Use of Routine Data in Evaluation:
Technical Brief

July 2020

Initial Evidence of Reduction of Malaria Cases and Deaths in Rwanda and Ethiopia Due to Rapid Scale-Up of Malaria Prevention and Treatment

This document is part of a series that describes how routine data were used in research and evaluations of health programs and projects. Data for Impact (D4I) has compiled these examples from its own work and the work of others found through a literature review—and consultation with the original authors—to compare ways routine data can be appropriate for evaluations and to shed light on its benefits and shortcomings for evaluation.

A companion guidance document compiling these lessons is available at the D4I website. This suite of materials may be useful for others contemplating using available and routine data in their own work.

This brief describes an impact evaluation conducted in Rwanda and Ethiopia using routine data to determine if four key interventions were effective in reducing malaria incidence and mortality. Read the full report here.

Program Description

The increases in funding for disease control and prevention occasioned by new funding mechanisms, such as The Global Fund to Fight AIDS, Tuberculosis and Malaria, has led to ambitious targets for reducing the global disease burden (Dieleman et al., 2015). For malaria, the global community committed that, by 2010, it would reduce cases and deaths attributable to malaria by 50 percent through increased coverage (more than 80%) of four key interventions: (1) treatment with artemisinin-based combination therapy (ACT), (2) distribution of long-lasting insecticide-treated bed nets (LLINs), (3) vector control via indoor residual spraying (IRS), and (4) intermittent preventive treatment in pregnancy (IPT). These interventions are child survival targets set out in the Millennium Development Goals (MDGs) by the World Health Organization in 2014. They were scaled up in Rwanda and Ethiopia between 2005 and 2007.

Intervention

LLINs were distributed as part of measles vaccination campaigns and ACTs were made available to all patients diagnosed with malaria. For example, in Rwanda, nearly two million LLINs were distributed in September 2006 in a country of eight million people. Coverage surveys eight months after distribution of the nets indicated that 60 percent of children under five years old were sleeping under bed nets. In Ethiopia, approximately 14 million LLINs were distributed by the end of 2007 and more than 10 million doses of ACT were administered for a population of 55 million, all of whom were at risk of malaria transmission. Surveys at the time (December 2007) indicated that 65 percent of households in areas at less than 2,000 meters elevation had at least one LLIN.

Rationale for the Use of Routine Data

Researchers recognized the need for frequent and rapid evaluation to gauge the effectiveness of these costly interventions to reduce malaria transmission. Given the fact that frequent evaluation is expensive, a secondary objective of the research in Rwanda and Ethiopia was to test the premise that such evaluations could be conducted using easily-accessible and already-available data from health facility records of service delivery or, conversely, if special studies were required.

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Evaluation Questions

At the end of 2007, researchers sought to evaluate the impact of these efforts on the malaria disease burden. Routine data were used to answer these questions:

- What was the change in malaria disease burden, as measured using the rate of malaria cases and deaths (both inpatient and outpatient) from baseline through the intervention period?
- How rapid was the impact of the intervention observed after scale-up?
- Can routine data be used to assess the impact of the interventions (i.e., could impact be measured with routine data alone or are special studies, with novel data collection, required)?

Additionally, the researchers sought to understand the causal relationship between the coverage targets and the disease control goals—that is, does 50 percent disease reduction require 80 percent coverage of all interventions or can partial coverage of selected interventions more efficiently achieve the goal? For this question, non-routine data sources were used to complement the routine data, including coverage survey data such as Demographic and Health Surveys (DHS) and the Multi-indicator Cluster Surveys for Malaria (MICS). This brief does not discuss those data.

Data Description and Data Management

Data were abstracted from outpatient registers in primary care facilities and from inpatient registers in hospitals. The data elements abstracted were malaria cases and deaths (<5 years of age, and ≥ 5 years of age). Monthly values for study data elements were abstracted for the total study period (baseline through intervention). Two-person data collection teams spent two days in each target facility over two weeks.

The principal indicator of impact was the percentage change in the number of inpatient malaria cases and deaths in children under age five before the intervention (2001–2005/2006) and after (2007). Data were stratified in two age groups, under age five and age five years and older, for all indicators.

