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PSI Research & Metrics Toolkit
Building Research Capacity

MAP FOR ACCESS STUDIES:

DESIGN, IMPLEMENTATION AND UTILIZATION

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Bottom Line Health Impact * Private Sector Speed and Efficiency * Decentralization, Innovation, and Entrepreneurship * Long-term Commitment to the People We Serve

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MAP for Access Studies: Design, Implementation and Utilization

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LEARNING OBJECTIVES

By the end of this chapter, the reader will be able to:

- Describe the objectives and characteristics of Measuring Access for Performance (MAP) for access surveys.
- Understand the advantages and limitations of access surveys.
- Design and implement an access survey and prepare data collection instruments.
- Prepare data for analysis, as well as analyze, report and interpret data.

BACKGROUND

This R&M Toolkit chapter provides guidance to researchers who wish to implement a MAP for Access study. It covers topics such as study design, sampling, data collection, analysis and reporting.

Before reading this toolkit, researchers should be familiar with the *MAP for Coverage Studies* toolkit, referred to as the Coverage toolkit in this document. The general background and introductory text are the same as in this preceding chapter so this section is not repeated here.

Briefly, there are four types of MAP studies (previously known as "phases" of Project MAP):

- **MAP for coverage and quality of coverage** (formerly known as MAP phase I) – This type of study aims to measure the geographic coverage of PSI products and/or services as well as the quality of the distribution network, measured by Lot Quality Assurance Sampling (LQAS) methods
- **MAP for access** (formerly MAP phase II) – This study measures the level of accessibility and equity of access to PSI products and/or services, using geographic information systems (GIS)
- **Combined TRaC & MAP study** (formerly MAP phase III) –This study uses objectively defined measures of access to predict product and/or service use, correlating availability and behavior
- **GIS applications for project planning and monitoring** – These MAP applications encompass the routine use of maps and geographic information systems to support decision making about PSI's social marketing interventions.

See also Appendix 1 of the Coverage toolkit for general information on the MAP methods and applications used in the different types of MAP studies. This information may be useful when presenting the tool to a colleague, donor or other partner.

Overview of MAP for Access Studies

MAP for Access studies integrate a geographic approach to product and service delivery system monitoring and take into account the concepts of need and target population distribution. In this sense, access studies can be seen as an extension of coverage studies. Surveys on coverage and quality of coverage answer questions related to how widely a given product or service is available, and how the product or service is made available to consumers. Surveys on access go one step further by answering whether a given product or service is available close to the target population groups: are we reaching the population segments among which need for the product or service is highest?

Even so, MAP for Access surveys are very similar to MAP for Coverage surveys, as they are usually based on the same sampling and auditing methods and they partially measure the same indicators. Typically, both MAP for Access and MAP for Coverage studies assess coverage, quality of coverage and outlet penetration. In addition to these indicators, access studies estimate the level of access that people have to a product or service. Such information is essential for understanding whether the social marketing program is appropriately reaching its target population groups.

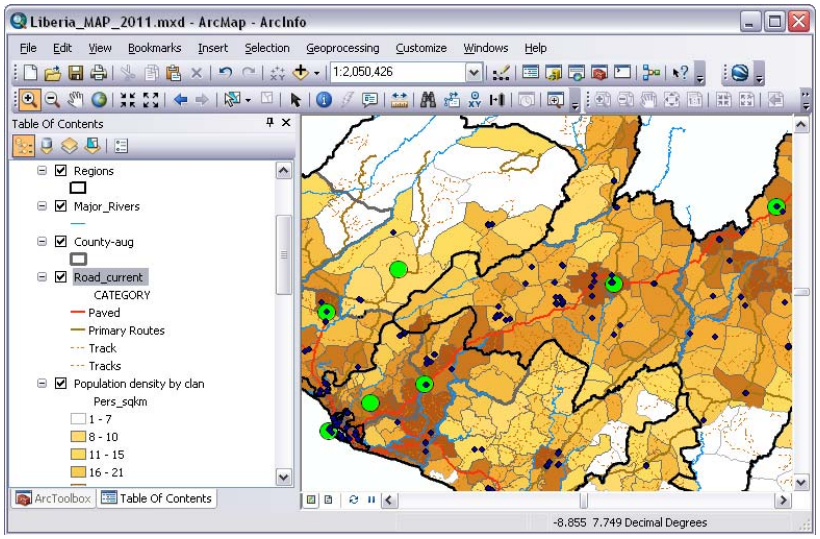
The main difference between Coverage and Access studies resides in the analysis methods: Access studies usually rely on spatial analysis techniques in a geographic information system (GIS) to identify areas with poor access among a given population segment. In terms of data collection, access studies go further than coverage studies by requiring that all sites – hotspots, outlets, villages and clinics – are georeferenced. Georeferencing sites means that their geographic coordinates are retrieved in order to integrate data into a GIS for mapping and analysis purposes. Coordinates are recorded with Global Positioning System (GPS) units, which provide the latitude and longitude values of any site on the globe. MAP for Access studies use GIS as the primary tool of analysis. GIS can estimate the proportion of a given population group that are situated within a specified distance from a product or service delivery point. They can also combine survey data with other geographic datasets.

Geographic Information Systems

The use of GIS is key to the successful implementation of an access study. On the simplest level, GIS are computer-based applications that are capable of capturing, storing, displaying, analyzing, and reporting spatial data. However, implementing GIS involves many things. In this broader view, GIS are a combination of hardware (computer equipment, printer, GPS and other data collection tools), software (GIS applications, database software), procedures (data processing, analysis), and people (surveyors, GIS technicians, decision-makers). By combining layers of spatial information and related attributes, a GIS can detect and display particular distribution patterns or identify specific sites based on their location and on other user-defined criteria. Figure 1 below shows a screen shot of a GIS software displaying regional and county boundaries, major rivers, road systems and population densities. GIS technology is applied to a wide range of domains, and is becoming common practice within the areas of public health and human services.

Many PSI platforms have been increasing their use of GIS mapping for routine project planning, monitoring and reporting. Indeed, the introduction of GIS as a routine management tool, alongside traditional monitoring and evaluation (M&E) tools, strengthens Management Information Systems (MIS), increases data use, improves targeting and planning, and results in cost savings.

Figure One: Combining and Viewing Geographic Information in GIS software (ArcGIS)

