A Desk study to inform development and testing of tools for the profiling of HIV risks in predefined HIV hotspots in selected districts in South Africa

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Introduction

The HIV epidemic in South Africa is heterogeneously distributed with differences observed amongst provinces, locality types and municipalities. Beginning in the early 1980s in the Western Cape, HIV infection was characterized by male homosexual transmission, similar to patterns identified among gay men in the northern hemisphere (Ras, Simson et al. 1983; Van Harmelen, Wood et al. 1997; Burrell, Mark et al. 2010). By the mid-1980s, a parallel epidemic emerged among heterosexuals in the general population (Maartens, Wood et al. 1997; Williams & Gouws, 2001). This resulted in a shift in the focus of HIV surveillance and intervention programs towards heterosexual transmission and prevention of mother-to-child transmission (PMTCT) (Department of 2007). By 2012 approximately 12.2% (6.4 million persons) of the South African population were HIV positive, with over 400 000 new HIV infections representing an overall increase in infections since 2008 (Shisana et al., 2014).

The first spatial models of HIV prevalence in South Africa using the 2003 national household youth survey of HIV infection and sexual behavior, showed marked variation in HIV prevalence within provinces; with north western KwaZulu-Natal, eastern Free State and southern Mpumalanga exhibiting the highest prevalence estimates (Kleinschmidt et al., 2007). In subsequent national surveys, four provinces consistently had the highest HIV prevalence, namely KwaZulu-Natal, Mpumalanga, Free State and the North West (Shisana et al., 2005, 2009, 2014).

At municipal level, eThekwini in KwaZulu-Natal and Ekurhuleni in Gauteng had the highest HIV prevalence, followed by Buffalo City in the Eastern Cape (Shisana et al., 2014). There were notable differences in prevalence amongst urban and rural settlements. People living in rural informal areas had a higher HIV prevalence compared to those living in urban formal areas (Shisana et al., 2014).

Gathering spatially referenced data affords the opportunity for assimilation of multiple layers of information which can be analysed and visualized at different spatial scales. It has been suggested that `places' could be more important than `people' in defining core groups which are characterized by disease incidence, high risk occupations or risky sexual behavior (Fichtenberg & Ellen, 2003; Dybul, 2015). In the context of geospatial analysis and geographic mapping of HIV,

> "***a hotspot is defined as a geographical location that has high HIV prevalence, STIs and risky behaviors that render people vulnerable to HIV infection (WHO, 2013).***"

Geographic mapping can assist stakeholders in understanding epidemic trends at different spatial scales, identify gaps in health services coverage, help to streamline information needed for improved programme efficiency and understand the vulnerability and context of at risk populations (Cunningham, 2015).

Following this approach, to target interventions, the South Africa National Aids Council (SANAC) is developing a HIV prevention Toolkit which location and population sensitive. The methods involve mapping the HIV hotspots in districts in South Africa and profiling the HIV risks among the population in the profiled hotspots.

Purpose of the Desk study

The objective of this desk study is to inform development of a practical methodology for the generating the HIV risk profile of population in identified hotspots within selected districts in South Africa, with the with the ultimate goal of informing the SANAC HIV prevention toolkit. The analysis undertaken includes a review of 75 studies on HIV risk profiling and consultation with the technical advisory committee comprising of experts in the HIV field.

Specific Objectives

- Defining a HIV risk profile
- A review of risks of HIV infection and associated factors that influence the HIV risks
- A review of methodologies used in HIV risk profiling,
- Selection of methods and tools for HIV risk profiling in identified HIV hotspots within selected districts in South Africa.

Defining a HIV risk Profile

A HIV risk profile documents the risks of HIV infection in particular the knowledge about HIV transmission and prevention and care, use or exposure to psychoactive substances, report or history of sexually transmitted infections (STIs) in a given population in a given location. The HIV risk profile incorporates factors that influence the risks of HIV infection including the socio-demographic risks (age, gender, race, occupation, educational level, socio-economic status, and locality); sexual risk behaviours (i.e., condom use, multiple sexual partnerships and transactional sex); risky sexual practices (i.e. unprotected oral, anal and vaginal sex) in heterosexual and homosexual contacts; and other behaviours such as sharing needles. The risk profile also document the structural factors (gender norms and gender-based violence (GBV), cultural norms) that increases vulnerability to HIV infection especially among women, and the pyscho-social barriers to care including sigma and fear of disclosure, and self-perception of risk and good health.

The HIV risk profile feeds into a local HIV epidemiologic profile(CDC, 2014) that

- Describes the current status of people living with HIV infection in the selected area and providing some understanding of how the localised HIV distribution may look in the future (forecasting).
- Provides thorough description of HIV among the various populations (overall and subpopulations) in selected areas in terms of their sociodemographic, geographic, behavioural and clinical characteristics.
- Identifies characteristics of the general population and of populations who are living with, or at high risk for HIV infection in the pre-defined geographic areas in need of primary and secondary prevention or care services
- Identifies social including psycho-social(stigma) , behavioural, cultural factors that influence the risk of HIV infection in a local area
- Provides information required to conduct needs assessments and gap analyses to complete the local epidemiological profile.

By providing insight into HIV risks and associated factors, the HIV risk profile becomes a tool to assist decision makers to design appropriate and sustainable interventions for HIV/AIDS prevention.

The following section provides a review of existing literature on HIV profiling and methods applied. This will guide development and testing of tools for HIV risk profiling in identified hotspots in South Africa.

Literature search to inform methods and tools for HIV risk profiling

Literature search in online databases including EBSCO and PubMed was done using the following search terms: “HIV Risk Profile”; “Risk Profile”; “HIV Risk”; “Key Population”; “sexual behaviour”; “HIV Risk groups”; “Epidemiological profile”; “Homosexual”; “Human Immunodeficiency Virus” "Primary Prevention"; "Secondary Prevention"; "Tertiary Prevention"; “Combination HIV Prevention”, “Social and structural drivers of HIV”

A total of 121 articles and report including existing epidemiological profiles in other contexts were sourced. Restricting the sources to the period 2010 to 2015, studies in English language, search terms: “HIV Risk” “HIV Risk Profile” “HIV Risk factors” “Sexual risk AND HIV” “HIV epidemiological profile” ”HIV drivers”; “Social and structural drivers of HIV”; “key populations” “HIV risk groups” , 75 articles and reports were reviewed.

