Modelling Summary | PrEP and microbicide modelling study literature review

OPTIONS collected a total of 64 modelling studies, reviews and analyses[1] focused on the impact, cost, cost-effectiveness, drug resistance and other parameters of both pre-exposure prophylaxis (PrEP) and microbicides. We searched peer reviewed journals and abstracts using key terms, the snowball method, and mining of study collections from project partners. Study publication dates range from 2003 to 2016. Study types included modelling on public health impact and cost-effectiveness as well as reviews of existing modelling work.

Of these studies, 46 looked at PrEP, 16 at microbicides and one at both PrEP and microbicides. Of these, eight studies are meta-analyses or reviews focused on PrEP and look at impact, cost-effectiveness and drug resistance. PrEP-focused meta-analyses and reviews conclude that PrEP can be highly effective as part of an integrated prevention package, but that the extent of the impact of PrEP will depend on cost, population and geographic prioritization, coverage and adherence.

The aim of this literature review was to identify the scope of the completed PrEP and microbicide modelling as part of an assessment to identify current modelling needs. This literature review did not attempt to assess the quality of the work but rather to identify the work and obtain a broad overview of the findings.

Findings | PrEP focused modelling summary of findings

Nearly all models looking at impact found significant benefit to implementing PrEP within the population under study, with varying degrees of impact and with different approaches (i.e., PrEP packages and combination prevention packages). Those studies modelling combination approaches found PrEP had impact, along with treatment, male circumcision and other interventions. Studies also modelled "focused" PrEP vs. "general" PrEP; some found that focusing PrEP on populations most at risk had more impact than providing PrEP to the general population. Two modelling studies, one looking at FSW (*Cremin, 2014*) and another at MSM (*Kessler, 2014*) found that providing PrEP to all FSW or MSM regardless of risk of acquisition averts more infections than providing PrEP to only those FSW or MSM at highest risk; however, the cost per infection is much higher.

Most modelling studies looking at cost and cost-effectiveness concluded that while PrEP can confer significant benefit, it requires substantial expenditure. One study projected that a large reduction in incidence cannot happen unless the cost of PrEP is reduced (*Cremin, 2013*). Several studies found that maximal cost-effectiveness is achieved by providing treatment to a greater number of infected individuals earlier rather than providing PrEP to uninfected individuals. Additionally, some modelling predicted that for PrEP to be most cost-effective it should be used before treatment reaches a saturation level while noting that early treatment alone cannot reduce HIV incidence enough (*Cremin, 2013; Pretorius, 2010; Supervie, 2011*).

Looking at population-specific data, one modelling study found that PrEP is cost-effective in the general adult population only in countries that have high levels of HIV burden and low levels of male circumcision (*Verguet, 2013*). Many modelling studies found PrEP a cost-effective intervention among MSM, and two studies found PrEP cost-effective in women in South Africa (*Walensky, 2012*) and young women in South Africa (*Schackman, 2012*). In sero-discordant couples, one modelling study found that PrEP is cost-saving overall: if the annual cost of PrEP is less than 40 percent of the

[1] Note, full CROI abstracts prior to 2015 are currently unavailable.

annual cost of ART and PrEP is 70 percent effective, providing PrEP to the uninfected partner can be at least as cost-effective as initiating ART in the infected partner (*Hallett, 2011*). Models also looked at adherence, and how the cost increases as adherence to PrEP goes down. One study modelled the cost estimated for PrEP provision in southwest Kenya to help the government implement combination prevention programs (*Chen, 2014*).

In the studies that modelled drug resistance, the resistance assumptions used influenced the projected impact of PrEP in the model. One study concluded that drug resistance from treatment is predicted to exceed that from PrEP use (*van de Vijver, 2013*). Another study found that if treatment and PrEP use the same ARVs they prevent less infections and increase resistance more than if they use different types of ARVs (*Abbas, 2013*).

The following parameters were looked at in the studies collected:

Measures/includes	*Total*	*PrEP*	*Microbicide*	*Both*
Impact	**37**	25	11	1
Cost/cost-effectiveness	**27**	23	3	1
Drug resistance	**15**	14	1	0

Studies and reviews specifically identified the following populations:

Population	*Total*	*PrEP*	*Microbicide*	*Both*
Heterosexual serodiscordant couples	**3**	3	0	0
Female sex workers (FSW)	**8**	5	3	0
Young women	**4**	3	1	
Men who have sex with men (MSM)	**15**	12	3	0
Young MSM	**2**	2	0	0

Studies and reviews focused on the following geographic areas:

Region	*Total*	*PrEP*	*Microbicide*	*Both*
East, South and South-East Asia	**6**	2	4	0
North America	**8**	7	1	0
South America and Caribbean	**3**	2	1	0
Sub-Saharan Africa	**37**	29	7	1
Eastern Europe and Central Asia	**2**	1	1	0

Countries looked at in the studies and reviews collected include:

Microbicide	*(Number of studies)*
Benin	3

India	4
Peru	1
South Africa	5
US	1
Uganda	1
PrEP	
Botswana	2
India	1
Kenya	5
India	1
Lesotho	1
Mozambique	1
Peru	2
South Africa	15
Ukraine	1
US	8
Zambia	2
Zimbabwe	1

Conclusions

This literature review highlights that PrEP, and to a lesser extent microbicides, have been extensively modelled. Some areas that may merit further exploration include costs of PrEP and microbicide delivery, factors that influence those costs, and ways to optimize the impact of PrEP and microbicide among specific populations. Additionally, modelling of PrEP within combination prevention programs and packages and in the context of scaling up treatment to reach the 90-90-90 goals will be important. Modelling PrEP for specific populations and geographies could be useful to highlight maximum cost-effectiveness and incidence reduction. Modelling to address the specific epidemic contexts where PrEP, and a possible microbicide, will be rolled out may be an important element to ensuring that policies and programs move forward sustainably and effectively.

This program is made possible by the generous assistance from the American people through the U.S. Agency for International Development (USAID), in partnership with PEPFAR. Financial assistance was provided by USAID to FHI 360, Wits RHI, and AVAC under the terms of Cooperative Agreement No. AID-OAA-A-15-00035. The contents do not necessarily reflect the views of USAID or the United States Government.