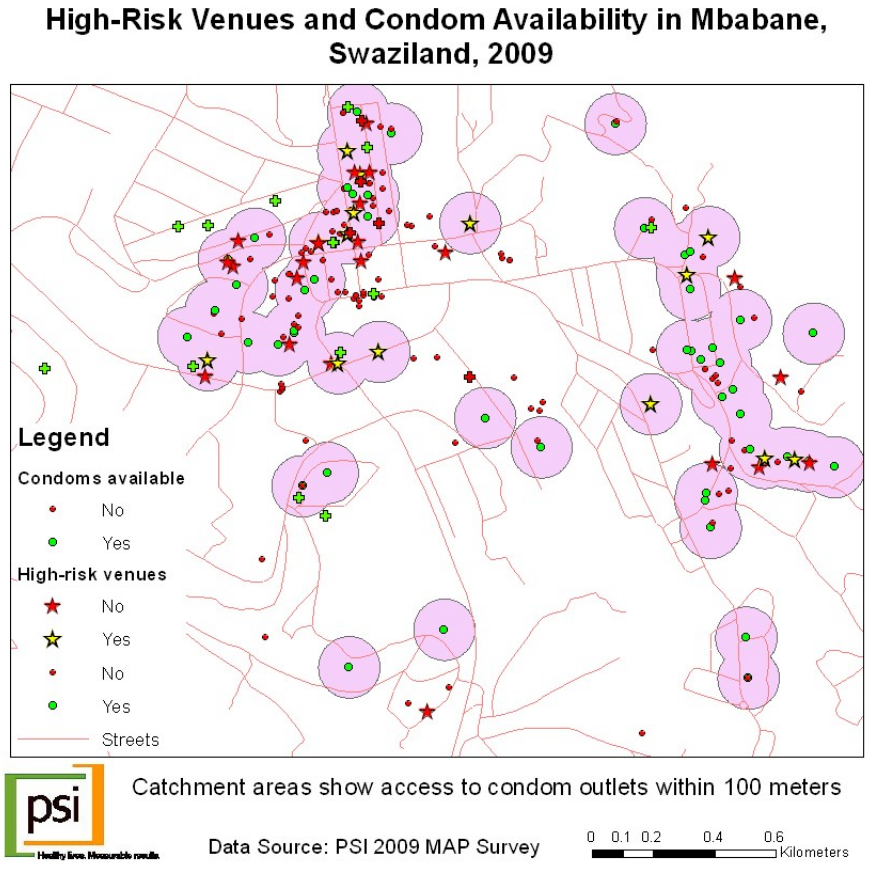


OUTPUTS OF A MAP FOR ACCESS STUDY

The primary output of a typical MAP for Access survey is a standard summary report that includes tables on product accessibility and other availability measures such as coverage, quality of coverage, and outlet penetration rates. Additional tables with findings related to consumer price levels, intention to sell, reasons for not selling a product, frequency of sales/supervision visits, and other variables may be produced, as recommended in the Coverage toolkit.

Maps are also outputs of MAP for access studies that can be used as planning and decision-making tools by program managers and field staff who conduct sales and distribution, service provision, or communication activities. Thus, it is often useful to include a number of maps in a study report. An example of a typical hotzone map with target audience sites and access to condoms is shown below (Fig. 2)

Figure Two: Example of a Map Showing Access to Condoms in a High-Risk Area



HOW TO DESIGN AND IMPLEMENT AN ACCESS STUDY

This section describes the steps to follow when designing and implementing an access study. Since the majority of access studies also measure the coverage and quality of coverage indicators, the reader should refer to the Coverage toolkit for general guidance on how to define minimum standards and supervision areas, on sampling, and on benchmarking. The same steps are followed here. This toolkit reviews in detail those aspects that are specific to access studies.

IMPLEMENTATION STEPS FOR A MAP FOR ACCESS STUDY

Step One	Define MAP Study Objectives
Step Two	Define the Unit of Analysis and Minimum Standards for Access
Step Three	Define Appropriate Stratification
Step Four	Benchmarking (for equity of access, if relevant)
Step Five	Create the Sampling Frame
Step Six	Determine the Sampling Procedure
Step Seven	Design the Audit Sheet
Step Eight	Define Data Collection Procedures
Step Nine	Establish Timeline and Budget
Step Ten	Set Up GIS
Step Eleven	Pilot Test the Audit Sheet and Data Collection Procedures
Step Twelve	Train Researchers, Interviewers and Supervisors
Step Thirteen	Conduct Auditing during Data Collection
Step Fourteen	Analyze Data
Step Fifteen	Hold DDM and Report on Findings

STEP 1: DEFINING MAP STUDY OBJECTIVES

When creating the study design for a MAP study (either for coverage or access surveys), the standard study design template should be used. It is important to clearly describe the objectives of the study, and to understand how these affect sampling, data requirements, data collection procedures, data management and analysis.

The primary objective of a MAP survey is always to monitor the availability of one or more products/services within a given intervention area. Most access studies will have the following specific objectives:

- Monitor the geographic coverage of products or services
- Monitor the quality of coverage of products or services
- Monitor the penetration rate at the outlet or facility level
- Monitor the level of access to products or services among the target group of interest

In studies involving more than one target population group, equity of access may also be examined.

The first three objectives are explained in the preceding toolkit chapter; access and equity of access are defined in the next step.

STEP 2: DEFINING THE UNIT OF ANALYSIS AND MINIMUM STANDARDS FOR ACCESS

Unit of Analysis and Sampling Unit

MAP for Access studies do not use geographic area as the unit of analysis, which is used in Coverage studies. Because the access indicator is always defined as the proportion of a given population segment that is "close" to a product or service provider, the unit of analysis for access studies is the target population. So, in order to evaluate access and equity of access, it is necessary to have data on the size of each population group. Obtaining this data requires either a census of outlets and target audience sites within the sampled areas, or a good population distribution dataset from secondary sources (e.g. latest demographic census).

In the case of a census of most at-risk populations (MARPs), researchers must estimate target population sizes for each site. To do so easily, it is recommended to select small rather than large areas as the geographic reference unit. Because it is generally not possible to cover an entire program intervention area with this census, researchers should at least sample geographic areas in which the study will be conducted. These geographic areas are the primary sampling unit, which needs to be well defined.

When defining the sampling unit for an access study, remember the following:

- **The geographic area used as the sampling unit is usually the "hotzone."** Because the majority of access studies investigate population groups at high risk of HIV infection (such as female sex workers (FSWs)), the hotzone is used as the sampling unit. A hotzone is an area where there is a concentration of sites where high-risk groups live, work, entertain or engage in high risk activity. These sites are called "hotspots." These hotzones includes streets where sex workers are stationed, a truck stop, or a collection of bars in a neighborhood where members of the high-risk groups meet. They often correspond to priority intervention areas for projects involving MARPs and other highly localized target groups.

- **It is important to establish a general definition of what is meant by a hotzone before data collection begins.** This definition will vary from one country to another. Then, the field teams will define the precise hotzone boundaries on the ground at the start of data collection. See Appendix 1 for several examples of how previous MAP surveys defined HIV high-risk areas.

- **Surveys on access to services generally require larger areas such as districts, communities or towns.** See the following section on minimum standards as well as the Coverage toolkit for more details on how to choose the type of geographic area and decide on an appropriate size.

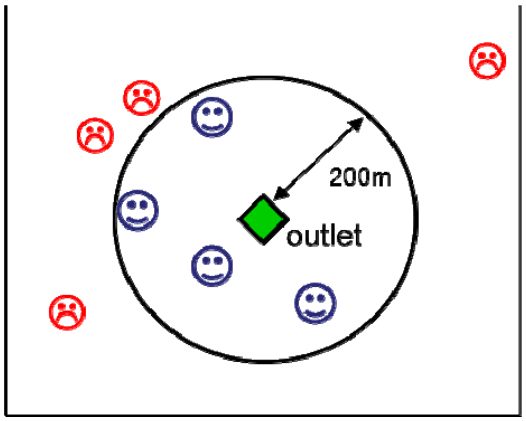
Indicator Definitions and Minimum Standards

Access

Access is an indicator that measures the availability of a PSI product or service in relation to target population distribution. It is defined as the *proportion of a population segment* in a geographically defined residential area or hotzone that is *within the catchment area of a product or service delivery point*. As the catchment area is defined in terms of time or geographic distance, this distance can be considered the minimum standard for access. Note that the underlying assumption for using access as an availability indicator is that those people or communities who live/work/meet/entertain within the catchment area of a product or service provider are more likely to use the product or service than those who are too far away.

A typical result of an access study would be phrased as follows: "Access to condoms among female sex workers is 72%: nearly three quarters of FSWs in the study area work or are based in venues that are within 200m of a condom outlet." In the schematic representation below (Fig. 3), the minimum standard of access is defined as venues that are within 200m of a condom outlet. The 72% from the result statement above would be those FSWs situated in the blue happy faces that represent venues with access. So, the FSWs in these venues are within the outlet catchment area. Alternatively, those venues represented by the red unhappy are considered too far away from the nearest condom outlets. Thus, these FSWs in these venues don't have access.