HIV Epidemic profiling in sub-Saharan Africa

In South Africa, several national and sub-national studies have looked at profiling HIV epidemics and associated risk factors in different settings either for the general population and/or for key populations. These studies include national household surveillance surveys that integrate HIV biomarkers and questions on demographics, behavioural and social risk factors together with programme response (HIV testing, Medical Male Circumcision) in a bid to identify high risk groups and related risk factors driving the HIV epidemic in a country. Examples of such studies include the biannual national HIV household surveys conducted by the Human Sciences Research Council, now in its fifth round (Shisana et al., 2002, 2005, 2009, 2014), The National Antenatal Sentinel HIV and Syphilis Prevalence Survey (Department of Health, 2007b, 2010, 2011, 2013), the South African Demographic and Health Surveys (Department of Health, 2007a), and the National Communication Surveys(UNAIDS, 2012). More detailed summary of HIV risks and methodologies are provided in Table 1.

The South African National Strategic Plan (NSP) on HIV, STIs and TB for 2012-2016 recognise up to 18 different groups of people as key populations vulnerable to HIV infection and who are prioritized in the national response (SANAC 2011). These include, among others, young women aged 15 to 24 years, people who live in informal settlements, uncircumcised men, people with disabilities, MSM, Sex workers (SWs) and their clients and people who abuse alcohol and drugs (PWID) (SANAC 2011). The UNAIDS (2011) guidelines also recognise MSM, Transgender people, PWIDs, and SWs as key populations at higher risk of HIV exposure compared to other groups.

Subsequently, several cross-sectional integrated bio-behavioural surveys (IBBS) have been implemented among the key populations (MSM, SWs, PWIDs) to profile the HIV epidemic and

the associated risks (Lane et al. 2014; Cloete et al. 2014; Baral et al. 2011; Burrell et al. 2010; Rispel et al. 2011; Scheibe, Brown & dos Santos 2015; Petersen et al. 2013; Baral et al. 2012). (See Table 1 for list of HIV risks, factors influencing risk of infection (sexual, behavioural, social and structural), among the key populations)

In a bid to understand the overall trends in HIV epidemic in South Africa, SANAC and the Government of South Africa, conducted a Know your epidemic, know your response through desktop study of published and unpublished documents about HIV in South Africa, and any other relevant documentation from other countries in the region together with secondary data analysis of three bio-behavioural HSRC surveys and two National Communication behavioural surveys using bivariate and multivariate approaches. (South African National AIDS Council & Government of South Africa, 2011; NCS, 2009). The study also profiled the key priority areas, with recommendations on plausible interventions (see Table 1 for list of HIV risks, factors influencing risk of infection (sexual, behavioural, social and structural), among the risk groups and priority intervention areas)

In Kenya, in a bid to effectively support county governments to implement successful programmes that are evidence based and take into account the county heterogeneity, the National AIDS and STI Control National AIDS Control Council (NACC),(2014) used secondary analysis of data from four national HIV surveys and the District Health Information System available by the end of 2013, as well as outputs from the Estimation and Projection Package modelling tool, to derive the HIV profile for the counties. The HIV profile highlighted the HIV burden by looking at number of HIV cases by risk groups (People living with HIV, Children living with HIV) looking at uptake of Male circumcision, PMTCT, HIV testing , and condom use in reducing HIV infection (see Table 1). The profile also documented the priority intervention areas as well as providing a set of possible interventions to apply in those intervention areas. The profile was an update of a previous developed profile.

In Connecticut USA, the HIV Surveillance Program(2013) team developed an integrated epidemiological profile of the HIV epidemic in Connecticut. This involved secondary analysis of data from HIV surveillance systems, national surveys for the general population and key populations, and district health information systems. .The profile showed the trends in number of people living with HIV by socio-demographics(gender, race and age groups); number of HIV cases and the distribution by risk groups (MSM, injection drug use (IDU), heterosexual contact); exposure to STIs, and co-infections with Hepatitis C. The study also profiled the locations or cities with the highest number of HIV cases including viral load testing as an indicator of entry into care; and percentage of adolescents and adults diagnosed with HIV (Table 1)

In profiling the HIV epidemic among MSM, Baral's (2010) study on Know Your Epidemic and Knowing Your Response among MSM and their needs in Low- and Middle-Income Countries used several methodologies: systematic review; electronic global consultation to obtain information on epidemiology, rights contexts, and programming for MSM; and Face to Face consultation with key informants from 28 countries to obtain country specific data for MSM (See Table 1)

Complexity in the links between the social/structural drivers of HIV infections and infection rates

UNAIDS (2010) and Seeley (2012) identifies how gender inequality, gender norms and gender-based violence (GBV) increases the complexity between HIV infection and the social and structural drivers. Seeley demonstrates through two studies how unequal gender and power relations lead to risky sexual behaviour and greater vulnerability to HIV. In one study, less social and economic opportunities for women led to dependence on sex work for livelihoods and risky sexual behaviour through poor condom use. Another study demonstrated how men controlling the means of production in the fishing industry in Southern Malawi contributed to transactional sex and women having difficulty negotiating condom use.

Even though unequal gender power relations and certain gender norms have been shown to be drivers of HIV, it must be borne in mind that the causal relationships are complex. Auerbach (2011) maintains that although studies show that, in a number of sub-Saharan African countries displaying gender inequality, HIV prevalence's are three to four times higher in young women than young men, in certain countries displaying the same extent of gender inequality, the differences in HIV infection are not as pronounced.

The Global Fund (2014-2017) also reports that the disproportionate exposure of women to GBV (UNAIDS, 2010) and gender oppression generally increase the risk of women to HIV.

Social, cultural and economic drivers

In demonstrating the importance of economic drivers that impact HIV vulnerability, Steeley (2012) reports how a programme in Malawi to provide a stipend to girls and their households had a significant impact on HIV. The programme did not even target sexual behaviour; however, the girls reported fewer sexual partners and less transactional sex with older men.

In demonstrating the importance of social and cultural drivers, Steeley (2012) reports a study where far fewer Ugandan men accessed HIV treatment than women, and the fact that these men have a higher mortality rate was linked to social and cultural attitudes. Men's responsibility to work was viewed as an expression of masculinity. Drug side effects limited and undermined their ability to work and thus their masculinity. This discouraged them from seeking treatment.

Orphans, vulnerable children and youth

Although orphans and vulnerable children are regarded as drivers by both the Global Fund and the SANAC strategic plan (2011), the SANAC strategic plan has identified education of school-going children, as well as education of parents and caregivers on intergenerational conversations and gender norms, as a protective factor against HIV infection. Education is also seen to reduce the vulnerability of girls to HIV infection.

