Identification of MPT Target Populations in sub-Saharan Africa
Final Report

Updated September 2019

Prepared by the Initiative for MPTs (IMPT)

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Executive Summary

Background: Multipurpose prevention technologies (MPTs) are an innovative class of products that deliver varied combinations of HIV prevention, other sexually transmitted infection (STI) prevention, and contraception. The objective of this activity is to identify and characterize priority sub-national areas in sub-Saharan Africa with a likelihood of successful and impactful uptake of MPTs that provide contraception and prevention from HIV. It is postulated that if the highest potential impact MPT target populations can be identified, future research aimed to clarify the preferred product characteristics (PPCs) for MPTs within these populations may help optimize product adherence and uptake.

Methods: In 2018, an epidemiological assessment of the total addressable market for contraception (TAMC) and HIV prevalence was conducted using the most recent, publicly available national datasets from the Demographic Health Surveys (DHS) and the AIDS Indicator Surveys (AIS) at the sub-national level for the following PEPFAR countries: Eswatini, Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. The TAMC was calculated as the weighted number of women who self-reported currently using a modern contraceptive, plus the weighted number of women who self-reported not currently using but intend to use in the future, divided by the total weighted number of women. The HIV prevalence was reported by positive blood test. Weighted frequencies and percentages were calculated for all women stratified by 5-year age categories. TAMC and HIV prevalence were ranked within each sub-national area and 5-year age category using natural breaks in ArcGIS in order to better define priority sub-national regions, or 'hot spots', in sub-Saharan Africa with a likelihood of successful and impactful uptake of MPTs and are displayed in an interactive GIS mapping tool.

In 2019, HIV prevalence and TAMC data for South Africa, as well as contraceptive method mix data for all eleven mapped PEPFAR countries, were added to the mapping tool. South African HIV prevalence and TAMC were calculated in the same manner as the analysis of the initial ten countries. Contraceptive method mix for all mapped regions was calculated using DHS variable V312, current contraceptive method. In addition, a summary of current contraceptive method was calculated using the following categories: variable V313, which categorizes the contraceptive method as non-user, folkloric method, traditional method, or modern method.

Results: Fifteen sub-national regions were identified that had both high HIV prevalence and high TAMC proportion. Out of the eleven countries that were mapped, six had sub-national regions that were classified as both high HIV prevalence and high TAMC proportion. Within the 15 sub-national regions that were identified as 'hot spots', the most common contraceptive methods for females 15-24 years of age included male condom, injections, implant/Norplant, and pill. The GIS interactive mapping tool is available [here]. This tool includes features to change the view between map layers, filter results, and save images of the map for use in reports. It also allows for addition of other useful data indicators moving forward.

Discussion: The analysis and mapping tool presented through this work serve as a solid base on which additional indicators may be added to better describe the MPT prioritized populations and inform where future MPT end-user research should be conducted. The next phase of this project aims to include HIV incidence data (upon availability), and other indicators, such as prevalence of non-HIV STIs, that help describe the MPT target populations and can inform the PPCs of MPTs that will have successful impact in these populations. Other indicators will be determined in coordination with key IMPT advisors and members of the Supporting Agency Collaboration Committee (SACC).

Introduction and Project Background

Multipurpose prevention technologies (MPTs) are an innovative class of products that deliver varied combinations of HIV prevention, other STI prevention, and contraception. To maximize the potential for MPT uptake, effective use, and public health impact, it is important to define and characterize priority target populations for these products. There is recognition that women in sub-Saharan Africa are at high unmet need for contraception and HIV prevention; however, they are a heterogeneous population. Thus, this research aimed to identify the specific population(s), by sub-national region in sub-Saharan Africa, that should be the focus of MPTs in development that combine contraception with HIV prevention. Although there are other potential MPTs with sexually transmitted infection (STI) indications beyond HIV, these are not a priority for this exercise. It is postulated that if the highest potential impact MPT target populations can be identified, future research aimed to clarify the preferred product characteristics (PPCs) for MPTs within these populations may help optimize product adherence and uptake.