Figure Three: Access to a Product or Service Delivery Point



When defining access, remember the following:

- **The size of the catchment area is decided by the social marketers**. When possible, the size should reflect existing marketing objectives, in the same way that the product and marketing objectives help define the geographic unit of analysis and minimum standards of availability in coverage studies. However, marketers do not always set clear objectives in terms of proximity of outlets for specific target groups. Therefore, researchers should discuss the appropriate minimum standards for accessibility with relevant program staff.

- **TRaC study findings or qualitative research findings on purchase behavior, if available, should be used to determine appropriate access standards**. A "willingness to walk" measure ("How far are you prepared to walk/travel to purchase product X or to access service Y?") provides valuable insights into realistic minimum standards for access.

- **It is possible to use time distance as an expression of access, but it will need to be converted to its equivalent in geographic distance during analysis.** An example of time distance is "a five minute walk to nearest condom outlet." An example of an equivalent in geographic distance is the distance covered by a person traveling "at average walking speed." See the analysis section of this toolkit for more information on this conversion.

Typical Examples of Access Standards:

- *Access to condom among MARPs:* 100 to 250 meters
- *Access to WaterGuard and other "fast-moving consumer goods" used by the general population:* 500 meters to 1 kilometer
- *Access to antimalarials, hormonal contraceptives, and other pharmaceutical products:* Between 1 and 5 kilometers
- *Access to HIV counseling and testing services, family planning and other service providers:* 5 to 10 kilometers

Note that the above examples are largely based on "expert opinion" rather than factual data. However, anecdotal evidence and certain studies (e.g. Grossman, 1986) suggest that our common practices are in line with true catchment areas and consumer behavior.

- **Different access standards may be used for urban and rural areas**. Since people generally travel greater distances in rural areas to purchase products or to access a given service, the standards will differ from those of urban areas. HIV Counseling and Testing (HCT) sites, for example, may have a catchment area of a few kilometers in large urban areas, mainly serving people from within the city. HCT sites in more rural areas may cover a much larger region, where the site "attracts" clients from further afield, perhaps up to 30 kilometers away.

- **Quality standards such as outlet operating hours or absence of regular stock-outs of the product of interest may be incorporated into the access definition.** For example, access could be defined as the proportion of people in entertainment venues who are within 200 meters of a condom outlet that is open until at least 10pm, and that does not report regular stock-outs of condoms.

- **Analysis differs for general population groups.** As mentioned earlier, the access indicator is particularly suitable for studies on the availability of products or services among specific high-risk groups that congregate in well-defined areas, such as hotzones. In a GIS, it is usually more difficult to apply a catchment area to products that relate to general, residential population groups (e.g. youth, women of reproductive age, children under 5, etc.) because the analysis would require the precise location of every household in the study area. This is the case especially when evaluating access to products or services with a relatively small catchment area (less than 1km).

- **Analysis can be more challenging for products or services with a larger catchment area**. For certain products or services, such as Long-Lasting Insecticidal Nets (LLINs) or HCT, it sometimes is possible to use detailed population data from the

census (by enumeration area or by village) in order to estimate the proportion of the population that resides within the catchment area. This detailed population data is often not available, however. In addition, knowing all the locations of the product or service delivery points in the study area can be another constraint. Just as it is necessary to carry out a census of hotspots and of outlets when working in hotzones, researchers would need to do a census of all product or service delivery points. For example, when estimating access to a social franchise network of family planning service providers, one needs to conduct a census of all facilities under the network within the country, or in a representative number of districts or regions at a minimum. On the other hand, platforms that have a well-developed, up-to-date and georeferenced MIS with service provider data, and where detailed population distribution maps are available, can calculate access with just these two pieces of information, without conducting a specific field survey.

- **Access definitions are simplified.** All of the above catchment area examples are simplified representations of the true catchment area of an outlet or service provider. In the real world, the size and shape varies from one outlet to another depending on how "popular" an outlet is and on factors such as outlet densities and road infrastructure. Moreover, a catchment area's shape is rarely a circle; road access, physical barriers, and administrative and cultural boundaries are all likely to influence an outlet's true catchment area.

  It is important to keep in mind that we usually measure access based on a straight line distance, rather than actual distance along roads or paths. A given access definition can thus be seen as being little precise and corresponding to realities on the ground, but because more precise access measurements are more complex to calculate and because we can apply the same minimum standard for access throughout multiple rounds and different studies, we do not usually perform sophisticated "network" analysis to estimate precise access times and distances. Indeed, professional GIS software such as ArcGIS can calculate distances along road networks and travel time, as well as incorporate physical barriers and other important factors when determining access to a health product or service provider. Such an analysis is however more complex and relies on accurate and comprehensive road network datasets. For more information on determining access to health services in general, see Rosero-Bixby (2004) and Noor et al. (2006).

  Because of these realities, it is necessary to simplify our access standards so they can be applied throughout the analysis. This simplification also avoids the need for highly sophisticated spatial analysis techniques (and much more detailed data than we currently collect).

  Even so, it can happen that it is not possible to record the precise location of outlets and target groups (usually because no GPS units are available or because detailed population datasets are unavailable). In this case, a simplified definition of access can be used, under which access is defined as *the proportion of a population segment that lives in geographically defined areas or hotzones where the product or service is available*. In other words, it is the proportion of people who live in areas where there is coverage (see Fig. 4). In the Coverage column of this table, 1 indicates that the area was covered according to minimum standards, while 0 stands for "not covered".

Figure Four: Example of a Table Used to Calculate Simplified Access Rates

Province	Area	Estimated Population	Condom Coverage	Population with Access
Nord-Kivu	Bishange	6278	0	0
Nord-Kivu	Buroha	2495	0	0
Nord-Kivu	Bweremana	5074	1	5074
Nord-Kivu	Karuba	1666	0	0
Nord-Kivu	Kibututu	3760	1	3760
Nord-Kivu	Kirotshe	2515	1	2515
Nord-Kivu	Mapendo	6327	1	6327
Nord-Kivu	Mitumbala	1609	0	0
Nord-Kivu	Rubare	2932	1	2932
Nord-Kivu	Rubaya	3609	1	3609
Nord-Kivu	Rugari	8585	0	0
Nord-Kivu	Rutshuru	11565	1	11565
Nord-Kivu	Sake	6523	1	6523
Nord-Kivu	Umoja	1605	1	1605
Total		**64543**		**43910**
Access Rate = # with Access/Estimated Population = 43910/64543				**68%**

When calculating this "simplified" access rate, the underlying assumption is that all individuals who live in the community are considered having physical access to the provider. Note that this method results in realistic access estimates only if the size of the geographic unit of analysis (for which population data are available) roughly corresponds to the size of the catchment area of the product or service. In such studies, access rates are generally similar to average coverage measures, though the simplified access definition will adjust for variations in population size of the sampled areas.

This approach mainly applies to studies on access to products or services that relate the general population or to population segments that are not highly concentrated in geographic locations (e.g. malaria risk strata).

Equity of Access

Equity of access is defined as equal levels of access to product or service delivery points at the minimum access standard among population segments with equal levels of need, risk or demand. Inequity of access, then, is when population segments do not have equal levels of access.

PSI measures the extent of inequity of access as the difference in access between the population with the highest level of access and other populations with similar levels of need. For example, among high-risk populations for HIV/AIDS, access to condoms among FSWs, men who have sex with men (MSM) and truck drivers may be 75%, 68%, and 57%, respectively. In this case, female sex workers have the highest access level. But there is inequity of access

when FSWs' access is compared with the access of other target groups: MSM access is 7 percentage points less and truck drivers is 18 percentage points less.

When defining equity of access, remember the following:

- **There is no unique cut-off point to decide on whether there is equity of access or not**. However, equity of access can be simply defined as a difference of less than 5 percentage points in access rates of individual target groups.

- **Equity of access can only be calculated if sufficient information about the various target groups is collected**. In addition to knowing whether a given target group is present, it is essential to know the approximate size of this group. Such information can be difficult and time-consuming to obtain. For these reasons, many MAP for Access studies have not reported equity of access.