Rights-based dimensions

Legal and policy frameworks can lead to the marginalisation of certain groups (UNAIDS, 2010). For example, age-related laws and policies can hinder young people from accessing HIV services (Global Fund, 2014-2017). Furthermore, criminalisation of drug use and sex work can also be a barrier to accessing health services rights (Global Fund, 2014 – 2017).

Particularly vulnerable populations such as orphans, migrants and refugees experience violation of rights through inequality, prejudice and marginalisation and are especially vulnerable to HIV. Women also experience inequality and violation of rights.

It is important to focus efforts and resources for protection of human rights of these groups (UNAIDS, 2010), including gender equality and gender rights (SANAC, 2011). It is also important to remove punitive laws that block the HIV response, contribute to gender inequality and HIV-related stigma and discrimination (UNAIDS, 2010).

Stigma and discrimination

The Global Fund (2014-2017) reports that gay and bisexual men, transgender people and sex workers are stigmatised and exposed to human rights abuses which increase their vulnerability to HIV. Furthermore, their uptake and access to services is significantly lower than for other groups. Stigma and discrimination to those living with HIV is a barrier to access to health services and treatment, and thus HIV prevention.

Community system strengthening

Social networks and organisations are important for support, advocacy, kinship and services. These in turn can be a positively affect HIV vulnerability. It is thus important to profile types and progress of community interventions (Global Fund, 2014-2017) and to map stakeholders, referral networks and feedback mechanisms for the ultimate purpose of mobilising the community, strengthening community systems (including mobilising the community) and addressing challenges around HIV prevention (UNAIDS, 2010). Furthermore, this driver is relevant for determining where interventions can be synergised with non-HIV specific programming, for example, HIV-related discrimination can be linked with broader efforts for the elimination of discrimination (UNAIDS, 2010).

Poverty alleviation and food security

Despite research finding that poverty is a driver of HIV infection; in certain Sub-Saharan African countries wealthier groups have displayed higher HIV prevalence rates (Auerbach, 2011). It is thus important in HIV risk profiling to recognise that patterns will differ across geographic areas. For example, the presence of wealth can lead to transactional sex with those living in poverty, and thus increase vulnerability of both groups to HIV (Auerbach, 2011). UNAIDS recognises food security as a driver of HIV prevention (UNAIDS, 2010). Poor food security is in turn is linked to HIV and TB acquisition and poor treatment adherence (SANAC, 201).

Cross cutting all of the above drivers, Steeley (2012) demonstrates how lack of accessibility to services is a negative factor in adherence to HIV treatment, and thus HIV prevalence (USAID, 2010).

Table 1: Literature review of HIV epidemic profiling Highlight HIV Risks and Methodologies applied

Study	Methodology	HIV risks (exposure to HIV infection)	Factors influencing HIV risks	Limitations / strengths
Kenya HIV county profiles(National AIDS and STI ControlNational AIDS Control Council (NACC), 2014)	A secondary analysis of data from four national HIV surveys and the District Health Information System available by the end of 2013, as well as outputs from the Estimation and Projection Package modelling tool, were used to derive the county specific information. Data from Kenya HIV Estimates Report, 2014; UNAIDS, Efficient and Sustainable HIV Responses: Case Studies on Country Progress, 2013; National AIDS Control Council, Sustainable Financing of AIDS in Kenya, 2011; National AIDS Control Council, Kenya HIV Prevention Response and Modes of Transmission Study, 2009; Global AIDS Progress Report, Kenya, 2013; UNICEF, 2012; Census, 2009	• Heterosexual transmission • Male circumcision • PMTCT • sexual debut • ARV- reducing viral load • Consistent and proper use of condoms	• HIV counselling and testing • Linkage to care and treatment as important steps in reducing the sexual transmission of HIV. • access to paediatric antiretroviral therapy • access to and uptake of sexual and reproductive health services for girls and women • community and peer support to create demand for and increase women's access to and uptake of antenatal care, as well as delivery in health facilities • Cash transfer programmes –delay sexual debut	Allows continuous update of the profile Nation wide Use of existing data depends on the quality of data
Epidemiologic Profile of HIV in Connecticut – 2013 –(HIV Surveillance Program, 2013)	A secondary analysis of data from • HIV surveillance system, • Behavioral Risk Factor Survey, a random, weighted telephone survey conducted annually in Connecticut, • Sexually Transmitted Diseases Surveillance system, • Hepatitis C Surveillance. • 2011 HIV Epidemiologic Profile (www.ct.gov/dph/HIVsurveillance): HIV statistics for Connecticut , CDC	• MSM, • IDUs, • Sex workers • Co-infections with Hepatitis C • STIs • PMTCT • Blood transplant	• By age groups, race, gender	Allows continuous update of the profile State wise data
A study of risk factors associated with HIV patients and in general population - A case control study in Ahmedabad city (Modi, Talsania, & Devaliya, 2013)	Case control study methodologies: interviewed HIV positive and negative patients attending Infectious Disease clinic after obtaining verbal and written consent	• Knowledge about HIV transmission and prevention in community • Sexually transmitted infection (STIs) is a key associate of HIV/AIDS. • Commercial sex workers and MSM practice. • FSW and their clients, who have high rates of acquiring and transmitting HIV, play key roles in the spread of HIV and for	• Economic disparities contribute to the HIV epidemic among black women • Social class is also one of the important risk factors for HIV/AIDS • Multiple sexual partners including contact with commercial sex workers and MSM practice.	Cases and control selection task difficult Data loss due to deaths precludes the possibility of obtaining a random sample of all people living with HIV/AIDS

