Use of Routine Data in Evaluation:
Technical Brief

June 2020

Improving Maternal and Child Health Outcomes in Kenya:

Impact of the Free Maternity Service Policy on Healthcare Use and Lives Saved

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 evalu ations 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.

The work described in this brief was conducted by the Health Policy Project and its successor project, Health Policy Plus, funded by the United States Agency for International Development (USAID). The evaluators who conducted the work are Zetianyu Wang and Arin Dutta, Palladium, of the Health Policy project. The case study was written by Lyubov Teplitskaya, Palladium.

Program Description

In 2013, Kenya's maternal mortality ratio remained well above World Health Organization (WHO) targets, at 364 maternal deaths per 100,000 live births (WHO, UNICEF, United Nations Population Fund [UNFPA], World Bank Group, and the United Nations Population Division, 2019). To lower maternal mortality, the government introduced the Free Maternity Service Policy in June 2013, which eliminated user fees for maternal health services at all public facilities, including hospitals. The government compensated public health institutions at a fixed rate for all costs, including registration, medicines, services, food provided during pregnancy, delivery (including Caesarean delivery), and postnatal care for all patients (Ministry of Health, 2015).

Evaluation Questions

This study, conducted by the Health Policy Project and its successor project, Health Policy Plus, funded by the United States Agency for International Development, answered the following questions:

- What is the impact of the Free Maternity Service Policy on the use of maternal healthcare?
- How many maternal and neonatal deaths were averted due to the Free Maternity Service Policy?

Rationale for the Use of Routine Data

The study aimed to assess the effect of Kenya's Free Maternity Service Policy on maternal healthcare use and maternal and newborn health (MNH) outcomes. The introduction of the policy nationwide served as a natural experiment, allowing for the application of quasi-experimental methods to evaluate the effect of the intervention. One such method, interrupted time series (ITS) analysis, is increasingly being used to measure the impact of public health legislation or interventions, and is known as the "next best" approach for quantifying the impact of an intervention when randomization is not possible. ITS analysis was also selected because its results can be used in such tools as the Lives Saved Tool (LiST) to estimate the number of deaths averted due to a policy.

Routine data is optimal for use in these analyses as they are collected frequently, giving them an advantage over special surveys. In the

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Kenya instance, routine data, such as those collected through the District Health Information Software, version 2 (DHIS2), platform, could provide monthly data points for ITS analyses, which require a time series, or a continuous sequence of observations on a population taken repeatedly (normally at equal intervals) (Bernal, Cummins, & Gasparrini, 2017). Monthly routine data, such as are contained in DHIS2, were preferred over surveys conducted quarterly or annually because those surveys do not normally fulfill the requirements for time series data analysis. The DHIS2 data were obtained through a formal request to the Ministry of Health (MOH).

Data Description and Data Management

Aggregated monthly national-level data from all 47 counties in Kenya's DHIS2 from the period January 2011 to July 2015 were transferred into Stata version 14. The analysis focused on five outcomes of interest in the DHIS2: (1) outpatient visits by children under five (OPDU5); (2) outpatient visits by females over five (OPDO5F); (3) four or more antenatal care visits (ANC4); (4) normal deliveries at facilities (NDEL); and (5) postnatal care visits (PNC). To understand the policy's effect on different health facility types, the data were exported into Stata, disaggregated by ownership: MOH, faith-based organization (FBO), and private-for-profit (PFP).

Assessment of the Usability and the Quality of the Data

The completeness of reporting by facilities was assessed. The average reporting rates during the period January 2011 to July 2015 were: MOH, 69 percent complete; FBO, 71 percent complete; and PFP, 65 percent complete. Reporting rates improved from 2011 to 2015, with the average reporting rates exceeding 75 percent for all facilities in 2014. Assumptions about the performance of non-reporting facilities were made using an adjustment factor based on comparison with Kenya Demographic and Health Survey (DHS) data. Reporting rates for specific coverage indicators were also looked at and the evaluators did not consider using indicators for which the data were incomplete. Outliers in the data were detected using a box plot method, with outliers including data below the first quartile (25th percentile) or above the third quartile (75th percentile). For each variable, outlier values were replaced with the mean value in the observations, excluding all outliers. Seasonal factors are known to influence the use of maternal and child healthcare (Fahey, Chevrier, Crause, Obida, Bornman, & Eskenazi, 2019; Makanga, et al., 2017) and, consequently, the DHIS2 raw data were adjusted for seasonality before conducting the ITS analysis. A seasonal factor was first defined as the ratio of the average value for the same month (e.g., average NDEL for January) and the average value of the whole series (e.g., the average value of all NDEL observations). Each value for the same month was then divided by a seasonal factor for that month.