STEP 3: DEFINE APPROPRIATE STRATIFICATION

MAP for Access studies also stratify data into supervision areas, as in coverage studies. It should be noted, however, that many access studies do not include multiple supervision areas. Often, access is measured in a sample of 19 hotzones nationwide as an additional component to the coverage survey (which is generally conducted in multiple supervision areas). The number 19 is derived from the LQAS method. In such cases, there are two distinct components to the study: 1) product or service availability in general areas of the country, stratified by administrative division (region, province, district etc.); and 2) access to products or services in specific high-risk areas (without any stratification levels).

Stratifying according to the type of area or to the level of risk may be more relevant than to stratify simply by region. Some studies – specifically those with a focus on equity of access – will measure access separately in two or more categories of hotzones. For example, researchers will measure access in hotzones where FSWs and their clients are present, and in hotzones where a majority of venues are mainly attended by an MSM audience. There is of course often a certain degree of overlap between target audience distributions, so some hotzones may contain more than one population segment. Another stratification option is to stratify risk areas into different categories of risk (e.g. low/medium/high risk) or according to their size (e.g. small/medium/large).

STEP 4: BENCHMARKING

Benchmarking is used primarily for analyzing coverage and quality of coverage when LQAS is used. It can also be used for analyzing equity of access. Benchmarks are the values that define whether the coverage or quality of coverage results for a given supervision area are acceptable or not. To a certain extent, the same may be applied to the equity of access indicator. To do so, researchers must define the minimum standard for equity of access prior to the analysis stage. In other words, they must determine what level of difference between the access values for each population group is acceptable for there to be equity of access (e.g. 5%). See also Step 2 above on setting minimum standards. This benchmarking step is only applicable when it is possible to calculate access levels for more than one individual target group; it has not been done systematically in the past.

STEP 5: CREATING THE SAMPLING FRAME

As in coverage studies, access studies require a complete and accurate list of geographic units in order to select the study sites. Readers should refer to the Coverage toolkit for general information on the sampling frame.

For access studies in particular, the geographic sampling units will be the so-called hotzones in most cases, as opposed to census enumeration areas or villages. Comprehensive lists of such high-risk areas are generally not readily available. As a result, researchers need to create a sampling frame, which is a list of all known hotzones from which a random sample will be drawn. It is often possible to combine information from the Behavior Change Communication (BCC) and sales departments, from previous MAP surveys (if any were conducted) and from external sources such as other NGOs that work in the same target population sites. PSI field staff such as sales representatives and peer educators often have very good knowledge of where these target areas are precisely located.

The list of target areas should be as precise as possible, and each hotzone should be labeled with a name and location information so that it can be easily identified.

STEP 6: SAMPLING

Sampling in access studies follows the same procedure as in coverage studies (see the Coverage toolkit for more information). We recommend the use of LQAS when the number of geographic units is greater than 25-30 or so, drawing a sample of 19 areas or zones in which an audit will take place. When the number is lower, then we usually conduct a census of all hotzones.

Access studies can also use purposive sampling with hotzones selected based on their programmatic importance. In such cases, no random sampling is done: areas are selected through discussions with the programmers, based on their relative importance or on how representative they are thought to be.

If a census is used, sampling is not needed. Instead, all product or service providers and all target audience sites in the study area are audited.

STEP 7: DESIGNING THE AUDIT SHEET

The audit sheet for an access study is very similar to the questionnaire used for coverage studies. However, two important additional categories of variables need to be collected:

1) **Geographic coordinates of each outlet and each target population site.** These coordinates are defined by the location's latitude and longitude, which allow for accurate mapping of each location in a GIS. Data collectors record these with GPS devices or with GPS-enabled Personal Digital Assistants (PDAs) – see the next step for information on recording format and procedures. In addition to the coordinates, the audit form should also include clear identification information for each site. Typically, this identifying data includes the name and/or code of the administrative area (region/province/district), the municipality or village, the neighborhood or hotzone, and the street address, if relevant.

2) **Type and size of target group.** This information is key for calculating access since access levels cannot be determined without information on the number of people that work/meet/entertain/reside in each of the sites. Usually the target group refers to the hotspot audience, such as the approximate daily number of clients in a bar, the number of FSWs in a brothel, the number of MSM in a night club, etc. Collect audience data only in the target audience sites, not in the outlets or service providers.

While it is usually not feasible to accurately determine the number of members of the target group of interest because of time/funding constraints, it is generally possible to obtain an estimate on the number of clients/workers/residents from a key informant such as the bartender, night club manager, or another person who is familiar with the venue. Because client numbers at these venues may vary from day to day (e.g. weekend vs. day in the week) as well as throughout the month or season, it is recommended that any questions on the target group size be formulated in a way so that the data can be compared for all sites. An example of a good question on target group size is: “On an average Friday or Saturday evening or night, how many clients come to this venue?”

Note that this information on population size does not need to be collected in access studies among the general population when detailed georeferenced population datasets exist (e.g. population by census enumeration area, number of residents per village).

STEP 8: DEFINING DATA COLLECTION PROCEDURES

The data collection process is the same in access studies as in coverage studies, although access studies use GPS units to record the coordinates of each outlet and/or hotspot. These geographic coordinates must be recorded in the standard WGS84 format, using decimal degrees as the unit of measurement (noted as “hddd.ddddd” in the GPS settings menu). Specify these parameters when setting up the GPS units for the first time. For example, the coordinates of an outlet may read as follows on the GPS, where N stands for “North [of the Equator]” (= latitude) and E for “East [of the Greenwich Meridian]” (= Longitude):

N 46.18146°
E 005.91526°

In the field, surveyors will collect data on the types and size of target population groups, such as the approximate number of sex workers that are usually present in a hotspot during the evening. Other information, such as the estimated distance of villages to the nearest road or the opening times of outlets, may also be collected.

As mentioned earlier, access data collection on access indicators always involves a census of all outlets and of all target audience sites within the selected geographic areas. The only exception is for studies on access to products or services that have a large catchment area. In these studies, it should be possible to use existing census and SES data, provided they are detailed enough and can be integrated into the GIS. In those cases, there is no need to collect population size data.

As with all MAP studies, verbal consent should be sought from all respondents before beginning the data collection process. Depending on local norms for research studies and the sensitivity of the target group or area in which the study is conducted, researchers may need to obtain written consent using informed consent forms.

STEP 9: ESTABLISHING A TIMELINE AND BUDGET

When planning for a first MAP for Access study, programmers need to factor GIS set-up into the timeline and budget. See the next step for more information on the activities and technology involved in GIS set-up.

The cost of installing a geographic information system, which includes the software, capacity building and a technical assistance visit by PSI's geographer, is approximately $8,000 - $10,000. Alternatively, platform staff with a GIS background and basic knowledge of access studies or experienced local consultants may be able to assist with this process.

Equipment costs are another significant portion of the budget. GPS units cost approximately $110 each, and each team of interviewers needs one unit in the field. Despite high installation costs, PDAs are a cost-effective alternative for paper questionnaires and traditional GPS units. Several PDA models and many smartphones have an integrated GPS receiver or can handle an external GPS extension. Please refer to the PSI Research Toolkit chapter on PDAs (Piot et al. 2006) for more information on the set-up process and costs for implementing GPS on PDAs. Besides these GPS units, a computer and a printer (preferably color), no other equipment is required to set up a GIS.

The timeline to implement an access study is similar to that of a coverage study. For platforms that are conducting an access study for the first time, it is recommended that the PSI geographer does a technical assistance visit during the study design phase. He will help set up the GIS, collect and organize basic geographic information, and build capacity among researchers. This visit may be combined with a broader GIS scope of work, so the platform can broaden its GIS capacity further. Training on data collection methods, in particular on the use of GPS units, is also included. Depending on the program's need for further capacity building or for assistance in analyzing data, a short follow-up visit several months later can be organized.