		maintaining HIV infection levels in the general population • unsafe sexual practices e.g. low condom use, anal sex	• Occupations including labourers and drivers; and migration for work •	
HIV risk profile and prostitution among female street youths (Weber, Boivin, Blais, Haley, & Roy, 2002)	Youth Cohort, who completed an interviewer-administered questionnaire Semi-annually,	• Injection drug use • unsafe sexual practices : Low consistent condom use for anal, vaginal, and oral sex	•	Study limited to young street girls involved in prostitution
Risk profile of HIV positive persons attending Integrated Counselling and testing centre of a tertiary care hospital, Amritsar (Priyanka, Singh, Deepti, & Roy, 2014)	Cross- sectional study at Integrated Counselling and Testing Centre at Govt. Medical College. Purposive sampling all the persons who came to collect their positive reports on selected days, written informed consent.	• Unprotected sex • IV drug abuse- sharing needles and syringes • Blood transfusion and unsafe injections by quacks	• Multiple partnership with majority acquiring infection via IV drug use, majority were using shared needles as well as syringes	Only capture people attending clinics
Know your epidemic, know your response (South African National AIDS Council & Government of South Africa, 2011)	Desk study: literature review forpublished and unpublished documents about HIV in South Africa, and any other relevant documentation from other countries in the region and secondary data analysis of three bio-behavioural HSRC surveys and two NCS behavioural surveys by HDA/JHHESA, using bivariate and multivariate analysis (2002,2005,2008 HSRC surveys, NCS 2009	• Unprotected anal intercourse • Male circumcision (MC • discordant couples; intra-couple transmission • Vertical transmission (PMTCT) • Vast majority of PLHIV do not know that they are HIV-positive • Low risk perception among people with considerable risk behaviours • Low levels of consistent condom use, in longer-term relationships and in pregnancy/postpartum periods • Transactional and commercial sex:	• Migrant labour system • Income inequality • Gender violence • Sexual violence • Alcohol consumption and associated higher-risk sexual behaviour • Low levels and late age of marriage and cohabitation • Multiple serial and concurrent sexual partners	
Differences in Sexual Practices, Sexual Behavior and HIV Risk Profile between Adolescents and Young Persons in Rural and Urban Nigeria (Folayan, Adebajo, Adeyemi, & Ogungbemi, 2015)	Cross-sectional study with a household survey. study participants were recruited from two states – one state with low HIV prevalence and the other state with high HIV prevalence based on the 2010 ANC Surveillance Report for	HIV risk profile • knowledge about HIV transmission • Knowledge of HIV prevention, • use of psychoactive substances, • history of sexually transmitted infection by gender and locational differences)	Sexual and behaviour risk • more than one sexual partner • transactional sex • age of sexual debut • condom use at last sex	Not generalizable to all of Nigeria. selection bias in the study sample Under-reporting of history of sexual intercourse. Self- reporting of HIV status
Know Your Epidemic And Knowing Your Response MSM And Their Needs In Low- And Middle-Income Countries(Baral, 2010)	Systematic literature review ;Electronic global consultation to obtain information on epidemiology, rights contexts, and programming for MSM; and Face to Face	• Unprotected receptive anal intercourse • Lack of circumcision • IDU • Male sex workers • Transgender	• Frequency of male partners • High lifetime partners Community related drivers • Stigma	Prevalence data Convenience youth Samples: Tells where epidemic was and not where it is going; not

	consultation with key informants from 28 countries to obtain country specific data ***133 prevalence studies from 130 unique reports , from 50 countries***	• Condom and lubricant use Knowledge • STIs	• Access to prevention services • Partner education	generalizable to general population of MSM
An HIV sexual risk profile of transgender men in a sample of men who have sex with men (MSM) in Vancouver, British Columbia(Rich et al., 2014)	Cross-sectional study of gay, bisexual and other men who have sex with men (GBMSM) in Vancouver, Canada and compared transgender versus cis-gender (people for whom self-identified gender matches their sex assigned at birth) men based on a longitudinal bio-behavioural study,	• anal sex partners	• Frequency of HIV testing • Condom use	
Impact of Non-HIV and HIV Risk Factors on Survival in HIV-Infected Patients on HAART: A Population-Based Nationwide Cohort Study (Obel et al., 2011)	Population-based cohort study, using population based registries to identify (1) HIV-infected patients who started HAART in the period 1 January 1998–1 July 2009, and (2) a comparison cohort of individuals matched on date of birth and gender	• Comorbidity e.g. Hepatitis C • Alcohol and injection drug use in general population • Detectable viral load (.49 copies/ml) and/or CD4 below 200 cells/ul at last measurement prior to study		Reliance on registry-based hospital diagnoses to identify comorbidities and alcohol/drug abuse, accessed population in contact with the health care system; only 25–64 years
HIV Risk-Reduction Counselling and Testing on Behavior Change of MSM(Huan et al., 2013)	Respondent-driven sampling (RDS) was used to recruit 430 MSM. Participants followed up at 6, 12 and 18 months to evaluate behavioral changes after counseling to reduce risk behaviors. Interview, blood collection and intervention at each round of the surveys.	• unprotected anal intercourse • STIs	• HIV testing and counselling • paid for sex	loss to follow-up limits generalizability to MSM population
HIV Prevalence and Risks Associated with HIV Infection among Transgender Individuals in Cambodia(Weissman et al., 2016)	Cross-sectional survey using a respondent driven sampling method with self-administered audio-computer assist among transgender people	• transgender individuals as one of the highest-risk groups • Unprotected anal sex , • receiving payment at first sex • having sex during/after using drugs • Risk Perception	• Discrimination in their lifetime assaulted • inconsistent condom use during last anal sex • Low consistent condom use with male and female	RDS is dependent on the connectivity of networks; Excluded < 18 years; not recently sexually active; and those who have had sex only with women
HIV Incidence and Risk Factors for Acquisition in HIV Discordant Couples in Masaka, Uganda: An HIV Vaccine Preparedness Study(Ruzagira et al., 2011)	HIV-uninfected adults living in HIV discordant couple relationships were enrolled and followed for 2 years. Interviews, medical investigations, HCT, syphilis and urine pregnancy (women) tests performed at quarterly visits. Sexual risk behaviour data were collected every 6 months	• discordant couple relationships, partner being ART naïve • Young age • Alcohol use • serological syphilis • reported genital discharge	• Condom use frequency	With the exception of ART, did not collect data on other risk factors among HIV-infected partners that could facilitate HIV transmission