In sampling health facilities, researchers sought a wide geographic representation of areas with stable transmission of *Plasmodium falciparum* malaria. In Ethiopia, two districts were selected in each of four regions with moderately endemic malaria. In Rwanda, two districts were sampled in all five provinces, with one rural health center and one rural hospital selected in each district. Facilities without complete data for the pre-intervention and post-intervention phases were excluded. Ultimately, the sample included data from 13 sites in Ethiopia and 19 sites in Rwanda.

Assessment of Usability and Quality of Data

Facilities were excluded if they didn't have data for the entire study period. The reference period for Rwanda was 2001–2006 and 2001–2005 for Ethiopia. In Rwanda only one facility was excluded, but in Ethiopia seven facilities had to be excluded (leaving just 13). For facilities with only one or two missing values, data were imputed to fill the gaps. In Ethiopia, inpatient data were imputed for 15 of 586 health-facility-months. In Rwanda, outpatient data were imputed for 55 of 1,595 health-facility-months and inpatient data for one of 133 facility-years.

Data Analysis Methods Used

The analysis sought to detect significant changes in malaria cases and deaths before and after the introduction of ACTs and LLINs. Data from January 2007 to October 2007 were compared with the average of the pre-intervention period, restricted to data from January to October for all years. In addition, time trends in indicators unrelated to the intervention—such as population growth and improved access to health services—were also measured.

Observed values for malaria cases and deaths for children under five years old from the intervention period were compared with expected values based on the linear trend from the pre-intervention period, using linear regression and 2-tailed Student's T-tests for assessing the statistical significance of the difference between observation and expectation. Declines in indicators greater than what was expected from the trend could thus be attributable to the interventions.

Limitations in Using Routine Data for Evaluation

The major limitation is that routine data available on malaria cases and deaths was only available for people who accessed care through the public health care system. The contribution to reduction of cases and deaths in private health facilities is unknown. Also, incomplete data reduced the sample size, as some facilities had to be excluded and this exclusion impacted our ability to detect differences between the baseline and intervention periods.

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What Worked Well?

Using routine data, researchers were able to clearly demonstrate dramatic reductions (~50% or higher) in both inpatient cases and deaths and in outpatient, laboratory-confirmed malaria cases attributable to malaria. Less clear was if the reduction in cases and deaths was attributable to the interventions or if the interventions merely contributed to the reduction. However, given the savings in time and resources by using available data as opposed to primary data collection, the approach shows great promise for regular and rapid assessment of effectiveness for public health interventions.

Conclusion

One goal of the study in Rwanda and Ethiopia was to determine if this type of program evaluation could be conducted using exclusively routine data from available health management information systems (HMIS). The data for the study were abstracted in 2008 from facility HMIS registers and reports. The indicators in question were malaria inpatient and outpatient cases and deaths, stratified on age (>= 5 yrs., < 5 yrs.). Increasingly, with the proliferation of standardized electronic data management and reporting systems—for example, the District Health Information Software, version 2 (DHIS2)—these facility-level data elements are being reported to the national level and are accessible from a desktop, obviating the need to travel to health facilities for data collection.

As LLINs and ACTs become more widely available and as malaria incidence decreases, malaria epidemiology will change in many countries from stable and endemic to unstable and epidemic. Monitoring of disease incidence and the effectiveness of interventions will need to become more continuous and regular to keep pace with changes in malaria epidemiology. Additionally, the ambitious targets of global disease control initiatives (e.g., the MDGs and the UN Sustainable Development Goals for 2030, adopted in 2015) and increases in funding available from large multi-national disease control and prevention programs will require that countries have cost-effective mechanisms for conducting impact evaluations to justify funder investments in particular interventions. This study shows that routine data is an effective source of information on program effectiveness that can be accessed more frequently, and at far lower cost, than special surveys would require.

References

Dieleman, J. L., Graves, C., Johnson, E., Templin, T., Birger, M., Hamavid, H., Freeman, M., Leach-Kemon, K., Singh, L., Haakenstad, A., & Murray, C. J. L. (2015). Sources and focus of health development assistance, 1990-2014. *Journal of the American Medical Association*, 313(23), 2359–2368. https://doi.org/10.1001/jama.2015.5825

World Health Organization (WHO). (2014, December). Millennium Development Goals (MDG) 6: combat HIV/AIDS, malaria and other diseases. WHO; World Health Organization. https://www.who.int/topics/millennium_development_goals/diseases/en/

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