Using Participatory Mapping to Inform a Community-Randomized Trial of HIV Counseling and Testing

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Participatory mapping and transect walks were used to inform the research and intervention design and to begin building community relations in preparation for Project Accept, a community-randomized trial sponsored by the National Institute of Mental Health. Project Accept is being conducted at five sites in four countries: Thailand, Zimbabwe, South Africa, and Tanzania. Results from the mapping exercises informed decisions such as defining community boundaries and identifying appropriate criteria for matching community pairs for the trial as well as where to situate the services. The mapping also informed intervention-related decisions such as where to situate the services. The participatory methods enabled researchers at each site to develop an understanding of the communities that could not have been derived from existing data or data collected through standard data collection techniques. Furthermore, the methods lay the foundation for collaborative community research partnerships.

Keywords: *participatory research methods; mapping; community-randomized trial; formative research*

Community-randomized trials are increasingly being used to evaluate the impact of large-scale public health interventions aimed at influencing social determinants of health behavior (Freedman et al. 1997; Green 1997; Todd et al. 2003). A number of challenges are associated with designing and implementing a community-randomized trial, however. The first is to ensure that intervention and control communities do not systematically differ from one another in ways that will influence study outcomes, a key challenge in research design (Smith and Morrow 1996; Green 1997). Although matching communities can ensure that clusters receiving the intervention are more likely to resemble those not receiving it in important ways (Freedman et al. 1997), communities should be matched only on factors known to be highly correlated with the outcome of interest. Inappropriate or inadequate matching can reduce the power of the study to detect a real effect when the sample of communities is small.

The second challenge is to determine the boundaries of communities to be used as analytical units in community-randomized trials. Communities are often defined administratively, on the basis of geography and population size. However, these administrative boundaries may not correspond to the community definition of boundaries. The delineation of community boundaries is critical when interventions are designed to operate through community-level change. If community boundaries have been defined in ways that do not accurately reflect patterns of interaction among individuals, the intervention may not have the desired impact at the community level. In addition, if boundaries are not internally consistent with the local use of space, then crossover between communities randomized to different conditions may become an issue for the trial. This type of crossover is an important threat to the internal validity of a trial.

The final challenge is that many intervention design issues need to be addressed before implementing an intervention trial in a community. Formative research, or research conducted prior to the implementation of a project, is now considered a key step in the intervention development process because it allows investigators to explore potential barriers and

facilitators to intervention adoption, develop appropriate communication strategies to promote adoption of the intervention, and address issues such as who should deliver the intervention and where the intervention should be delivered (Gittelsohn et al. 1995; Young et al. 2006). The formative research phase is also an important opportunity for the study team to begin building long-term collaborative partnerships between study communities and researchers.

Participatory mapping was developed as a data collection methodology in the field of resource management and land reform in the 1980s (Rambaldi et al. 2006). Participatory mapping falls within a broader framework of participatory research methods. Investigators using a participatory research approach engage community members in the collection and generation of information, using methods that place the locus control over data generation with the participants themselves. In participatory mapping, emphasis is placed on local knowledge and on building relations between community members and researchers (Rambaldi et al. 2006). Participatory mapping has been adapted in the field of public health to identify malaria breeding sites (Dongus et al. 2007), garbage burning sites (McMahan and Burke 2007), and areas of high sexual risk (Power, Langhaug, and Cowan 2008) and to describe patterns of health service utilization (Fletcher et al. 1999; Rutta et al. 2005) and patterns of mobility that may describe the spread of epidemics (Steen et al. 2000). Transect walks, or guided tours of communities with knowledgeable community informants, have often been used in conjunction with participatory mapping exercises to explore in more detail some of the information that emerged during the mapping process. Transect walks have been used to gain understanding of barriers to health care access in a refugee camp in Ngara, Tanzania (Rutta et al. 2005); water use habits in Cape Province, South Africa (Motteux et al. 1999); and community knowledge of the use of tree species in Cameroon and the Central African Republic (Vabi 1996).

Participatory mapping methods changed in the 1990s with access to spatial information technologies such as geographic information systems and global positioning systems, though the core approach remains the same, namely, to integrate local knowledge with "expert" data so as to understand the physical and social organization of places (Dunn 2007; Glantz and McMahan 2007). The integration of community development with the geospatial technologies has come to be known as participatory geographic information systems and has been applied in a wide range of contexts, including urban planning, managing conflict over access to land and other natural resources, resource management, and conservation and health (Hassan 2005; Dunn 2007; Glantz and McMahan 2007).