Thus, the goals of this activity are to identify and characterize priority sub-national areas and target populations with a *high likelihood of successful and impactful MPT uptake*. This work builds upon earlier research by Schelar et al. which assessed prioritization globally for an MPT product that could address HIV, herpes simplex virus (HSV), and/or HPV along with providing contraception. The Schelar paper was global in nature and used the country as the basic unit of analysis. This report, in contrast, is focused on HIV prevention in southern and eastern Africa. This smaller geographic focus enables comparisons at the sub-national level addressing the substantial heterogeneity of HIV risk within countries. With the addition in 2019 of contraceptive method mix data from the eleven mapped PEPFAR countries, the tool can now be used to describe contraceptive method use patterns among women 15-49 in the mapped countries.

This analysis, and the resulting interactive mapping tool, serves as a foundation on which subsequent work can build, which may include layering additional indicators on to this analysis as well as targeted end-user research to help inform development of PPCs within the identified target populations.

Methodology

This project was conducted between July 2017 and September 2019. The scope of analysis was developed in close collaboration between the IMPT Secretariat and a designated Expert Advisory Group including: Mike Chirenje (University of Zimbabwe), Thesla Palanee-Phillips (Wits Reproductive Health and HIV Institute), Chelsea Polis (Guttmacher Institute), Joseph Romano (NWJ Group), Meghan Reidy (Avenir Health), Elizabeth Russell (USAID Office of HIV/AIDS), and Michelle Weinberger (Avenir Health). The statistical and geospatial analysis and mapping was conducted by Suzanne Ryan-Ibarra and Kyli Gallington of the Public Health Institute (PHI) Survey Research Group (SRG) and builds upon the preliminary assessment completed by Global Impact Advisors (GIA) in October 2017.

Sample

The most recent, publicly available (as of May 2019) national datasets from the Demographic Health Surveys (DHS) and the AIDS Indicator Surveys (AIS) were used to calculate the total addressable market for MPTs and contraceptive method mix (n=134,187) and HIV prevalence (n=87,927) for the following President's Emergency Plan for AIDS Relief (PEPFAR) countries: Eswatini (DHS 2006-07), Kenya (DHS 2008-09), Lesotho (DHS 2014), Malawi (DHS 2015-16), Mozambique (DHS 2011, AIS 2015), Namibia (DHS 2013), Swaziland (DHS 2006-07), Tanzania (DHS 2015-16, AIS 2011-12), Uganda (DHS 2016, AIS 2011), Zambia (DHS 2013-14), and Zimbabwe (DHS 2015).

Because the sub-national variable V101, differed for the Uganda datasets (DHS 2016, AIS 2011), information from the online DHS Spatial Data Repository was used to recode the sub-national variable in DHS 2016 to match the region variable in AIS 2011.

Contraceptive method mix data were analyzed and mapped for these eleven countries.

Outcomes
This analysis had three outcomes of interest: the total addressable market for contraception (TAMC), HIV prevalence, and contraceptive method mix.

The ***total addressable market for contraception (TAMC)*** was calculated as: (weighted number of women who self-reported currently using a modern contraceptive + the weighted number of women who self-reported not currently using but intend to use in the future)/ total weighted number of women. The family planning variable, V364, was used to calculate the TAMC.

HIV prevalence was reported by positive blood test using variable HIV03. To calculate HIV prevalence among women by age and region using the most recent DHS dataset, the HIV file was merged with the individual recode file for each country (Eswatini, Kenya, Lesotho, Malawi, Namibia, South Africa, Zambia, and Zimbabwe). For countries that did not have an HIV file for the most recent DHS survey, the AIS file was used instead (Mozambique, Tanzania, and Uganda). Survey participants that had values of 'don't know' or 'refused' for HIV03 were excluded from the analyses.

Contraceptive method mix was calculated using DHS variable V312, current contraceptive method. In addition, a summary of current contraceptive method was calculated using the following categories: variable V313, which categorizes the contraceptive method as non-user, folkloric method, traditional method, or modern method.

Statistical Analysis
Weighted frequencies and percentages were calculated for all women stratified by 5-year age categories within region using PROC SURVEYFREQ in SAS, version 9.4 (Cary, North Carolina). The weight for women, V0005, was applied in the analyses for the TAMC and contraceptive method mix, and the weight for HIV, HIV05, was applied in the analyses of HIV prevalence. Both weight variables were normalized by dividing by 1,000,000 prior to using in analyses. Cluster and stratum variables were included in all analyses, as appropriate for each country and each outcome of interest.