In addition, it can take time to procure the technology needed for the GIS. GPS units need to be ordered well in advance of when surveyors will be trained on data collection procedures. Purchasing GPS units may take several weeks. Before purchasing this equipment from the US or elsewhere, programmers should inquire about any regulations on the use of these devices that may exist in the country. If ArcGIS will be used as the GIS software, note that the procurement process can take up to 6 weeks from initial order to final delivery of the software.

STEP 10: SETTING UP THE GIS

To set up the GIS, programmers need to procure GPS units and the appropriate software tool, and research teams need to be trained on how to use this technology. Building this capacity can take time, especially in a platform that is new to GIS and mapping.

As part of set-up, PSI platform teams need to decide which software to use as well as identify digital maps and reference datasets that are required to take full advantage of the mapping and analysis opportunities offered by GIS.

Choosing Software

During the Project MAP pilot phase, PSI Research & Metrics (R&M) worked to develop, install and evaluate the cost-effectiveness of HealthMapper. This software is a simple customized GIS application for public health mapping developed by the World Health Organization for purposes of measuring access and equity of access (Chapman et al. 2005). PSI and WHO have established a partnership agreement that outlines data sharing and capacity building rights and responsibilities, and gives PSI access to the WHO HealthMapper.

HealthMapper is currently still in use in several PSI platforms. However, since 2010, R&M has promoted more advanced GIS software: ESRI ArcGIS Desktop, which previously was only available under expensive licensing fees. Through ESRI's non-profit scheme, PSI only pays about $100 per annual license for the full software package, including advanced mapping and analysis extensions.[1]

Identifying Digital Maps and Reference Datasets

Any GIS relies on a series of digital maps (often called "GIS layers") and on various reference datasets (the "attribute data") such as demographic, socio-economic or public health data. Digital maps include the boundaries of administrative divisions (e.g. regions, provinces, districts, census enumeration areas), the location of settlements and of health infrastructure (e.g. health centers, clinics, pharmacies), the country's road network, and environmental information such as rivers, lakes, altitude and land cover. Other reference information includes population census data or detailed population estimates, relevant public health indicators such as HIV prevalence rates by risk group or malaria incidence data, and information on the socio-economic status of populations. It should be noted that the quality and level of detail of these datasets varies tremendously among countries, resulting in different levels of potential GIS applications. For example, if no digital maps of census enumeration areas exist, it will not be possible to generate maps showing availability data at this specific geographic level or to use the variable "population by enumeration area" to estimate access to a given product or service.

Over the past few years, R&M has gradually built up a fairly comprehensive library of digital map datasets. These have to be updated on a regular basis, since administrative boundaries may change, new information may become available (e.g. population census), or because existing basemaps may be improved (e.g. road network). As such, it is always recommended to find out whether any updates are available from local GIS resources and other GIS users in the country or in the region. These resources may include government agencies (survey department, national geographic institute, ministry of health), UN agencies or non-governmental organizations. Where limited public domain GIS resources exist, it might be necessary to purchase digital maps from private companies, though these are

[1] Another reason for phasing out HealthMapper and replacing it with ArcGIS is that the former does not have well-developed analysis functions (and only contains basic layout features. Moreover, the software hasn't been updated in several years. Note that HealthMapper is sufficient for access analysis.

often very expensive. Fortunately, the need for purchasing maps is diminishing, due to the increased availability of base maps on the Internet.

These GIS resources should ideally be obtained in an ArcGIS-compatible file format (usually shapefiles) and any existing meta-data about each layer should also be collected. The meta-data describe the contents, accuracy, source, structure, geographic reference system (projection) and any other relevant issues about the datasets.

STEP 11: PRETESTING THE AUDIT SHEET AND DATA COLLECTION PROCEDURES THROUGH A PILOT TEST

Follow the standard pilot procedures that are explained in the Coverage toolkit. In addition, be sure to check the settings of all GPS units prior to sending out teams to the field, and make sure that the devices have full batteries. The units in which geographic coordinates are recorded should always be set to decimal degrees (see Step 8).

STEP 12: TRAINING RESEARCHERS, INTERVIEWERS AND SUPERVISORS

Again, training for access studies resembles the training used for coverage studies. The main difference is that researchers also need to know how to use the GIS software and how to operate GPS units. Certainly, they need to know how to collect spatial data. They also need to know how to use the mapping software for integrating layers with product/service and target audience site information. By doing so, they can analyze the layers and produce the access indicators and various map outputs. Interviewers and supervisors also need to know how to use GPS devices.

ArcGIS trainings typically require five days, after which participants are expected to be able to operate the software on their own: display geographic information, import attribute data, analyze access, generate maps and create GIS outputs (maps, charts, data reports). Ideally, three to five staff receive this training – primarily researchers, but also MIS managers or monitoring and evaluation staff in programs that wish to apply GIS beyond simple access analysis for MAP studies. R&M also organizes regional GIS training workshops, with a standard 5-day curriculum. It is important that trainees have adequate computer literacy before this training and that they will be able to practice their new skills with ArcGIS soon after the training.

Training field workers on how to use the GPS devices only takes about an hour. They need to be taught how to retrieve the latitude and longitude coordinates of outlets and/or hotspots. A short GPS manual exists for the standard model that PSI uses in most platforms, the *Garmin eTrex* device (see image under Step 8). Most devices also come with a short user manual.

In addition to training data collectors on the technology, they need to be familiar with the concepts of hotspot, hotzone and target audience. This knowledge will help them identify target audience sites and estimate target audience size, if needed.

STEP 13: AUDITING DURING DATA COLLECTION

Auditing is the process of verifying whether an outlet or a service provider meets the required minimum standards of availability and quality. The process is the same used in coverage

studies, though access studies record the coordinates of each outlet and/or hotspot with a GPS unit. Also, information on the population segment of interest is collected.

See the Coverage toolkit for detailed guidance on this step.

STEP 14: ANALYZING DATA

The analysis of access data is mostly done in the GIS. There are several steps in this process:

Step 1: Import attribute data on target audience sites (including the number of people in each site). Based on the latitude and longitude values, each site will be displayed in the GIS, along with its attributes on the type and size of the target population. In the example in Figure 5 below, the first meeting venue, Rochets Road House, is located at -27.315094° latitude and 31.888999° longitude. It is a restaurant that is located in Emadladleni community in Shiselweni region. Additional variables on condom availability, target audience presence, quality standards, etc. are included in subsequent columns not shown in this example.

Note that dBase (.dbf) and Excel files (.xls or .xlsx) are the two main table file formats that can be read by GIS software. If your original data is in SPSS, then the relevant variables first need to be exported to either dBase or Excel.

Figure Five: Example of an Attributes Table for a Dataset on High-Risk Venues, as Seen in ArcGIS (Note: not all fields are shown.)