We conducted participatory mapping, including transect walks, as an innovative formative research methodology before implementing Project Accept, a community-randomized trial that is sponsored by the National Institute of Mental Health (NIMH) and designed to test the efficacy of a community-based model of HIV counseling and testing in four countries: Tanzania, Thailand, South Africa, and Zimbabwe. The community-based HIV counseling and testing model being evaluated through NIMH Project Accept has three major components: (1) to make voluntary counseling and testing (VCT) more available in community settings, (2) to engage the community through outreach, and (3) to provide posttest support. These components are designed to change community norms and reduce risk for HIV infection among all community members. The community-based model of HIV counseling and testing is designed to overcome barriers, including fear of stigma and lack of posttest support, to HIV testing identified through previous research (Khumalo-Sakutukwa et al. 2008). Project Accept is the first international community-randomized phase III trial to determine the efficacy of a behavioral/social science intervention with an HIV incidence endpoint.

In this article, we report on our use of participatory mapping, including transect walks, as a methodology for overcoming the common challenges in designing and implementing a community-randomized trial. We describe how mapping was conducted at the five project sites. We then present some results from a few sites to illustrate the ways in which the methods informed the research and intervention design for the trial and facilitated the community relationship–building process prior to the implementation of the intervention.

METHODS

Study Sites

NIMH Project Accept is being conducted in forty-eight communities in four countries, including ten communities in Kisarawe, Tanzania; fourteen in Chiang Mai, Thailand; eight in Mutoko, Zimbabwe; and sixteen in South Africa (eight in Vulindlela, KwaZulu-Natal, and eight in Soweto, Gauteng). This trial is being conducted in sites that will allow for testing HIV incidence, thus allowing the study to have both behavioral (HIV risk practices) and biological (HIV incidence) endpoints. Participating sites were selected so that the average annual incidence across all communities in the study is likely to reach at least 3%. To ensure sufficient numbers of individuals to

evaluate community-level change, communities of approximately 7,000–10,000 people were selected. In the context of this trial, a community was defined as a group of individuals who live next to one another and participate in common practices, depend on one another, make decisions together, identify themselves as part of something larger than the sum of their individual relationships, and commit themselves to the group's well-being (Shaffer and Amundsen 1993; MacQueen et al. 2001). The communities at each site were initially selected on the basis of existing demographic and health indicators, geographic maps, and other existing publicly available information, such as HIV prevalence data.

The study sites are all rural, with the exception of Soweto, South Africa. Soweto (an abbreviation of South Western Townships) is an urban area of the city of Johannesburg, Gauteng Province. Located 15 km southwest of the central business district, Soweto is composed of several townships in an area of 63 km^2 and has a population of approximately one million. The second site in South Africa, Vulindlela, is a subdistrict within the KwaZulu-Natal midlands region. The communities in Vulindlela are situated about 140 km northwest of Durban, and the subdistrict has a total population of approximately 400,000. In Tanzania, the study site is located in Kisarawe, a rural district of approximately 100,000 people located 30 km southwest of Dar es Salaam. The Zimbabwe site is located in Mutoko, a rural district, with approximately 130,000 residents, 150 km northeast of Harare. The only Asian site included in the trial is located within Chiang Mai Province, in northern Thailand. The study communities are located in a mountainous area between 40 and 160 km northeast of Chiang Mai City.

Data Collection

In preparation for the trial, members of the qualitative research team at each site conducted participatory mapping and transect walks to describe the physical and social organization of the communities. The participatory mapping and transect walk process had three objectives. First, these data were gathered to inform the research design, including identifying community boundaries, describing geographic and social separation of communities, and identifying relevant matching criteria. Second, data from these exercises were used to inform the intervention design, including identifying appropriate sites for the clinic- and community-based provision of HIV VCT. Finally, as one of the first data collection efforts in the study communities for this trial, the third objective of the mapping process was to build relations in the community. The intervention is designed to last 2.5 years in each community, but with the formative work and the postintervention

assessment that will happen after intervention implementation is completed, the research teams will be present in the study communities for an average of approximately 4.5–5 years. The relationships between the researchers and the community members beyond the life of the study will depend on the availability of funds and the ongoing interest and commitment of both researchers and community members.

Prior to developing the maps, the project teams at all sites had a series of meetings over several months with administrative and community leaders from the province, districts, and specific communities in which they were working. These meetings were designed to introduce the project to leaders and seek their permission to work in the study communities. Permission was needed at every level before finally reaching the community. Community members were briefed on the project through meetings with community leaders. Information was provided on the project activities and timelines, and questions were answered.