Using the prevalence rates calculated in the weighted analyses, the percentage of women who represent the TAMC and the percentage of women who are HIV positive within each region and 5-year age category were used to build an interactive map using ArcGIS that ranks 'hot spots' where the TAMC and HIV prevalence are highest. The top three contraceptive methods by prevalence were ranked for each sub-national region in SAS.

Prevalence estimates were considered unstable if the confidence interval width was 20 or higher, the estimate was generated using a weighted count of 25 or less, or both. A filter was incorporated into the mapping tool to exclude unstable estimates, if desired.

As a quality control check for the statistical analysis programming, three sets of prevalence rates were calculated for each country using the same methods used in the statistical analysis for this study: the prevalence of women using a modern contraceptive method, the prevalence of current contraceptive method used among women, and HIV prevalence among women. These rates were compared to published rates in DHS/AIS reports to ensure they were the same.

All HIV prevalence data is sourced from cross-sectional surveys that test participants for HIV. HIV data were manually recorded from country reports or queried from the DHS StatCompiler tool using the "HIV prevalence among general population" indicator. This includes the HIV prevalence for men and women between the ages of 15 and 49 in the selected region. Data for the original ten PEPFAR countries mapped in 2018 were accessed on 4 May 2018; additional data for South Africa and for the contraceptive method mix were accessed 11 March 2019.

Geospatial Analysis and Mapping
Country boundary shapefiles were downloaded from the DHS Spatial Data Repository and reviewed to ensure that region names were consistent with the datasets. Boundary shapefiles were merged using ArcMap 10.6. The merged boundary shapefile was joined with the HIV prevalence, TAMC, and contraceptive method mix data files using an assigned common object ID. The final shapefiles were uploaded to Esri ArcGIS Online as separate map layers. The data was mapped to display HIV prevalence, proportion TAMC, top contraceptive methods, and proportion of contraceptive non-users by sub-national region for the 15-24 year old stratum. The HIV and TAMC map layers include data stratified by 5-year age groups, while the contraceptive method mix data is stratified by 15-24 years and 25-49 years. Prevalence and proportion data layers were classified into three classes using Natural Breaks. An additional map layer was created containing both HIV and TAMC data. This layer was mapped to display the relationship between HIV prevalence and TAMC proportion for the 15-24 year old stratum, using Esri's Smart Mapping Relationships feature. Both variables were classified into three classes using Natural Breaks and displayed on the map to show regions that are High, Medium, and Low for both variables. The map was programmed to display as a mapping tool using Esri WebApp Builder.

Results

The interactive mapping tool is available here. This tool includes features to change the view between map layers, filter results, and save images of the map for use in reports. It also allows for addition of other useful data indicators moving forward.

High HIV prevalence was classified as HIV prevalence >10.6, and high TAMC proportion was classified as TAMC >76.9 (

Table 1). Fifteen sub-national regions were identified that had both high HIV prevalence and high TAMC proportion (Table 2). Out of the eleven countries that were mapped, six had sub-national regions that were classified as both high HIV prevalence and high TAMC proportion.

Within the fifteen sub-national regions that were identified as 'hot spots', the most common contraceptive methods for females 15-24 years of age included male condom, injections, implant/Norplant, and pill (Table 3). Male condom was ranked the top contraceptive method in eleven out of the fifteen 'hot spot' regions (73%). In all fifteen 'hot spot' regions, the majority of females 15-24 years of age were not using a contraceptive method (range: 52.10% - 76.05%).

Limitations

There were several limitations to the analyses, including those resulting from available data and choice of indicators. These are elaborated on below.

Data limitations

Variation in the data sources was limited by use of DHS and AIS data, rather than choosing the newest data source available (UNAIDS, PHIA, PMA2020). The DHS surveys from which the data are pulled were completed in various years between 2006 and 2016. Furthermore, this prioritization is based on single points in time and does not incorporate trends, which may be important given the time horizon of an MPT product.

Indicator limitations

HIV prevalence and contraceptive use are imperfect indicators. HIV prevalence reflects the current burden of disease and historical pattern of transmission but does not necessarily reflect current HIV risk. The addressable market for contraceptives neither informs how to reach women with an unmet need for family planning, nor does it reflect the choices among family planning products women are choosing in a given region. Subsequent analyses may address these additional indicators.