Know Your Epidemic, Know Your Response: The Case for Continued Investment in Young People(Youth Health and Rights Coalition, 2012)	Using data from four PEPFAR priority countries, Case studies : South Africa, Kenya, Vietnam, India	• unprotected sex, • age of sexual debut • MSM • IDUs • FSWs	high levels of sexual and gender-based violence Cultural, psychosocial, and economic factors promoting intergenerational sex; multiple concurrent partners; poverty, gender inequality, and limited access to appropriate, high quality sexual and reproductive health (SRH) information and service; level of education	Use of available survey prevalence data (HSRC surveys) which is likely to mask the severity of the impact of HIV among this population.
Female Sex Workers, Male Circumcision and HIV: A Qualitative Study of Their Understanding, Experience, and HIV Risk in Zambia(Abbott, Haberland, Mulenga, & Hewett, 2013)	In-depth interviews were conducted with twenty female sex workers (FSWs) in Lusaka	• Understanding of male circumcision • STIs • unprotected sex	• individual and structural-environmental factors place •	Lack of generalisations
Drivers of HIV/AIDS Epidemics in Tanzania Mainland: Case Study of Makete, Temeke, Geita, Lindi, Kigoma and Meru Districts(Maswanya et al., 2010)	descriptive cross-sectional study, which deployed both qualitative and quantitative techniques of data collection conducted in six districts (Temeke, Makete, Lindi Urban, Geita, Kigoma and Meru) selected according to HIV prevalence; The districts were clustered and from each cluster districts were selected based on levels of HIV prevalence (i.e., low, moderate and high).	• Gender • Knowledge of the HIV/AIDS • age for sexual debut • risk groups (MSM, IDUS, SWs) and the risks factors o Multiple partners, o non condoms use, o alcoholism, o forced sex, o anal intercourse, o low level of knowledge of risks if infections, sharing of syringes,	• Rural/ urban divide • don't know where to obtain condoms wherever are needed • Extramarital sex • condoms during casual sex • fear to go for HIV testing, • trust and stigma • inheritance of widows	Lack of cooperation from most at risk population groups such as MSM, CSWs, IDUs and Discordant Couples response bias are very common
A Population-Structured HIV Epidemic in Israel: Roles of Risk and Ethnicity(Grossman et al., 2015)	Analysis of demographic and virology data from 1,427 HIV-infected individuals diagnosed with HIV-I during 1998–2012 retrospective analysis of clinical and laboratory data approved by ethics bodies	HIV risk exposures • MSM • IDU • heterosexuals		Sample size not strictly random. More MSM as they are likely to access healthcare than other groups.
A Descriptive Analysis of HIV Prevalence, HIV Service Uptake, and HIV-Related Risk Behaviour among Patients Attending a Mental Health Clinic in Rural Malawi(Lommerse, Stewart, Chilimba, van den Akker, & Lund, 2013)	Descriptive cross-sectional study of patients attending a mental health and epilepsy clinics Semi-structured interviews were performed with patients capable to consent (94%), and with those accompanied by a capable caregiver who consented.	• absence of knowledge of the HIV status of those partners • low uptake of preventive measures and ART • physical health problems	• multiple partners • Inconsistent condom use with stable and occasional sexual partners,	

Socio demographic, Sexual, and HIV and Other Sexually Transmitted Disease Risk Profiles of Non homosexual- Identified Men Who Have Sex(Jeffries, 2009)	Use of secondary data from National Survey of Family Growth, a nationally representative, stratified-cluster sample of 4928 household- abiding males aged 15 to 44 years.	• Oral sex with men. • insertive and receptive anal intercourse • drugs or alcohol during past-year sexual encounters,	• having 4 or more lifetime male partners	Lack of laboratory-based HIV or STD test results, multiple and thorough measures of condom use, and larger sample sizes.
Profiles of Malawian adolescents at risk for HIV infections: Implications for targeted prevention, policy, and practices(Small & Weller, 2013)	Cross-sectional study to identify a typology of risk for HIV among Malawian adolescents. Examined the distribution of HIV status within each group in the typology, and tested the association between class membership and changes in sexual behaviors to avoid HIV	○ Risk perceptions	• Failure to report changes in their sexual behaviors to avoid HIV.	ages of 15 and 18 .
An exploration of elevated HIV and STI risk among male sex workers from India(Narayanan et al., 2013)	A cross-sectional study was conducted during 2008– 2009 in four dedicated MSM clinics, run by NGOs implementing HIV prevention programmes for HR- MSM and TGs. The clinics were located in Mumbai and Hyderabad, two large cities in India. 483 high-risk MSM	• transactional sex • higher rates of receptive anal sex • HIV prevalence among MSWs • positive syphilis serology • Lack of personalized risk-reduction counselling and STI screening.	○ more male partners ○ place of residence ○ duration of sex work	no data on prior HIV testing limits our understanding of MSWs possible uptake of treatment services; no causal inferences
A profile of HIV risk factors in the context of sex work environments among migrant female sex workers in Beijing, China(Yi et al., 2010)	Needs assessment in the FSW community established a drop-in center for FSWs in a low to middle-income neighborhood in a north western district of Beijing	• HIV knowledge, source of HIV information, • HIV testing, • STI symptoms and care • Illicit drug use. • unsafe sex with both clients	• socio demographic factors • clients' refusal to use condoms • sex work environments socio-structural factors: police arrest, lack of protection from violence, Verbal and physical abuse	small population
Racial and Sex Disparities in Life Expectancy Losses among HIV-Infected Persons in the United States: Impact of Risk Behavior, Late Initiation, and Early Discontinuation of Antiretroviral Therapy(Losina et al., 2009)	State-transition model of HIV disease, using simulated cohorts of HIV-infected persons and compared them with uninfected individuals who had similar demographic characteristics. Estimated non– HIV-related mortality with use of risk-adjusted standardized mortality ratios, as well as years of life lost because of late presentation and early discontinuation of antiretroviral therapy (ART) for HIV infection. Data from the national HIV Research Network	Survival affected by • late treatment initiation • premature ART discontinuation by race, education, gender, age • HIV infection	• sex • race/ethnicity • early linkage to care • better retention in care	
A study on socio-demographic profile and risk factors present in HIV infected patients attending	Hospital based cross sectional study done at Anti Retro Viral therapy (ART) Center, Department of Medicine SMS Medical College & Hospital, Jaipur (Rajasthan,	• age groups • Mode of transmission - unprotected sexual route, heterosexual route • History of Sexually Transmitted Diseases	• multiple partners • Married • gender • race	Hospital based study