To develop the maps, six to thirteen members of the community who represented various community constituents—including youth, women, men, and elders—were selected by community leaders to participate in the mapping exercises (Alcorn 2000). In selecting the mapping participants, leaders were asked to identify individuals who were knowledgeable about the community and who they felt best represented these different constituencies (HIV/AIDS Alliance 2008). The team identified an open location for the community members to draw the maps, often outside or in an empty school classroom (Mascarenhas and Kumar 1991; Kirsopp-Reed 1994). One member of the formative research team explained the exercise to the group and asked the group to designate someone to draw the map, with input from others. The maps were initially drawn on the ground, using a stick, chalk, or some other tool to draw the boundaries around the community and the roads within the community. The community members used other local products, such as shells and bottle caps, to identify landmarks within the community.

The community members decided what landmarks and other important attributes to include in the maps, and they created their own legends for the maps. There was a designated note taker from the research team, whose role was to capture the dialog that occurred between community members as they constructed the maps. The field notes were expanded into full transcripts after the mapping exercise was finished so that we had detailed text to analyze for the decisions on research and intervention design. The note taker was also responsible for transferring the maps that were drawn by community members on the ground onto paper after the exercise was finished. See Figure 1 for a photo of the mapping process in Tanzania.

FIGURE 1
Photo of the Mapping Process

The research teams conducted transect walks in each community after the participatory mapping exercises. Transect walks are tours of the community using community guides who are knowledgeable about their own community and who represent different groups within the community (Mahiri 1998). The study team that conducted the mapping exercises with the community members selected two to four participants for the transect walks. On the basis of the maps that were drawn, the communities were divided into grids, and two research team members transected the grids accompanied by community members, either by foot or in a car, depending on the distances involved. As the team crossed the community, a research team member asked questions about the community in the form of a mobile interview. The notes that were taken in the field were later expanded into full transcripts for each transect walk. Tables 1 and 2 summarize the methods by site.

Ethics approvals for the participatory mapping and transect walks were obtained from all U.S. and international institutions participating in the multisite trial. We obtained informed consent from all participants

TABLE 1
Comparison of Participatory Mapping Methods

Site	Number of Community Participants	Who Selected Participants and Criteria Used for Selection	Materials Used	Duration
Soweto, South Africa	6–13 people, with average of 10 per community	Ward councilors and *Indunas* were asked to invite community members. They were asked to select male and female participants who they judged to be knowledgeable about the community.	Flip chart size sheets, markers, pencils, adhesive tape, different-colored paper cut into shapes to represent different structures	4 hours per community
Vulindlela, South Africa	6–10 people	Community members were selected by village leaders. Leaders were asked to select male and female participants who they judged to be knowledgeable about their community.	Locally available products, including rocks, bottle caps, shells, etc.	3–4 hours
Chiang Mai, Thailand	7–8 people	Community health center staff members and village health volunteers were selected by the community leaders.	Paper, pens	11 days per community (included household enumeration)
Mutoko, Zimbabwe	6 people	Community leaders selected participants. They selected participants on the basis of how long they had lived in the community, and they included a mix of ages and gender.	Chalk and chalkboards in school rooms or on concrete walls and floors	2–3 hours per community
Kisarawe, Tanzania	4–13 people, with an average of 9 per community	Village leaders selected participants. They were asked to select participants who lived in the communities, and who represented different gender and ages.	Sticks, bottle caps, rocks and chalk of different colors, leaves, shells and other local materials	Each village map took between 40 minutes and 2.5 hours to complete. Village maps were combined into one community map.

<div align="center">TABLE 2</div>
<div align="center">Comparison of Transect Walk Methods by Site</div>

Site	Number of Guides	Mode of Transportation
Soweto, South Africa	2–3 per community	Walked in 2 communities with hostels, drove in remaining 6 communities
Vulindlela, South Africa	3–5 per community	Drove in 2 communities because of inclement weather
Chiang Mai, Thailand	2 per community	Walking, except in 2 large villages they used a vehicle
Mutoko, Zimbabwe	4 per community	Driving in all communities
Kisarawe, Tanzania	2–4 guides per grid	Walked in the densely population regions of the communities and drove in the regions between villages that were not settled

before conducting the mapping exercises and transect walks. Written informed consent was obtained in Soweto, Zimbabwe, and Tanzania; verbal consent was obtained at the other sites prior to participation.