This work also does not take population size into account and there is wide population variance at the sub-national level.

Next Steps

The analysis and mapping tool presented through this work serve as a solid base on which additional indicators may be added to better describe the MPT prioritized populations and inform where future MPT end-user research should be conducted. The next phase of this project aims to add HIV incidence data for these sub-national regions, contingent upon funding and availability of data. In addition, upon availability, HIV incidence data will be assessed, and the mapping tool will be updated. Other indicators will be determined in coordination with key IMPT advisors and members of the Supporting Agency Collaboration Committee (SACC). Together, this aims to inform future research that can clarify the PPCs for MPTs within these populations that can optimize MPT product impact and success.

Appendix 1

Figure 1. Image of mapping tool displaying the relationship between HIV prevalence and TAMC proportion for the 15-24-year-old stratum.
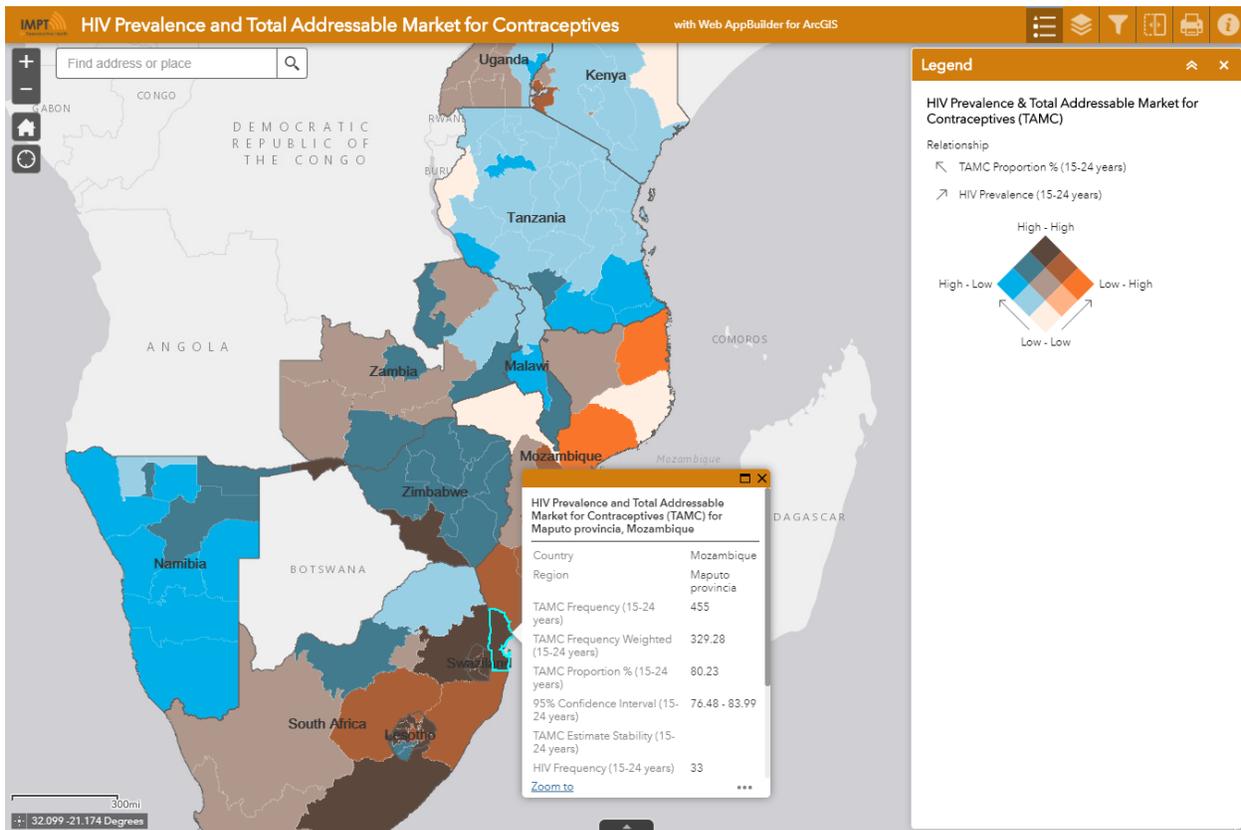
Figure 2. Image of mapping tool displaying four different visualization options in the 15-24 year old stratum

