

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

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## Abstract

**Background:** 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.

**Methods:** 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.

**Results:** 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.

**Conclusions:** 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

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.

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The following table shows the number of household-years of protection for each household in the sample. The total number of household-years of protection is 365.

$$\text{Household-years of protection} = \frac{N \times 365}{(1 - \text{fraction of households with protection})} \quad (1)$$

The fraction of households with protection is 0.1, so the number of household-years of protection is 365 / (1 - 0.1) = 405.5.

Diarrhea cases averted among children under five per unit of product

$$= \frac{1}{6} \left( \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \right) \quad (3)$$

Diarrhea deaths averted among children under five per unit of product

$$= \frac{1}{6} \left( \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \right) \quad (4)$$

DALYs averted among children under five per unit of product

$$= \left( \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \right) + \left( \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \right) \cdot (1 - 0.63) \quad (5)$$

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$$P = 1 - \prod_{i=regular} (1 - P_i) = 1 - \prod_{i=regular} (1 - p_i * (1 - (1 - \gamma_i)^{m_i}))$$

$$P_i = p_i * (1 - (1 - \gamma_i)^{m_i})$$

**Estimated number of new infections averted per condom per year**

$$= (R - 1) * \sum_{i=regular} (1 - P_i) * \text{PSI}$$

$$= (R - 1) * \sum_{i=regular} (1 - p_i * (1 - (1 - \gamma_i)^{m_i})) * \text{PSI}$$



**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		

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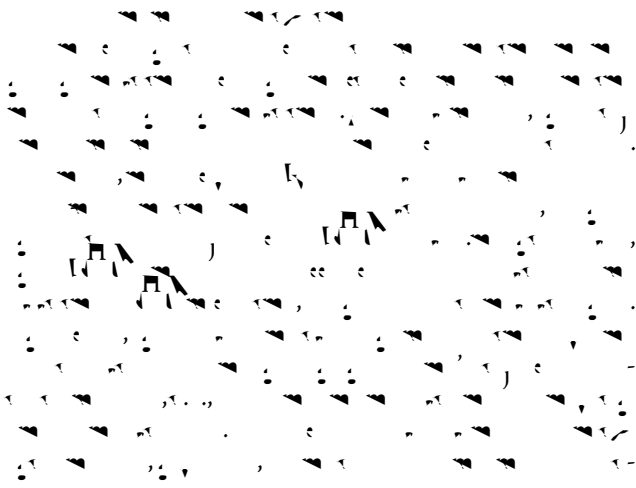
1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud. The text notes that without reliable records, it would be difficult to track the flow of funds and to identify any irregularities.

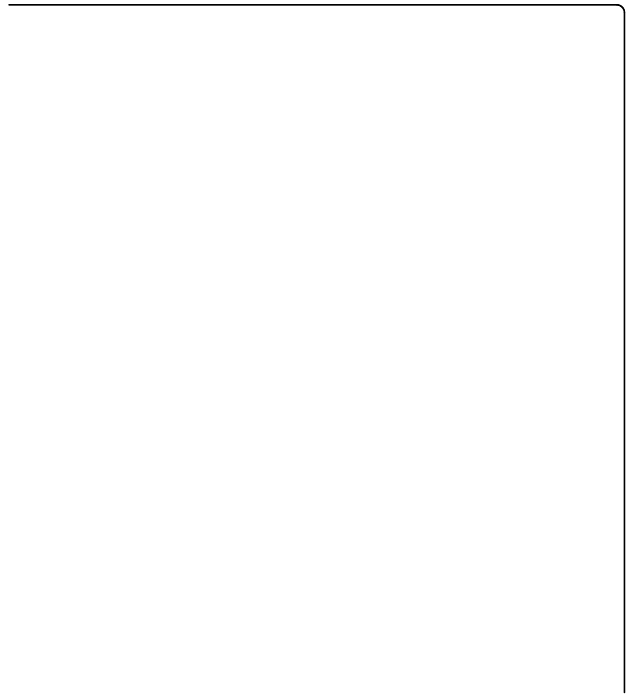
2. The second part of the document focuses on the role of internal controls in ensuring the accuracy and reliability of financial information. It describes how internal controls are designed to prevent errors and to detect any unauthorized transactions. The text highlights that internal controls are a key component of an organization's risk management strategy and are essential for maintaining the trust of stakeholders.

3. The third part of the document discusses the importance of transparency and accountability in financial reporting. It notes that organizations should provide clear and concise information about their financial performance and should be open to external scrutiny. The text emphasizes that transparency is essential for building trust and for ensuring that the financial system is fair and equitable.

4. The fourth part of the document discusses the role of external audits in providing an independent assessment of an organization's financial statements. It notes that external audits are essential for ensuring the accuracy and reliability of financial information and for providing assurance to stakeholders. The text highlights that external audits are a key component of an organization's risk management strategy and are essential for maintaining the trust of stakeholders.

5. The fifth part of the document discusses the importance of ongoing monitoring and evaluation of financial performance. It notes that organizations should regularly review their financial performance and should be open to feedback from stakeholders. The text emphasizes that ongoing monitoring and evaluation are essential for identifying areas for improvement and for ensuring that the financial system is effective and efficient.







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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