RESULTS

In the sections below, we highlight findings from the mapping exercises and transect walks at the sites to illustrate the ways in which the data were used to inform the research and intervention design and to build community relations.

Research Design

Information from the participatory mapping and transect walks were used to verify community boundaries and to identify relevant attributes to match and minimize crossover between intervention and control communities. In selecting communities for inclusion in this trial, those at the sites had to identify attributes of the communities that may be associated with HIV incidence and try to match paired intervention and comparison communities on these attributes. For example, it is well established that communities in closer proximity to major transportation routes tend to have higher HIV prevalence because these communities have markets and other activities that draw people from different communities and businesses such as hotels and bars that cater to these individuals. Thus, it is important in designing a study to consider attributes such as proximity to transportation

FIGURE 2
Photo of the Completed Map from Kisarawe, Tanzania
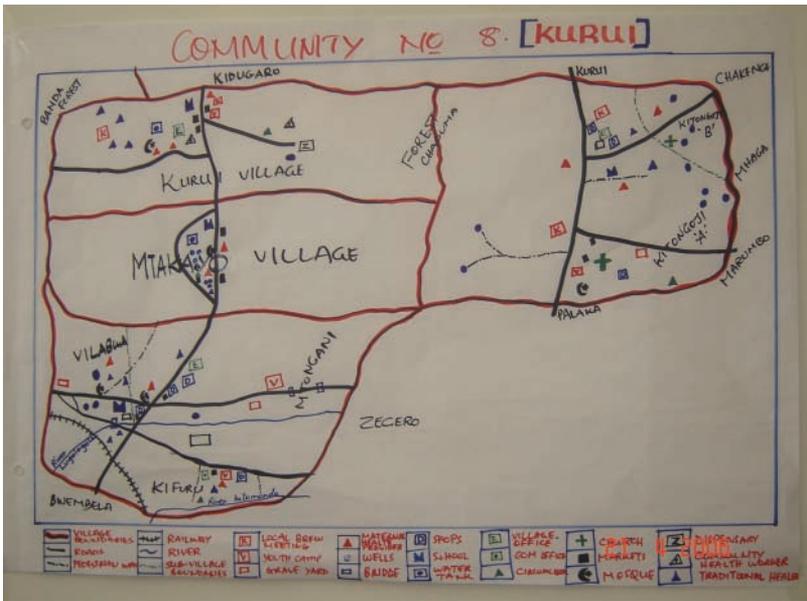
routes so that they are evenly balanced between intervention and comparison communities. It is also important to minimize crossover between communities in the intervention and the comparison arm of a randomized trial so that the true effect of the intervention can be compared with the comparison condition.

Defining community boundaries. In Tanzania, the study team learned that community members defined their communities as those pieces of land where people were living. As a result, large areas of unsettled land that were included in district maps were not always included in the maps that the participants drew of their own communities. This generated debate among community members as to where one community ended and another began. Figure 2 is a map that was created in Tanzania. The map includes details such as village boundaries, subvillage boundaries, graveyards, wells, bridges, schools, village office, mosque, traditional healers, and secondary transportation (walking/bike) routes.

Unlike the other semiurban or rural sites, the Soweto site is a densely populated urban site with administrative boundaries that do not necessarily demarcate natural divisions between communities. The challenge of defining boundaries was apparent in the participatory mapping exercise. In six of the eight mapping exercises, the study team reported that the participants had a lot of difficulty defining the physical boundaries of their communities. In almost all cases, the community definition of boundaries did not match the administrative boundaries found on government maps.

Identifying criteria for matching and assessing geographical separation. During the mapping process in Zimbabwe, the investigators learned about public spaces associated with high-risk sexual behavior and health infrastructure. These factors, together with other data on population size and distance from the district headquarters, were used to match communities into pairs. To reduce the chance of crossover between communities, the investigators knew that matched communities should not be linked through roads or bus routes and that they needed to be roughly equidistant from the central business district for this rural area. Through mapping and transecting the communities, the research team also documented how secondary transportation routes (e.g., bicycle and pedestrian trails) linked communities. The team used this information on secondary transportation routes together with the information on the main roads to ensure that matched pairs were not connected in meaningful ways.

Intervention Design

Researchers gathered information on potential counseling and testing sites, community mobilization strategies, and posttest support options during the participatory mapping exercises and transect walks to inform the intervention design at each site.

