Modeling health impact of global health programs implemented by Population Services International

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Abstract

: Global health implementing organizations benefit most from health impact estimation models that isolate the individual effects of distributed products and services - a feature not typically found in intervention impact models, but which allow comparisons across interventions and intervention settings. Population Services International (PSI), a social marketing organization, has developed a set of impact models covering seven health program areas, which translate product/service distribution data into impact estimates. Each model's primary output is the number of disability-adjusted life-years (DALYs) averted by an intervention within a specific country and population context. This paper aims to describe the structure and inputs for two types of DALYs averted models, considering the benefits and limitations of this methodology.

t : PSI employs two modeling approaches for estimating health impact: a macro approach for most interventions and a micro approach for HIV, tuberculosis (TB), and behavior change communication (BCC) interventions. Within each intervention country context, the macro approach determines the coverage that one product/service unit provides a population in person-years, whereas the micro approach estimates an individual's risk of infection with and without the product/service unit. The models use these estimations to generate per unit DALYs averted coefficients for each intervention. When multiplied by program output data, these coefficients predict the total number of DALYs averted by an intervention in a country.

t : Model outputs are presented by country for two examples: Water Chlorination DALYs Averted Model, a macro model, and the HIV Condom DALYs Averted Model for heterosexual transmission, a micro model. Health impact estimates measured in DALYs averted for PSI interventions on a global level are also presented.

: The DALYs averted models offer implementing organizations practical measurement solutions for understanding an intervention's contribution to improving health. These models calculate health impact estimates that reflect the scale and diversity of program operations and intervention settings, and that enable comparisons across health areas and countries. Challenges remain in accounting for intervention synergies, attributing impact to a single organization, and sourcing and updating model inputs. Nevertheless, these models demonstrate how DALYs averted can be viably used by the global health community as a metric for predicting intervention impact using standard program output data.

Background

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[illegible] 43-7 % [illegible] 15. [illegible] 16. [illegible] (. [illegible]). [illegible] 20 [illegible] 20 [illegible].

[illegible] 17,1 [illegible] 3% [illegible] ([illegible] (0.03, 0)).

[illegible] 1( )-1([illegible]

[illegible]

Household-years of protection = (N [illegible])

/([illegible] * [illegible] * 365)

* ([illegible]) * (1 − [illegible]) (1)

[illegible]

Diarrhea cases averted among children under five per unit of product

= í 6 6 6 í 6 (3)

* 6

Diarrhea deaths averted among children under five per unit of product

= í 6 6 6 í 6 (4)

* 6 6

DALYs averted among children under five per unit of product

= (6 6 í 6* 6 í

* 6 6 í)

\+ 6 6 6 í 6 (5)

* (í 6 – 6 6 í)

(6 63% í í 6)

HI C m DAL A

M m (m)

(. ., (. ., , .).

5 ( ). 5(6 61( )7)-63.01 1 (( )-335( )-)-33

5-1(.-362(-2 63)6-3 54))-357((4( )-3 63)6 57(()-3 5) 54 1)-33.0143 (6)1

[illegible]

$$P = 1 - \prod_{\substack{i=regular\\ casual\\ commercial}} (1 - P_i) = 1 - \prod_{\substack{i=regular\\ casual\\ commercial}} (1 - p_i * (1 - (1 - \gamma_i)^{n_i})^{m_i}) \qquad (\ )$$

[illegible], p_i [illegible]

[illegible]

Estimated number of new infections averted per condom per year

= (R 6 HI 6

/ 6 6 PSI)

* (1 – 6) ( )

[illegible] (1 -) [illegible]

[illegible]

Table 7 DALYs averted for *PUR* by PSI programs in 2012*, by country

t -	t t *P R*	2012 *P R* t	t - t *P R*, 2012
Congo-Kinshasa	0.000195	3,729,019	728
Dominican Republic	0.000032	758,640	24
Ethiopia	0.000150	5,665,462	847
Kenya	0.000120	7,374,447	885
Panama Warehouse**	0.000041	2,411,040	99
Malawi	2542(7030)]TJlaw12,017,029	1,648	

2,430 [illegible] ([illegible]) [illegible] 2012, [illegible]

[illegible] 4[illegible]
[illegible] 2012 [illegible]

therapy; AZT: zidovudine; NVP: nevirapine; MC: male circumcision; PLHIV: people living with HIV; LLINs: long-lasting, insecticide-treated nets; ACT: artemisinin-based combination therapy; RDT: rapid diagnostic testing; DOTS: directly observed therapy, short-course; WHO: World Health Organization; DHS: Demographic and Health Survey; UNAIDS: Joint United Nations Programme on

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