art centre in tertiary care hospital in rajasthan, india (Baig, Madhusudan, Bhardwaj, Monika, & Amita, 2012)	India) for a period of 9 months. Subjects were the HIV infected patients attending (ART) Center.		• Low socio-economic status • residence	
Evidence from epidemic appraisals in Nigeria (Ezirim, Ogungbemi, Daniel, Blanchard, & Ezire, 2012) The EA is a methodology countries can use to understand HIV epidemic typologies and drivers (Blanchard 2012:15)	Mapping to determine the size, typology and locations of MARPs; Venue profiling to identify and profile venues where general populations engaged in high-risk behaviours; rural appraisals: rapid assessment (RA) and the polling booth survey (PBS) to provide insights into risk behaviours and sexual networking in villages.	• Risk groups- MARPS	high-risk behaviours	RA and PBS are bridge between formal surveys and research methods such as in-depth interviews, focus group and observational studies; less time to produce results; low cost of surveying; reduces social desirability bias in HIV-related behavioural surveys
Addressing the structural drivers of HIV. A luxury or necessity for programmes? (Seeley et al., 2012)	A desk review on the importance of addressing the structural drivers of HIV and the need to integrate responses to the structural drivers of HIV/AIDS into future HIV investments	• Alcohol use	Social and economic forces: economic inequality; Economic status / poverty; livelihood security • Stigma and marginalisation • Lack of access to health systems • Gender and power relationships • Cultural norms	
Addressing social drivers of HIV/ AIDS for the long-term response. Conceptual and methodological considerations (Auerbach, 2011)	A desk review for providing a framework, examples, and some guidance for how to conceptualise, operationalize, measure, and evaluate complex social/structural approaches to HIV prevention to help situate them more concretely in a long-term strategy to end AIDS.		• Policy and legal changes • Environmental enablers (infrastructure, access to services) • Harmful social norms, sigma and discrimination • Social, economic and political factors • Empowerment of community groups	
Combination HIV Prevention. Tailoring and Coordinating Biomedical, Behavioural and Structural Strategies to reduce new HIV infections. A UNAIDS discussion paper (UNAIDS, 2010)	Based on a desk review, the paper summarises the "combination prevention" approach to HIV prevention programming, provides a framework for defining essential prevention strategies that have been debated and agreed by the UNAIDS Prevention Reference Group and highlights key issues in the planning of combination prevention programmes. It is intended for use by HIV policymakers and technical support providers at national and regional level.		• Social, cultural, economic, political and legal factors • Gender inequality and gender-based violence • Income / economic inequality • Stigma and discrimination • Violation of human rights and social marginalisation • Community mobilisation • Food security	

HIV Incidence Provincial Surveillance System (HIPSS) to monitor HIV prevalence and incidence(Kharsany, Cawood, Khanyile, & Grobler, 2015)	Two sequential cross-sectional surveys of 10,000 randomly selected individuals aged 15–49 years to be conducted one year apart, in uMgungundlovu municipality (Vulindlela and the Greater Edendale) of KZN, South Africa.			
Wand and Ramjee (2010) Targeting the hotspots: investigating spatial and demographic variations in HIV infection in small communities in South Africa. Journal of the International AIDS Society, 13(1), 41. http://doi.org/10.1186/1758-2652-13-41	Identified three hotspots of high HIV prevalence in Durban, KwaZulu-Natal including Inchanga/Hammarsdale, Umzinto/Molweni/Mtwalume and Hillcrest/Botha's Hill.	○ age and demographic risk	Location	
Wand et al., (2011) Geoadditive models to assess spatial variation of HIV infections among women in local communities of Durban, South Africa. International Journal of Health Geographics, 10(1), 28. http://doi.org/10.1186/1476-072X-10-28			Geographical locations Local rural communities	Only looked at women
Tanser et al. (2009); Namosha, Sartorius, & Tanser, 2013) Localized spatial clustering of HIV infections in a widely disseminated rural South African epidemic. International Journal of Epidemiology, 38(4), 1008–16. http://doi.org/10.1093/ije/dyp148			○ socio-geographic spaces (Communities) ○ access to transport and transport routes ○ Location near South Africa's National Roads in peri-urban communities located within the Hlabisa sub district.	

Wabiri et al.(2016) Assessing the spatial nonstationarity in relationship between local patterns of HIV infections and the covariates in South Africa : A geographically weighted regression analysis. Spatial and Spatio-Temporal Epidemiology, 16, 88–99. http://doi.org/10.1016/j.sste.2015.12.003	Spatial analysis conducted on a subset of the 2008 national HIV prevalence survey data at district level		○ Race ○ lower socio-economic status, ○ higher proportion of females, ○ low marriage rates, ○ high rates of multiple sexual partners ○ Intergenerational sex.	

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HIV Risks and associated factors that influence the risk of HIV infection

Figure 1 shows a summary HIV risks, the influencing factors: individual and community (e.g. Stigma, access to prevention services) level factors that increases or decreases exposure to infection and outcomes including mortality. For example, looking at prevention benefits of AR, (Frank Tanser, Bärnighausen, Grapsa, Zaidi, & Newell, 2012) noted that 40% ART coverage of all HIV+ associated with 31% reduction in new HIV infections in KwaZulu-Natal, while (Jia et al., 2013) noted that 26% reduction in HIV transmission associated with ART start in programmatic cohort of 38,000 couples in China. Donnell Lancet 2010 noted 92% reduction in HIV transmission from HIV+ on ART in sero-discordant couples, and according to Mona et.al 2013 the rate of transmission was 0.0 to 0.14 per 100 person-years.

The risks highlighted in Figure 2 need to be looked in the broader context of legitimising systems including the legal frameworks, laws and policies that for example criminalise sex worker practice and drug use, creating barriers to access of services further increasing risks of HIV infection.