Identifying counseling and testing sites. An important aim of NIMH Project Accept is to increase access to HIV counseling and testing in the communities randomized to the intervention arm. To do this, there are counseling and testing services available in mobile caravans at the sites that can be driven to different venues in the community, in tents that the teams temporarily erect in venues throughout the communities, or through the use of existing community facilities such as schools, community centers, or churches. The site teams used the participatory mapping and transect walks to explore potential venues for the provision of counseling and testing.

In Soweto, the research team planned to use mobile caravans to provide counseling and testing services in the intervention communities. Initially, the team planned to use empty lots that were scattered throughout communities as possible sites for their mobile provision of counseling and testing. However, after transecting the communities, the team learned that the empty public spaces that were located on the outskirts of communities were often affiliated with crime and drug activity and thus would be one of the least desirable sites for service provision.

Determining community mobilization strategies. Another critical component of the community-based counseling and testing strategy is to mobilize communities around HIV counseling and testing to increase demand and reduce stigma associated with HIV testing. To do this, researchers at each site identified community-based volunteers and established a community working group that could be consulted as an advisory board to help manage community relations and community groups they could liaise with to promote HIV testing including women's groups, faith-based groups, and so on. The mapping and transect walks helped the study teams identify groups they could partner with for the mobilization activities and helped them identify where to implement the mobilization activities.

The Soweto team learned about the governance structure of the communities during the participatory mapping exercises and transect walks and how to work within these structures to mobilize communities regarding counseling and testing. They learned that communities with large hostels, or dormitory-like housing facilities for male migrant laborers, had governance structures that were separate from the administrative jurisdiction of the ward councilors found in every Soweto district. In the hostels, a hostel chairman and hostel committee carry out most local government activities. They are overseen by a traditional leader, an *Induna*, whose role is to mediate when there are issues that the hostel committee has failed to address or comes to a deadlock in attempting to address. Understanding this administrative and leadership structure was critical in terms of knowing how to build relations for the community mobilization process in the hostel communities.

Identifying posttest support strategies. The last element of the community-based counseling and testing strategy is provision of posttest support for individuals who have been tested for HIV. During the participatory mapping and transect walks, researchers at all sites had to identify what support services existed in the communities. Each site aimed to build on these

existing services to provide posttest support services or the intervention communities.

At the Vulindlela, South Africa, site, the study team identified several existing posttest support services during their mapping exercises and transect walks. They identified medical and health services, as well as social support services that were available in communities. They created a database of all posttest support services and gave this information to the posttest support services intervention team. The intervention team then went back to each organization, verified that they existed, and gathered more information on what services they provided.

In Zimbabwe, the team learned that many communities did not have access to any type of medical or social support related to HIV. There are three major hospitals in Mutoko district, one run by the government and two mission hospitals. In addition, they identified one community-based organization that provides antiretroviral treatment. The Zimbabwe site established agreements with the hospitals and the community-based organization to serve clients referred from VCT in the study communities. The project provides these referral services with additional resources to support their activities.

Building Community Relations

At all five sites, the participatory mapping and transect walks were two of the earliest data collection efforts for this study that occurred in the study communities. As such, these exercises represented an important opportunity for community relation building. The community members' access to project staff members gave them an opportunity to ask questions regarding the activities and the overall study. The site teams learned about some of the emerging concerns and questions from the community regarding the project.

The types of questions asked most frequently during the mapping exercise fell into three general categories: (1) questions regarding the overall project, (2) questions related to how the community would benefit from the project, and (3) questions about basic information and education related to HIV and HIV testing.

In the first category of questions, which related to the overall study, community members often asked how the HIV testing services would be implemented, how and when they would receive their results, and how some of these specific activities (mapping and transect walks) were related to the overall project.

In the second category of questions, which related to how the community would benefit from the project, in some sites community members

asked whether they would be paid for participating in the mapping and transect walk process. They also wanted to know whether the services that would be provided through the project would be offered free of charge. The research teams explained that all study-related services were free of charge and that participants would not be paid for participating in intervention services, but would be compensated for some of the research visits. In some of the sites, particularly the two South African sites, the communities selected for inclusion in this trial had been part of other research studies. Some community members who had participated in these prior research projects believed that these earlier studies had resulted in questionable benefits for the communities. Thus, the team had to address the mistrust and suspicion on the part of these community members during the mapping and transect walks.

In the third category of questions, some community members had questions about how HIV can be transmitted and prevented and where HIV testing is currently happening.