Table

High-risk venues

Shape *	OBJECTID	Q1NAME	Q4TYPE	CATEGORY	LAT	LONG	REGION	Q2LOCATION	COMMUNITY
Point ZM	8	Rochels Road House	Restaurant /Food Outlet	Formal outlet	-27.315094	31.888999	Shiselweni	Urban	Emadladleni
Point ZM	7	Moyamunye Butchery	Butchery & Brai Points	Formal outlet	-27.315671	31.891578	Shiselweni	Urban	Emadladleni
Point ZM	18	Nsalitje	General Dealer /Grocery shop	Formal outlet	-27.315016	31.643845	Shiselweni	Rural	Sitilo
Point ZM	20	Good Hope Bar	Bar	Formal outlet	-27.312324	31.888466	Shiselweni	Urban	Emadladleni
Point ZM	28	Thabede	Sheeben	Informal outlet	-27.288334	31.672978	Shiselweni	Rural	Sitilo
Point ZM	1	Lavumisa Hotel	Bar	Formal outlet	-27.316384	31.889778	Shiselweni	Urban	Emadladleni
Point ZM	2	Museni Spaza	Spaza Shop /Phone Outlet	Informal outlet	-27.316066	31.888874	Shiselweni	Urban	Emadladleni
Point ZM	3	Phetsile Investment	Restaurant /Food Outlet	Formal outlet	-27.315934	31.888999	Shiselweni	Urban	Emadladleni
Point ZM	42	A Nxumalo Sheeben	Sheeben	Informal outlet	-27.270085	31.472829	Shiselweni	Rural	Hluthi
Point ZM	51	Shongwe's Sheeben	Sheeben	Informal outlet	-27.26264	31.535155	Shiselweni	Rural	Hluthi
Point ZM	52	Kamahhishaza Sheeben	Sheeben	Informal outlet	-27.260087	31.437059	Shiselweni	Rural	Mgazini
Point ZM	53	Mahhishaza 2	Sheeben	Informal outlet	-27.259873	31.437301	Shiselweni	Rural	Mgazini
Point ZM	66	Dlamini's Sheeben	Sheeben	Informal outlet	-27.254564	31.587713	Shiselweni	Rural	Nsingizini
Point ZM	98	Mngometulus Sheeben	Sheeben	Informal outlet	-27.217303	31.65704	Shiselweni	Rural	Hlushwana
Point ZM	118	Sebenzile Restaurant	Restaurant /Food Outlet	Formal outlet	-27.20336	31.556374	Shiselweni	Rural	Nsingizini
Point ZM	142	Maphango Sheeben	Sheeben	Informal outlet	-27.197778	31.333366	Shiselweni	Rural	Ngwenyameni
Point ZM	181	Phumlani Grocery	General Dealer /Grocery shop	Formal outlet	-27.164974	31.779648	Shiselweni	Rural	Mdlanyoni
Point ZM	199	A1 Bar	Bar	Formal outlet	-27.1606	31.667954	Shiselweni	Rural	Nkutjini
Point ZM	205	Enhlanhleni Wine & Malt	Bar	Formal outlet	-27.161153	31.266629	Shiselweni	Rural	Thembelihle
Point ZM	217	Msibi	Sheeben	Informal outlet	-27.15376	31.512118	Shiselweni	Rural	Ka-Mngayi
Point ZM	230	Kunene	Sheeben	Informal outlet	-27.144547	31.124062	Shiselweni	Rural	Ngelane
Point ZM	235	KaMsibi Sheeben	Sheeben	Informal outlet	-27.142815	31.124519	Shiselweni	Rural	Ngelane

1 (0 out of 612 Selected)

High-risk venues

Step 2: Import attribute data on product/service availability in a separate layer. This data layer should show the outlet/clinic locations with attribute data on availability and quality.

Step 3: Verify the quality of the location data, since sites and outlets with incorrect coordinates will negatively affect the survey findings. Sites with incorrect coordinates will usually appear out of place and are easily identified. The errors usually stem either from incorrect recording of GPS coordinates in the field (in which case it may be difficult to correct the values), or from incorrect data entry (in which case one should refer to the paper questionnaires to retrieve the correct values). Any sites for which coordinates cannot be corrected should be removed from the access analysis. Once the required corrections have been made to the coordinates, start again with Step 1 of the analysis process.

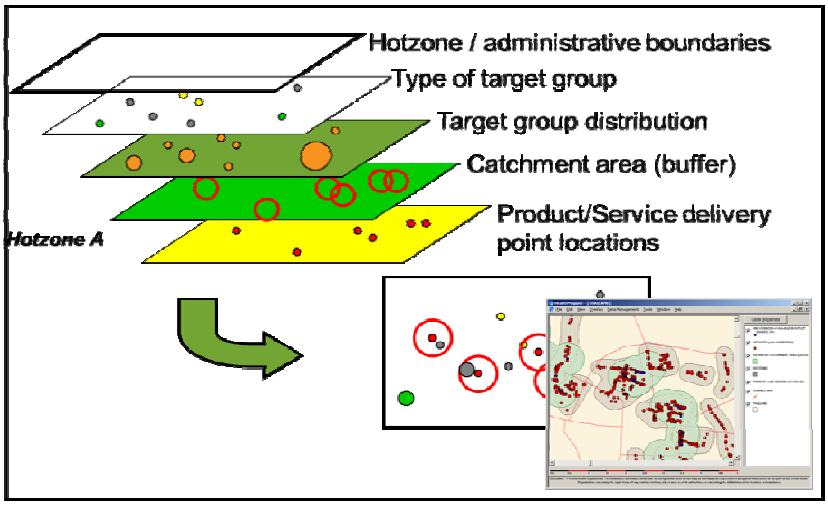
Step 4: Generate the catchment areas ("buffers") around the outlets/providers where the product/service is available. If a time distance (e.g. "5 minutes' walk") was chosen as the minimum access standard, then this value needs to be converted to the equivalent in meters. The standard rule is to use the conversion of 15 minutes = 1 kilometer, since the average walking speed is about 4 km / hour.

Step 5: Identify and select the target audience sites that are within the catchment area of one or more product or service providers. This identification can be done automatically through a spatial query ("select based on location" in ArcGIS).

Step 6: Compute the access rate. To do so, divide the number of people inside the catchment area (those with access) by the total number of people in the target group. This last step is usually done in Excel or manually with a calculator, based on the numerator and denominator obtained in the GIS.

Note that the general procedure described above may differ from one software package to another. Even within the same software, there may be several possible combinations of functions and tools to obtain the correct result. All of these variations and tools are covered in detail during the GIS training. Appendix 2 explains one of the methods that can be used in ArcGIS to calculate access. See Figure 6 for an illustration of the different types of data layers and how these are combined in order to enable access analysis in a GIS.

Figure Six: Calculating Access in a GIS: Required Information Layers



STEP 15: REPORT WRITING AND DASHBOARD-TO-DECISION MAKING SESSIONS

The standard MAP Summary Report template should be followed to present the findings of the Access study. It should also contain a number of relevant programmatic recommendations based on these findings, in view of improving (or maintaining) adequate access levels. The report template contains instructions on the format and contents of the report.

The sample tables below show how results from surveys on access to condoms among FSWs in four cities (Table 1) and among three distinct high-risk groups (Table 2) would be presented in the summary report. The examples are from studies that were conducted in Yunnan province, China (2005) and in several provinces in Laos (2004).

Table One: Example of a Table with Access Findings

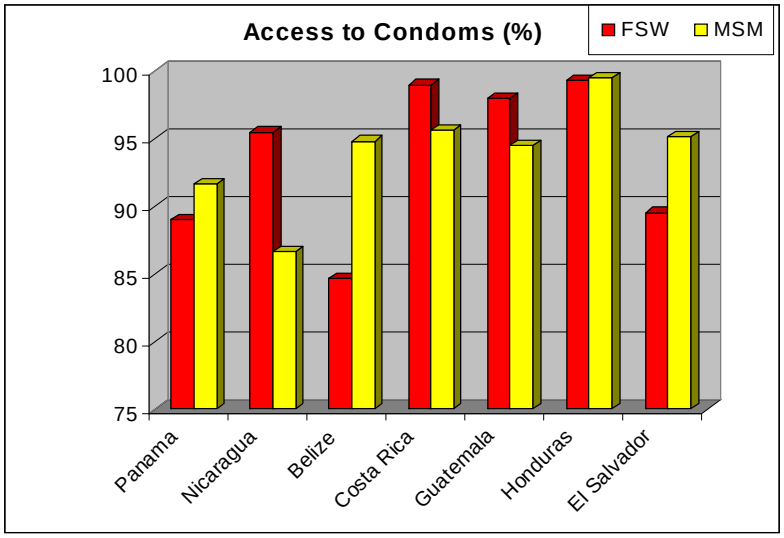
City	Total FSW population in the selected hotzones	# of FSWs within the condom outlet catchment area	**Access to HXH condom among FSWs**
Kunming	6032	1385	**23%**
Kaiyuan	1065	259	**24%**
Gejiu	789	241	**31%**
Mengzi	721	447	**62%**
Yunnan Province	**8607**	**2332**	**27%**