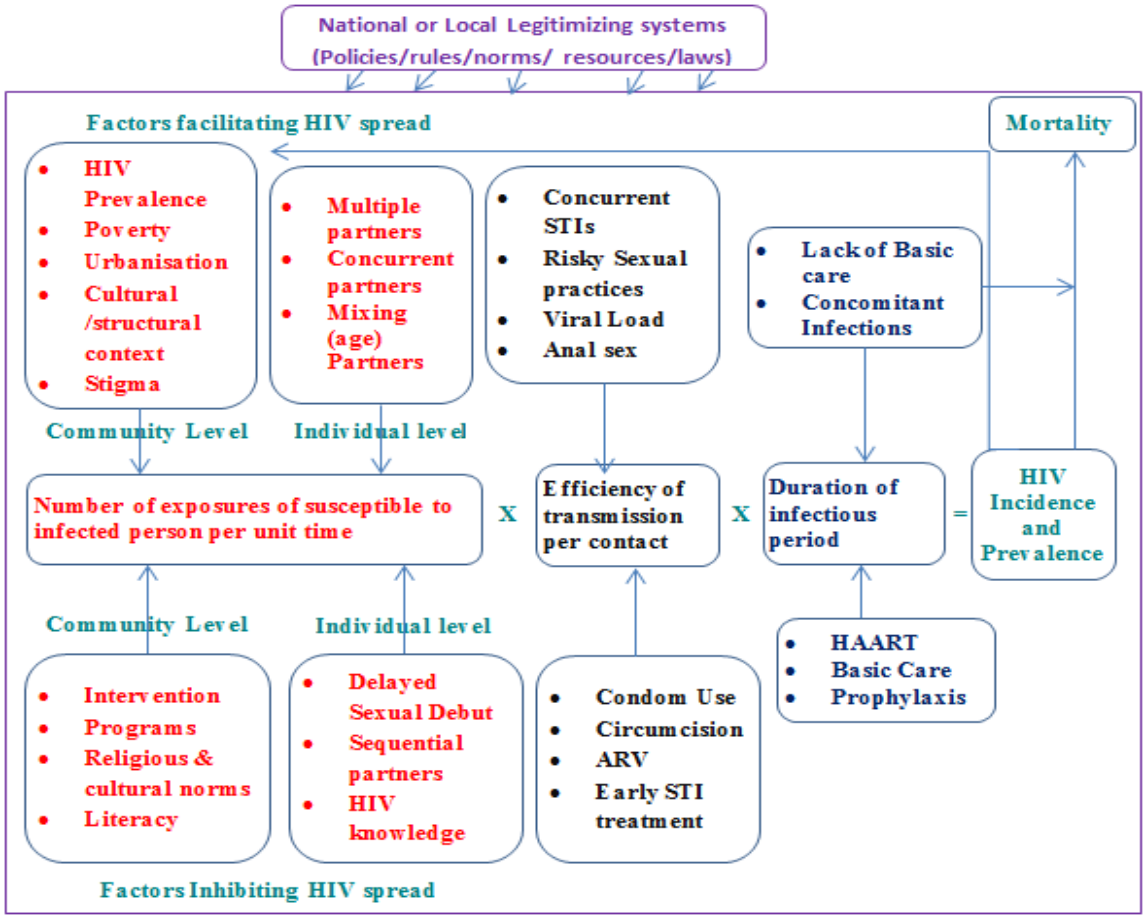

Figure 1: HIV Risks, influencing factors and outcomes factors and Outcomes[1]

[1] Modified from the 2007 unpublished report on recommendations for Policy in the Western Cape Province for the prevention of Major Infectious Diseases, including HIV/AIDS and Tuberculosis Final report June 2007

Methods for HIV epidemic profiling

Figure 2 is a summary of methods and tools for HIV epidemic profiling. Most widely used method is desk study incorporating literature review and analysis of secondary routine or survey data. Often some of routine secondary data is not publicly available. This requires face-to-face consultation with key stakeholders in the profile development. Examples include Know your Epidemic, Know your Response in South Africa, Know your Epidemic, Know your Response among MSM in 21 LMIC, and the Kenya county profiles among others. The approaches ensure that the profile covers all population groups and can be easily updated when new secondary data become available. This also takes cognisance of the limitations of use of Secondary data. The review also proposes adoption of approaches like Polling booth surveys that can be used as routine methods of collecting HIV risk factors data.

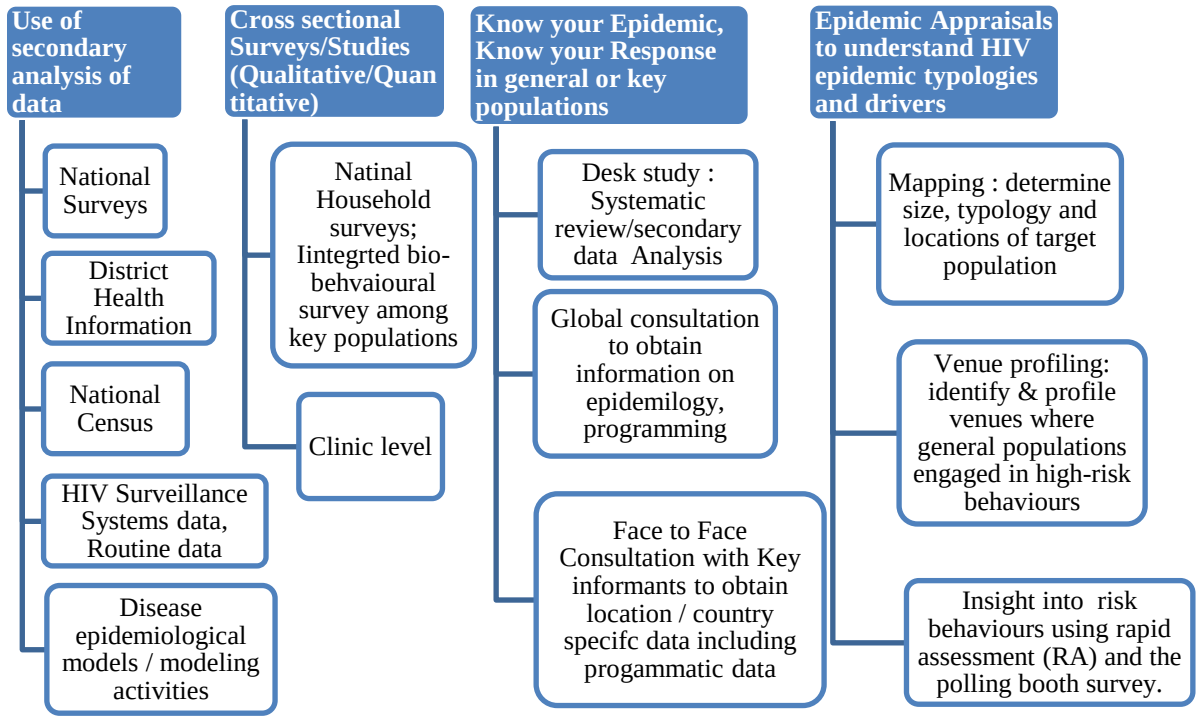

Figure 2: Methodologies and tools HIV risk profiling

Adopted approach to developing HIV risk profile

To develop the HIV risk profile, key issues need to be addressed as outlined sections below. Following a summary of methods and steps for generating the HIV risk profile in selected Hotspots is shown in Figure 3

Section 1: Determining the Scope

This involves determining the boundaries, such as the time frame and geographic area (hotspots) that define the extent of information in the profile using the following checklist

- Is the profile a comprehensive HIV risk profile?
- What planning jurisdiction(s) or service area(s) should be included?