'Hot Spots', HIV Prevalence, TAMC and Contraceptive Method Mix among Women 15-24 in sub-Saharan Africa
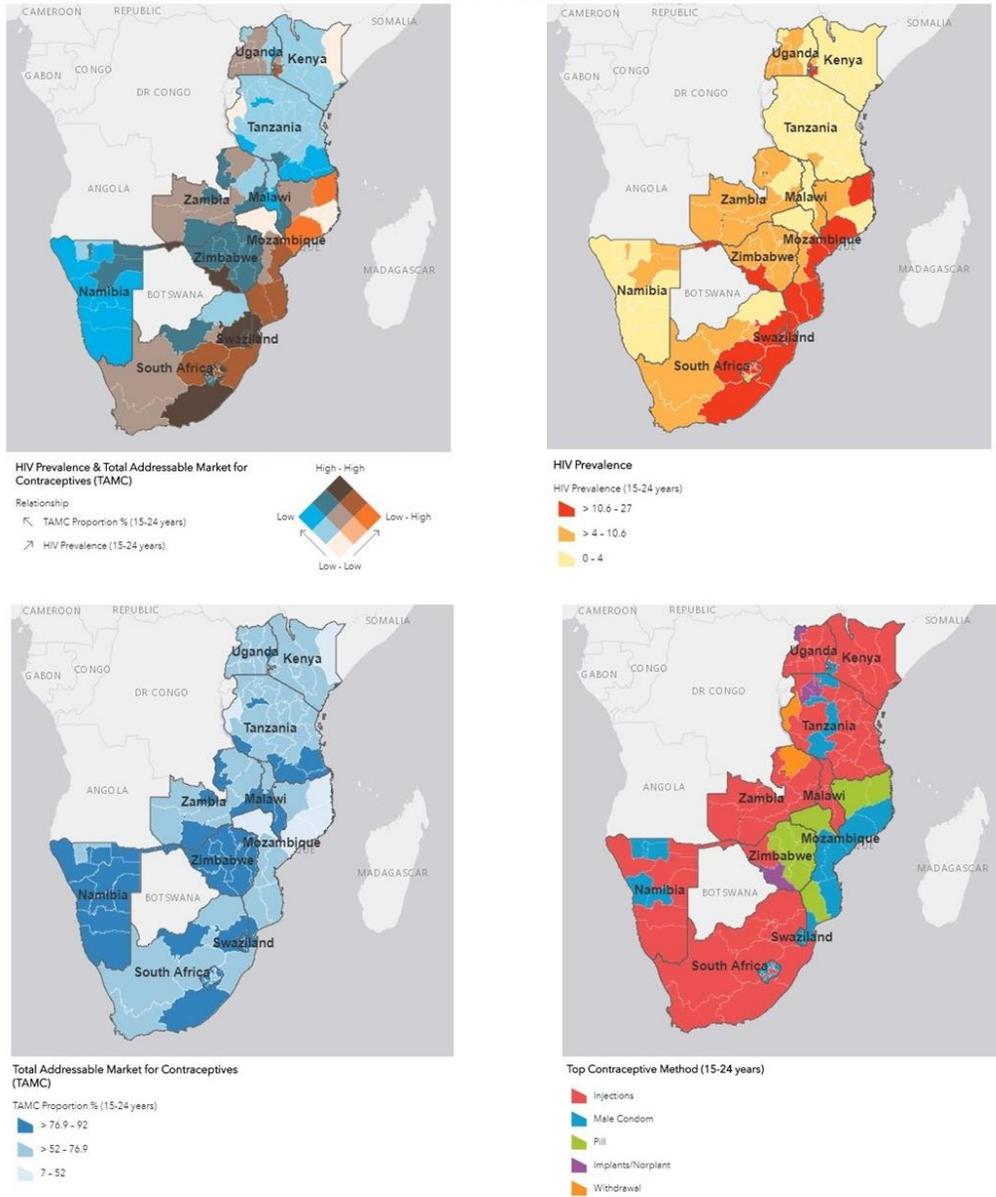
Table 1. Classifications for HIV prevalence and TAMC proportion.

