: New York.

(18) World Bank (2004) World Development Report: Making services work for poor people. World Bank and Oxford University Press: Washington.

(19) World Bank. (2010). Cites and Climate Change: An Urgent Agenda. Washington, DC: World Bank.