DISCUSSION

NIMH Project Accept is designed to change the environmental context in which people make decisions about HIV testing and HIV risk. As the intervention is delivered at the community level, a community-randomized trial design is the most appropriate design for evaluation of study impact. The formative research phase of the trial enabled the study teams to gain a deeper understanding of the communities and to begin to build relationships of trust with community members in preparation for the trial.

Understanding how communities defined themselves both spatially and socially was critical at this early stage of the trial. Spatially, understanding the community definition of boundaries was important for the research design because the unit of analysis for the trial is the community. At some sites, the community definitions of boundaries closely mirrored administrative boundaries, but in Tanzania and Soweto the community definitions of boundaries were different than what appeared on administrative maps. The teams in these sites adopted the community definition of boundaries because these were believed to incorporate both a spatial and a social understanding of the communities that were relevant for the conduct of this trial.

For example, in Soweto, through the dialog that the mapping participants had about community boundaries during the mapping process, the researchers learned a lot about the social cohesion of these communities. If there were no clear landmarks that the mapping participants could use to

bound the communities, the individuals doing the mapping talked about social distinctions between individuals that enabled them to draw boundaries in very densely populated areas. Because the intervention being evaluated in this trial is hypothesized to work through community channels, understanding these social distinctions was critical for conceptualizing how the intervention may take effect in the community.

In Tanzania, the mapping participants never included uninhabited tracks of land in their maps of communities. This is similar to what Dongus et al. (2007) found when they did participatory mapping in Dar es Salaam to identify malaria breeding sites. They found that the mapping participants in Dar es Salaam did not include areas that were not inhabited in their community maps. In their case, it was important for the researchers to include these uninhabited urban spaces, such as industrial areas, in their intervention catchment area, because these areas included malaria breeding sites that were important targets for their intervention. In our case, the uninhabited areas were not included on community maps in Kisarawe, but the investigators used these uninhabited areas as buffer zones between intervention and comparison communities.

Data from the mapping and transect walks also enabled to the teams to identify attributes of the community they anticipated would be related to the study outcome, and thus were important to use for matching. These attributes could not have been derived from publicly available maps or data sources. Other community-randomized trials of HIV prevention have been conducted in Africa to evaluate the efficacy of improving the clinic-based management of sexually transmitted infection (STI) control in Mwanza, Tanzania (Hayes et al. 1995), improved syndromic management of STI (Kamali et al. 2003), and mass presumptive treatment of STIs (Wawer et al. 1998). Two of these three studies employed matched designs. The investigators in these studies used publicly available information such as maps and demographic and health data to match the communities. We were not able to find other examples of community-randomized trials that incorporated community definitions of boundaries and attributes in the research design process.

These data from participatory mapping and transect walks were also used to inform intervention-related decisions in this trial. In Soweto, for example, if the team had remained unaware of how public spaces were perceived and used by community members and tried to implement the mobile testing in these venues, the uptake of services by community members would have been hindered. The maps created by the teams continued to be used throughout the implementation phase of the project in planning fieldwork, reconsidering sites for intervention delivery, and locating households that were sampled for the qualitative cohort.

As one of the earliest forms of data collection for this project in these sites, the exercises also provided the community members with access to the project team, and thus represented an important opportunity for the project team to build community relations and respond to some of the early questions and concerns that were emerging from the community. Failure to foster community relations and obtain community input at this early stage in the research process would likely have led to problems in the implementation phase of the trial (Ziff et al. 2006).

We used a participatory approach to generate information about the social and geographic landscape of our study communities. We acknowledge that the way in which we implemented the participatory mapping process in the project sites did not adhere to some of the core principles of community-based participatory research methods. However, community-based participatory research methods have been used successfully in the past to not only generate local understanding from the perspective of the community, but also as a tool for transformation that can enable communities to address their own problems.

Project-based participatory approaches have been critiqued and described as technical methods of project work rather than a political methodology of empowerment (Hickey and Mohan 2004). In this study, these methods were used in the context of a multisite randomized trial. Although the trial participants clearly wanted to be informed by community perceptions, the ability to change core elements of the research or study design was not permitted.

Some decisions relevant to the trial had been determined prior to the mapping exercises. For example, there was some flexibility in how we defined boundaries of the communities for this trial, but the sites for the trial had already been selected. Similarly, although we wanted community input on where to provide the services in the intervention communities, what services we were going to provide had already been defined. Thus, the process became community informed but not necessarily community driven.