Table Two: Example of a Findings Table on Equity of Access

Target Audience	**Access (%)**
Female sex workers	52%
Mobile men (e.g. migrant workers or truck drivers)	47%
MSM	32%

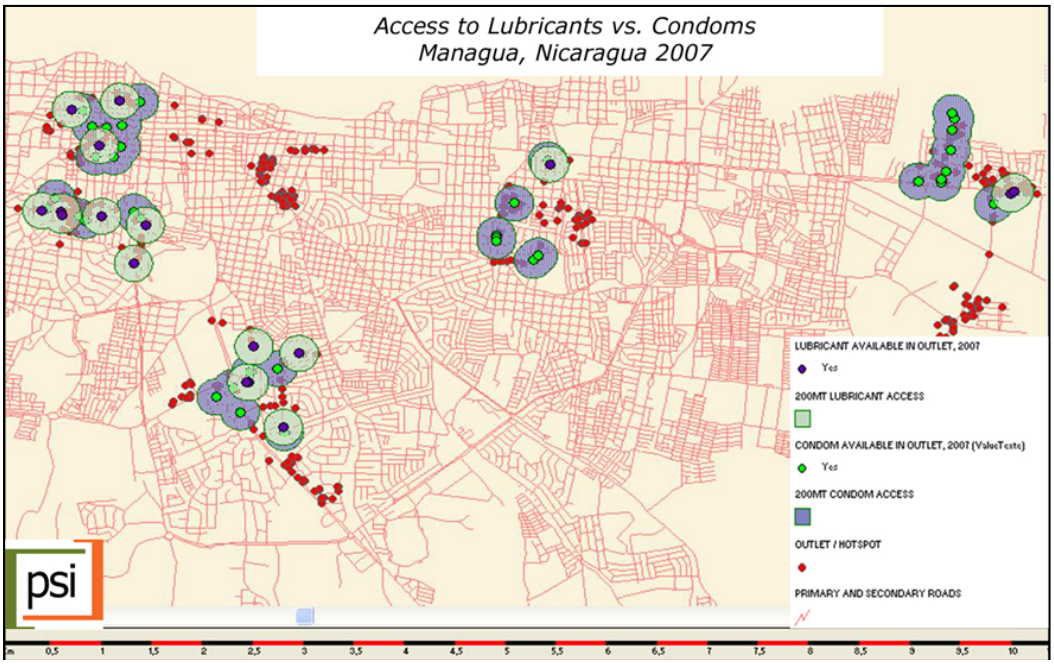
The graph in Figure 7 is an example of how the data can be displayed. Since it combines access rate by supervision area (in the seven countries in the study) and by target group (MSM and FSW), it is possible to compare availability levels between countries and between population segments.

Figure Seven: Example of a Graph Displaying Findings on Access



Researchers should also add maps displaying data to the report. Maps can simply show the distribution of target audience venues or other locations where a specific population at risk is present, along with product availability and catchment areas, as shown in Figure 8. These maps can be valuable tools for designing and planning field interventions. See also Fig. 1 for another example.

Figure Eight: Example of a Map Showing Access to Condoms and Lubricants



Note that it may be useful to give programmers access to interactive maps, rather than static images. These can be created using Google Earth and/or Google Maps – two user-friendly software programs that are ideal for creating and sharing maps with other users. An example is shown in Fig. 9. Data just needs to be in Excel format in order to use these tools. See the *PSI Google Mapping Toolkit* (Duvall & Piot 2011) for information on how to use Google Earth and Google Maps to create and share interactive maps. Note, however, that these two tools are not GIS software and as such they do not have any analysis functions, and cannot be used to calculate access.

Figure Nine: Example of a Google Map Showing Product Availability

Most importantly, the summary report should include a number of programmatic recommendations based on the study findings. These should be discussed with the programmers and marketers soon after the analysis is completed, and before the summary report is finalized. This discussion should take place during a formal Dashboard-to-Decision-making (DDM) session. DDM session outputs are a series of programmatic recommendations and an action plan that addresses coverage gaps and issues with quality of coverage. These outputs should be summarized in the Programmatic Recommendations section of the MAP report. A separate MAP DDM guidance document describes in detail the entire process and outputs of a DDM session.

SUMMARY OF IMPLEMENTATION STEPS FOR A MAP FOR ACCESS STUDY

Step One	Define MAP Study Objectives
Step Two	Define the Unit of Analysis and Minimum Standards for Access
Step Three	Define Appropriate Stratification
Step Four	Benchmarking (for equity of access, if relevant)
Step Five	Create the Sampling Frame
Step Six	Determine the Sampling Procedure
Step Seven	Design the Audit Sheet
Step Eight	Define Data Collection Procedures
Step Nine	Establish Timeline and Budget
Step Ten	Set Up GIS
Step Eleven	Pilot Test the Audit Sheet and Data Collection Procedures
Step Twelve	Train Researchers, Interviewers and Supervisors
Step Thirteen	Conduct Auditing during Data Collection
Step Fourteen	Analyze Data
Step Fifteen	Hold DDM and Report on Findings

QUALITY IMPROVEMENT CHECKLIST

To ensure the MAP for Access study is effective and produces high-quality outputs, use the following checklist.

- ☐ The objectives of the study are clearly defined and understood by the research and program teams.
- ☐ The study objectives and indicator definitions are discussed with program managers.
- ☐ A study design that clearly describes the primary sampling unit/geographic unit of analysis, the sampling frame and indicator definitions (minimum standards) exists.
- ☐ Data collection tools are designed to collect product or service availability.
- ☐ The audit sheet(s) and data collection procedures are pretested.
- ☐ All interviewers and supervisors are trained on data collection procedures, including use of GPS units.
- ☐ Researchers have the capacity to analyze access.
- ☐ Analysis is performed within a few weeks of data entry/data upload.
- ☐ A DDM session is conducted with the program teams shortly after analysis is completed and before the report is written.
- ☐ The report follows the standard MAP Summary Report template.

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Appendix 1: Sample Hotzone Definitions from Various PSI Platforms

The following definitions of high-risk areas (hotzones or hotspots) for HIV/AIDS are based on a non-exhaustive review of MAP study designs. These definitions differ from platform to platform and are given as examples only.

Burundi

Hotzone: an area within a 500m radius of a hotspot.

India

Category A hotspots: contain more than 95 FSWs and require at least 15 condom outlets
Category B hotpots: contain 30-95 FSWs and require at least 10 condom outlets
Category C hotspots: contain less than 30 FSWs and require at least 5 condom outlets

Tanzania

Hotspot: a hotspot is any meeting place where people at high risk of HIV (CSWs and their clients) congregate, or where high-risk activity (transactional, cross-generational or multi-partner sex) takes place. A hotspot can be a bar, nightclub or guest house.

Hotzone: a hotzone is a closely clustered group of hotspots (hotspots within easy walking distance from one another). A hotzone is typically an urban neighborhood or street with many bars, nightclubs, 'groceries' and/or guesthouses.

Malawi

Hotspot: specific areas of high-risk activity, including truck/bus stops, bars, taverns, bottlestores, lodges/motels and nightclubs.

Hotzone: the outer perimeter of a hotzone is ultimately defined by programmatic need.