Classification	HIV Prevalence	TAMC Proportion
High	>10.6	>76.9
Medium	>4 – 10.6	>52.0 – 76.9
Low	≤4	≤52

Table 2. Regions with high HIV prevalence and high TAMC proportion among 15-24 year old women, in order of HIV prevalence.

Region, Country	HIV		TAMC	
	Prevalence	95% Confidence Interval	Proportion	95% Confidence Interval
Hhohho, Eswatini	27.80	22.51 – 33.09	81.74	77.00 – 86.47
Shiselweni, Eswatini	21.89	18.25 – 25.53	89.24	87.04 – 91.44
Manzini, Eswatini	20.65	16.35 – 24.96	86.67	83.09 – 90.26
Lubombo, Eswatini	20.47	16.84 – 24.10	87.54	83.96 – 91.13
Caprivi, Namibia	19.25	11.39 – 27.10*	87.09	82.68 – 91.49
Mpumalanga, South Africa	19.90	7.60 – 32.19*	79.63	75.96 – 83.31
Matabeleland South, Zimbabwe	16.11	12.22 – 20.01	83.67	79.53 – 87.82
Maseru, Lesotho	15.89	10.04 – 21.75	84.14	80.64 – 87.64
Maputo provincia, Mozambique	15.66	10.92 – 20.39*	80.23	76.48 – 83.99
Eastern Cape, South Africa	15.62	8.57 – 22.68*	84.14	79.81 – 88.48
Mafeteng, Lesotho	14.07	8.14 – 19.99*	83.85	78.90 – 88.80
Leribe, Lesotho	12.42	6.70 – 18.15	85.46	81.27 – 89.64
Berea, Lesotho	11.84	6.79 – 16.88*	83.52	79.06 – 87.98
Qacha's-nek, Lesotho	11.74	4.37 – 19.12*	85.03	79.76 – 90.30
Mokhotlong, Lesotho	10.98	5.60 – 16.36*	79.03	74.14 – 83.92

*HIV prevalence estimate is statistically unstable.

Table 3. Top contraceptive method and proportion of non-users among 15-24 year old women in regions with high HIV prevalence and high TAMC proportion in order of HIV prevalence.

Region, Country	Top Contraceptive Methods			Contraceptive Non-Users	
	Method 1	Method 2	Method 3	Proportion (%)	95% Confidence Interval
Hhohho, Eswatini	Male Condom	Injections	Pill	72.38	67.58 - 77.17
Shiselweni, Eswatini	Male Condom	Injections	Pill	73.88	70.86 - 76.9
Manzini, Eswatini	Male Condom	Injections	Pill	71.77	67.67 - 75.85
Lubombo, Eswatini	Male Condom	Injections	Pill	71.00	66.5 - 75.49
Caprivi, Namibia	Injections	Male Condom	Pill	52.10	45.77 - 58.43
Mpumalanga, South Africa	Injections	Male Condom	Pill	57.25	51.03 - 63.46
Matabeleland South, Zimbabwe	Implants/ Norplant	Pill	Injections	67.11	62.02 - 72.2
Maseru, Lesotho	Male Condom	Injections	Pill	64.46	59.42 - 69.49
Maputo provincia, Mozambique	Male Condom	Pill	Injections	67.55	63.23 - 71.87
Eastern Cape, South Africa	Injections	Male Condom	Implants/ Norplant	46.56	41.22 - 51.89
Mafeteng, Lesotho	Male Condom	Pill	Injections	68.95	63.84 - 74.05
Leribe, Lesotho	Male Condom	Injections	Pill	59.47	54.16 - 64.76
Berea, Lesotho	Male Condom	Injections	Pill	61.87	54.44 - 69.29
Qacha's-nek, Lesotho	Male Condom	Injections	Pill	60.95	54.03 - 67.85
Mokhotlong, Lesotho	Male Condom	Injections	Pill	76.05	70.06 - 82.04

*HIV prevalence estimate is statistically unstable.

Appendix 2
Summary table of report updates

Date Updated	Substantive Changes
September 2019	DHS data for South Africa were analyzed and added to the map. Contraceptive method mix data for all eleven countries were analyzed and added to the map. Swaziland was changed to Eswatini.