Another limitation of the mapping process that we used is that the teams did not collect geographic distances to correspond to all of the community maps, so it is not possible to assess actual distances between landmarks within and across communities. The transect walks helped the research team gain a better appreciation of distances within and between the communities.

Finally, we cannot assume that the maps created by the groups in each community are representative of the entire community. We asked the leaders to select participants for the mapping exercises and gave them broad guidelines for the type of participants we would like represented in the

groups. We feel the groups were generally representative of key community constituents, but researchers at some sites felt that the groups lacked representation from more marginalized sectors of the community. In future research projects employing participatory mapping exercises, we feel it would be useful to generate maps with a few different groups in the community to compare perspectives on boundaries, landmarks, and other key features of the communities.

Despite these limitations, these participatory methods enabled researchers at each site to develop an understanding of their communities, in terms of both structure and attributes, that could not have been derived from existing data or data collected through standard data collection techniques. Furthermore, the methods communicated an important message to community members that their perspectives and input are valued and necessary for the success of this research study. To our knowledge, this was the first time these methods were applied in the formative phase of a research trial to inform research- and intervention-related decisions.

REFERENCES

Alcorn, J. B. 2000. Keys to unleash mapping's good magic. *PLA Notes* 39 (2): 10–13.

Dongus, S., D. Nyika, K. Kannady, D. Mtasiwa, H. Mshinda, U. Fillinger, A. W. Drescher, M.C.C. Tanner, and G. F. Killeen. 2007. Participatory mapping of target areas to enable operational larval source management to suppress malaria vector mosquitoes in Dar es Salaam, Tanzania. *International Journal of Health Geographics* 6:37.

Dunn, C. E. 2007. Participatory GIS—A people's GIS? *Progress in Human Geography* 31 (5): 616–37.

Fletcher, A. E., M. Donoghue, J. Devavaram, R. D. Thulasiraj, S. Scott, M. Abdalla, A. K. Shanmuham, and P. B. Murugan. 1999. Low uptake of eye services in rural India: A challenge for programs of blindness prevention. *Archives of Ophthalmology* 117:1393–99.

Freedman, L. S., M. Gail, S. B. Green, and D. K. Corle. 1997. The efficiency of the matched-pairs design of the Community Intervention Trial for Smoking Cessation (COMMIT). *Controlled Clinical Trials* 18 (2): 131–39.

Gittelsohn, J., S. B. Harris, S. Whitehead, T.M.S. Wolever, A.J.G. Hanley, and A. Barnie, L. Kakegamic, A. Logan, and B. Zinman. 1995. Developing diabetes interventions in an Ojibwa-Cree community in northern Ontario: Linking qualitative and quantitative data. *Chronic Diseases of Canada* 16 (4): 157–64.

Glantz, N., and B. McMahan. 2007. Formative research and participatory GIS mapping: Elder well-being in Chiapas, Mexico. *Practicing Anthropology* 29 (4): 6–13.

Green, S. B. 1997. The advantages of community-randomized trials for evaluating lifestyle modification. *Controlled Clinical Trials* 18 (6): 506–13.

Hassan, M. M. 2005. Arsenic poisoning in Bangladesh: Spatial mitigation planning with GIS and public participation. *Health Policy* 74 (3): 247–60.

Hayes, R. H., F. Mosha, A. Nicoll, H. Grosskurth, J. Newell, J. Todd, J. Killewo, J. Bugemalila, and D. Mabey. 1995. A community trial of the impact of improved

sexually transmitted disease treatment on the HIV epidemic in rural Tanzania. *AIDS* 9 (8): 919–26.

Hickey, S., and G. Mohan. 2004. *Participation: From tyranny to transformation. Exploring new approaches to participation in development*. New York: Zed.

HIV/AIDS Alliance. 2008. Tools together now! 100 Participatory tools to mobilise communities for HIV/AIDS. http://www.aidsalliance.org. Accessed November 11, 2008.

Kamali, A., M. Quigley, J. Nakiyingi, J. Kinsman, J. Kengeya-Kayondo, R. Gopal, A. Ojwiya, P. Hughes, L. M. Carpenter, and J. Whitworth. 2003. Syndromic management of sexually-transmitted infections and behaviour change interventions on transmission of HIV-1 in rural Uganda: A community randomised trial. *Lancet* 361 (9358): 645–52.