Myanmar

Hotspot: specific areas of high-risk activity, which are different for each target population group. Hotspots of FSWs include streets, parks, tea shops, brothels, massages/beauty parlors, hotels, nightclubs and KTV/restaurants. Hotspots for MSM include beauty parlors, bus stops, nightclubs, parks/bridges/street junctions, teashops, markets/night markets, and houses of '*Natgadaws.*' *Natgadaws* are women believed to be chosen as consort by a *nat* (spirit). Sometimes these are men (mainly MSM), who are dressed like women.

Hotzones: areas defined by clustering hotspots with contiguous catchments.

Nepal

Hotzone: a cluster of points with contiguous catchments where the high-risk target group is active. For FSWs these points include streets where sex workers operate, truck/bus stops, bars, cabin restaurants, dance restaurants or hotels. The outer perimeter of a hotzone will ultimately be defined by programmatic need and may vary between urban and rural areas.

Papua New Guinea

Hotzone: area where there is a concentration of establishments ("hotspots") in which members of the target group are present. They may correspond to a neighborhood or a section of a street. Census units are suitable for measuring the availability of condoms in the provincial capitals and in the selected enclaves, whereas hotzones are more appropriate when measuring access to condoms among specific at-risk groups such as sex workers.

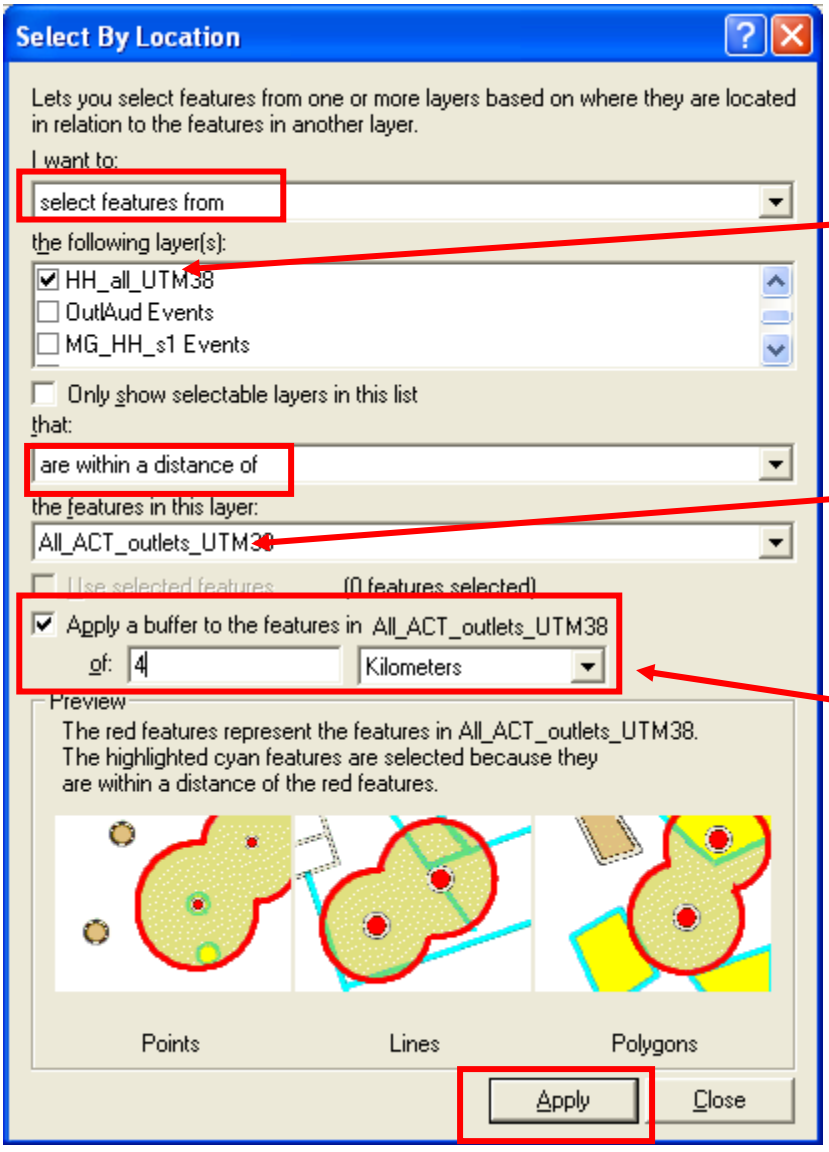
Zimbabwe

Hotzone: a catchment area within a radius of 1km of a condom outlet in rural areas and within 500m in high-risk areas in urban sites.

Appendix 2: Summary Steps for Calculating Access in ArcGIS (version 9)

Step 1: Open ArcMap and display the two layers that you need to calculate access: 1) the layer with population data (e.g. number of clients per hotspot) and 2) the layer with product availability (e.g. number of condoms by outlet). Use a shapefile (extracted from the HealthMapper Data\Temp folder), or add a .dbf table to ArcMap and use the function Add XY Data… (under the Tools menu).

Step 2: Use the "Select by Location" function to automatically select all records in a population layer that are within the catchment area of the product outlets. To access this function, go to the Selection menu and choose Select by Location… Then, specify the parameters as shown in the example below. Click Apply after you finish selecting the parameters.

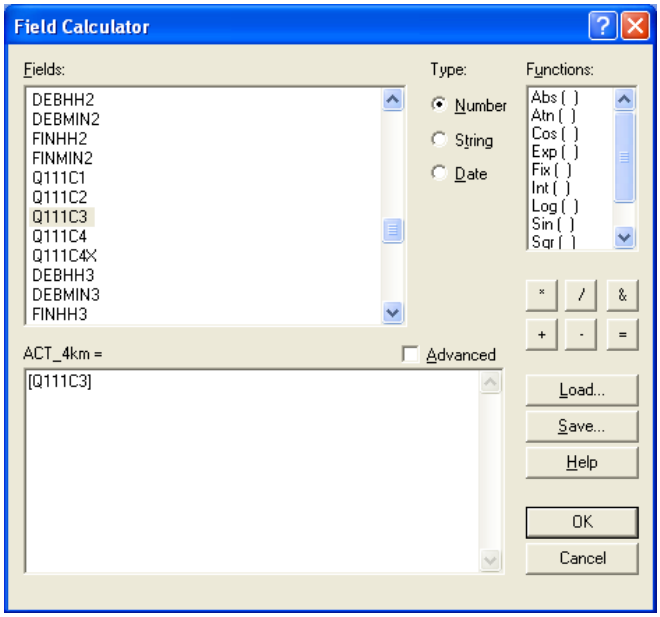


The layer with the POPULATION data

The layer with the PRODUCT data. If the layer contains *all* outlets and an attribute for availability, first select only those records with value "Yes" (or 1). Then, check the option "Use selected features."

Check the option "Apply a buffer…" and specify distance (radius) and units (km or meters).

Step 3: Now, create a new field in the table where you can copy the value of the population size of the outlet (number of clients). Only copy the value from those records that were selected under step 2 (i.e. those that have access). To do so, open the attributes table (right-click on layer to see this option), then click the Option button and choose the Add … field. Give an appropriate name to this new field (e.g. "Cond200m"). Then, right-click on the header of this new field to use the field calculator: Calculate Values… In the Field Calculator that pops up, now choose the population variable in the Fields box by clicking on it. In the example below, field Q11C3 is the field with the number of clients in each hotspot. Click "OK" after the field is chosen.



Step 4: Use the Statistics function to get access information about a specific site, including the access rate. To access this function, right-click on the header of the newly created field. You will get the sum of the population that is within the catchment area of the products layer. This number must then be divided by the TOTAL population in your population layer (e.g. number of clients in all hotspots in the study sites). In the example below, the count is the total population, the sum is the number of population members within the catchment area of the products layer, and mean is the access rate. The above steps were used to calculate the proportion of households that are within 4km of an ACT outlet (3711 out of 5085 households, or 72.9%):