- What years of data will be presented in the profile?
- What specific questions for prevention and care planning should be addressed by this profile?
- What data are available to supplement the HIV surveillance data that describe the HIV-positive population and associated risks of transmission including key population as higher risk groups?
- What information is already available? More information, which is readily available, may allow for a broader scope.

Section 2: Determining the Content and Organization of the HIV Risk Profile

To be useful for prevention and care planning, the HIV risks profile should answer several core epidemiologic questions:

- What are the socio demographic characteristics of the population including sub populations e.g. key populations in the considered service area? The key populations can also be considered as a risk group in the service are where by large proportions of key population in the area increases risks of HIV infection.
- What is the scope of HIV in the service area?
- What are the indicators of risk for HIV infection in the population covered by considered service area?

Section 3: Development Process

- In collaboration with national and local surveillance staff and prevention and care planning groups, determine the specific and unique needs of the planning group. Determine the boundaries and the scope of the profile. Establish mechanisms to ensure collaboration throughout the profile development process.
- Obtain core and supplemental data. Determine which of these data to include in the analysis.
- Analyse and interpret data.
- Present data in user-friendly formats.
- Draw overall conclusions and write an effective, useful narrative.
- Write remaining sections and compile complete epidemiologic profile.
- Prepare clear presentations for appropriate audiences.

Section 4: Obtaining Profile Data and Testing of the HIV risk profile

It is important to note that the quality of a risk profile depends on the quality of secondary data used. Secondly data may be publicly or not publicly available and it is important to have wider key stakeholders' consultations to gain access to useful secondary data that is not publicly available. The following are considerations for reviewing data and data sources to be used in the HIV risk profile:

- **Completeness of the data**: How well do the prevalence of HIV and the associated factors represent the true number of persons living with HIV in the selected hotspots?
- **Representativeness of the data**: How well do the characteristics from a data source correspond to the characteristics of the overall population? For example, data from a hospital-based sample may not represent all HIV-infected persons or all HIV-infected persons in care in the area covered by the survey.

- **Age of the data**: For example, a behavioral survey conducted in 2000 might not provide data that are sufficiently up-to-date for current prevention activities.
- **Timeliness of the data**: if dealing with administrative data, how long is the reporting delay between the diagnosis of HIV and associated socio demographic characteristics recorded and reported to relevant departments?
- **Surrogate, or proxy, markers**: A proxy variable is used as a marker for other variables when what we really want to measure is too difficult to measure directly. For example, some areas may use STI data as a proxy when data on sexual behaviors are not available.
- **Reliability of the data**: How accurate and complete are the data? For example, how well was information e.g. age, recorded whether in a survey or in administrative records and transcribed to the case report from the medical record.
- **Small numbers**: Small numbers of cases need to be interpreted with caution because small absolute changes in the number of cases can produce large relative or proportionate changes in rates that may be misinterpreted by end users. Rates calculated from numerators smaller than 10 should be denoted in a footnote as unreliable. Data should also be presented in terms of defined socio-demographics characteristics across different HIV risk groups (heterosexuals, MSM, IDUs, SWs, PMTCT)

Section 5: Development and testing of methods and tools for HIV risk profiling

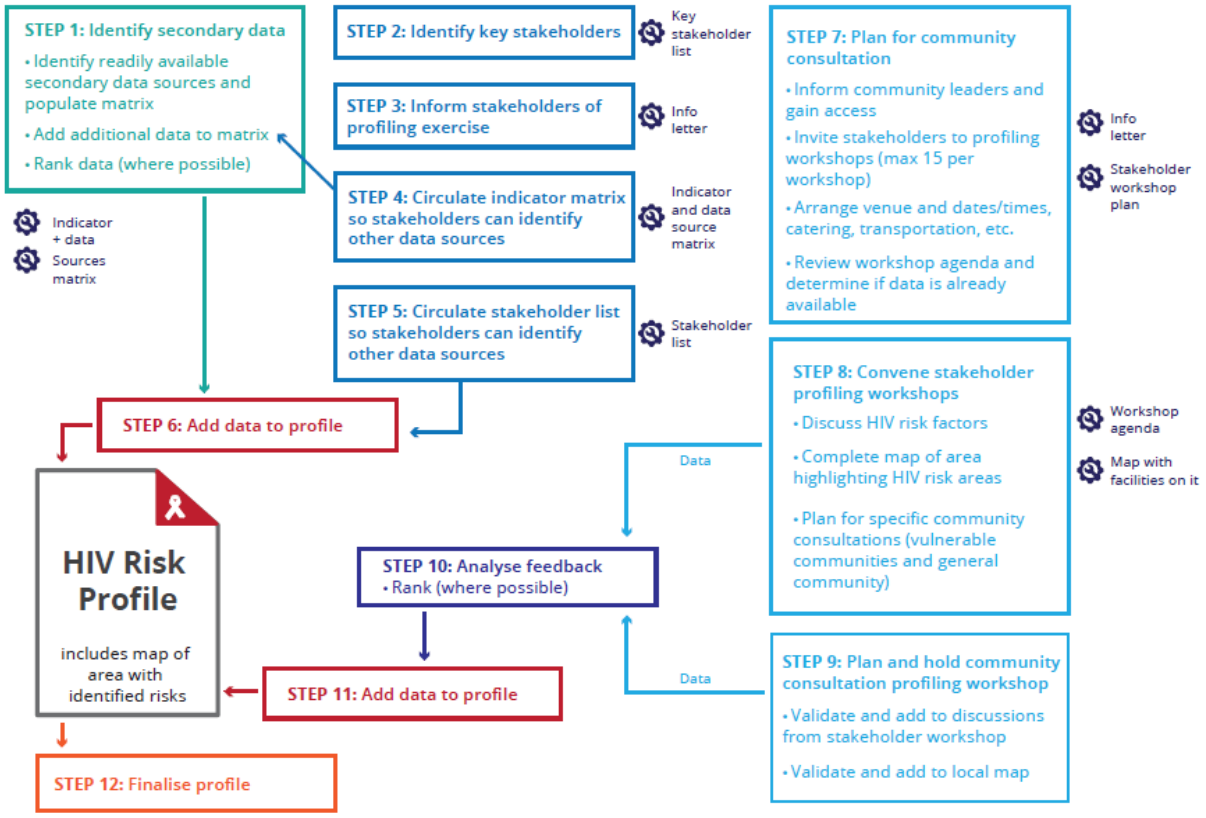

Figure 3: Methods and steps for completing and the HIV risk profile

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Appendix I: A glossary of terms (to be include of the HIV risk profile template)