Khumalo-Sakutukwa, G., S. Morin, K. Fritz, E. D. Charlebois, H. VanRooyen, P. Modiba, S. Visrutaratna, B. Singh, M. Sweat, D. Celentano, and T. J. Coates, for the NIMH Project Accept Study Team. 2008. Project Accept (HPTN 043): A community-based intervention to reduce HIV incidence in populations at risk for HIV in sub-Saharan Africa and Thailand. *Journal of Acquired Immune Deficiency Syndromes* 49 (4): 422–31.

Kirsopp-Reed, K. 1994. A review of PRA methods for livestock research and development. *RRA Notes* 20:11–36.

MacQueen, K. M., E. McLellan, D. S. Metzger, S. Kegeles, R. P. Strauss, L. Blanchard, and R. T. Trotter. 2001. What is community? An evidence-based definition for participatory public health. *American Journal of Public Health* 91 (12): 129–38.

Mahiri, I. 1998. Comparing transect walks with experts and local people. *PLA Notes* 31:4–8.

Mascarenhas, J., and P. Kumar. 1991. Participatory mapping and modeling users' notes. *RRA Notes* 12:9–20.

McMahan, B., and B. Burke. 2007. Participatory mapping for community health assessment on the U.S.-Mexico border. *Practicing Anthropology* 29 (4): 34–38.

Motteux, N., T. Binns, E. Nel, and K. Rowntree. 1999. Empowerment for development: Taking participatory appraisal further in rural South Africa. *Development in Practice* 9 (3): 261–67.

Power, R., L. Langhaug, and F. Cowan. 2008. "But there are snakes in the wood": Risk mapping as an outcome measure in evaluating complex interventions. *Sexually Transmitted Infections* 83 (3): 232–36.

Rambaldi, G., P.A.K. Kyem, M. McCall, and D. Weiner. 2006. Participatory spatial information management and communication in developing countries. *Electronic Journal on Information Systems in Developing Countries* 25 (1): 1–9.

Rutta, E., H. Williams, A. Mwansasu, F. Mung'ong'o, H. Burke, R. Gongo, R. Veneranda, and M. Qassim. 2005. Refugee perceptions of the quality of healthcare: findings from a participatory assessment in Ngara, Tanzania. *Disasters* 29 (4): 291–309.

Shaffer, C., and A. K. Amundsen. 1993. *Creating community anywhere: Finding support and connection in a fragmented world*. New York: Putnam.

Smith, P. G., and R.H.J. Morrow. 1996. *Methods for field trials of interventions in developing countries: A toolbox*. London: Macmillan Education.

Steen, R., B. Vuylsteke, T. DeCoito, S. Ralepeli, G. Gehler, J. Conley, L. Bruckers, G. Dallabeta, and R. Ballard. 2000. Evidence of declining STD prevalence in a South African mining community following a core-group intervention. *Sexually Transmitted Diseases* 27 (1): 1–8.

Todd, J., L. Carpenter, X. Li, J. Nakinyingi, R. Gray, and R. Hayes. 2003. The effect of alternative study designs on the power of community-randomized trials: Evidence from three studies of human immunodeficiency virus prevention in East Africa. *International Journal of Epidemiology* 32 (5): 755–62.

Vabi, M. 1996. Knowledge about the uses of trees through participatory rural appraisal methods: Examples from Cameroon and the Central African Republic. *Rural Development Forestry Network Paper* 19e (30): 36.

Wawer, M., R. Gray, N. Sewankambo, D. Serwadda, L. Paxton, S. Berkley, D. McNairn, F. Wabwire-Mangen, C. Li, F. Nalugoda, N. Kiwanuka, T. Lutalo, R. Brookmeyer, R. Kelly, and T. C. Quinn. 1998. A randomized, community trial of intensive sexually transmitted disease control for AIDS prevention in Rakai, Uganda. *BMJ* 12:1211–25.

Young, D. R., C. C. Johnson, A. Steckler, J. Gittelsohn, R. P. Saunders, B. I. Saksvig, K. M. Ribsl, L. A. Lytle, and T. L. McKenzie. 2006. Data to action: Using formative research to develop intervention programs to increase physical activity in adolescent girls. *Health Education and Behavior* 33 (1): 97–111.

Ziff, M., G. W. Harper, K. S. Chutuape, B. G. Deeds, D. Futterman, V. T. Fancisco, L. R. Muenz, J. M. Ellen, and Adolescent Medicine Trials Network for HIV/AIDS Intervention. 2006. Laying the foundation for connect to protect: A multi-site community mobilization intervention to reduce HIV/AIDS incidence and prevalence among urban youth. *Journal of Urban Health* 83 (3): 506–22.

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