Data Analysis Methods Used

To answer the first study question, the impact of Kenya's Free Maternity Service Policy on the use of maternal and newborn healthcare was evaluated using the ITS analysis. Ordinary least squares regression with a time series specification was used to predict monthly trends in each outcome of interest before the policy was implemented (January 2011–May 2013) and after the policy was introduced (June 2013–August 2015). Using this model, the evaluators examined the immediate policy effect by looking at the level change of trend in each outcome of interest right after the policy intervention. The policy effect over time was also assessed by examining the slope change of trend for each outcome of interest after the policy intervention. The following model was used for intervention (i):

$$Y=\beta\_0+\beta\_1\ time(t)+\beta\_2\ level(i)+\beta\_3\ trend(it)+\varepsilon$$

Where is the value of the indicator of interest, time is a continuous variable ranging from 1 (start of the period, January 2011) to 55 (end of the period, July 2015), and intervention is a binary variable with the period before policy intervention coded as 0 and the period thereafter coded as 1.

- β_0 is the intercept term, or the starting level of the outcome variable at the beginning of the period.
- β_1 captures the trend of the outcome variable before the intervention.
- β_2 reflects the change in the level of the outcome after the intervention.
- β_3 manifests the slope change in the trend for the outcome after the intervention.
- ε is the error term.

The models were constructed using the "itsa" command in Stata 14.

To answer the second study question, the ITS healthcare utilization results in the LiST analysis were used to estimate the number of maternal and neonatal deaths averted as a result of the Free Maternity Service Policy. LiST is a mathematical modelling tool that allows users to estimate the impact of coverage change (such as due to a policy or intervention) on mortality. The evaluators then translated the trends in selected

healthcare service use from 2013 to 2015 into coverage of interventions in LiST, which is embedded in Spectrum 5, using 2012 as the baseline year.

The MNH interventions in the DHIS2 did not perfectly align with the interventions used as inputs in LiST. To address this, specific formulas were used to translate ITS coverage to the corresponding MNH intervention coverage in LiST. For example, coverage of normal delivery using the ITS analysis results needed to be translated into inputs in LiST, including skilled birth attendance (SBA) coverage and coverage of postnatal practices. It was assumed that health facility delivery coverage corresponded to coverage of postnatal practices. Because it is possible for mothers to deliver in a health facility with the aid of a non-skilled birth attendant, SBA coverage was adjusted in LiST using data from the DHS 2008 and DHS 2014. (See the appendix for details.)

The results of the LiST analysis is a projection of how many neonatal and maternal deaths were averted from 2013 to 2015, compared with the situation in which the coverage of all health interventions remained at the same level as in 2012. The evaluators developed a counterfactual projection to account for the pre-policy coverage trend had the policy not occurred, assuming that there were no additional external factors affecting the trend other than the policy intervention at hand. The counterfactual coverage of interventions in LiST was projected using the initial trend of indicators revealed in the ITS analysis. By subtracting the counterfactual numbers from the real-world numbers, what remained was the number of neonatal and maternal deaths averted specifically due to the policy.

Limitations in Using Routine Data for Evaluation

Incomplete facility reporting and lack of alignment between the DHIS2 intervention coverage and LiST service coverage were the most significant limitations faced during this analysis. Because every health facility in Kenya did not report data to the DHIS2, it was assumed that the facilities included in the DHIS2 were nationally representative. Because the DHIS2 does not report all possible healthcare use data, the evaluators also made several assumptions to translate the DHIS2 data into national coverage of interventions in the LiST analysis. For example, whereas the DHIS2 records data on the number of normal deliveries by facility, it does not record the number of deliveries assisted by a SBA or coverage of clean postnatal practices, which were data required as input into the LiST analysis. As such, some assumptions needed to be made using DHS data to estimate SBA coverage.

Moreover, DHIS2 data were not available for each year on the proportion of facilities that could provide essential care, basic emergency obstetric care, and comprehensive emergency obstetric care. The proportions for 2014 and 2015 were therefore extrapolated based on data available for 2013 and 2016.

Labor Requirements

This study required a master's-level quantitative analyst to aggregate, clean, and process the DHIS2 data and to perform the necessary quality checks and improvements, comprising a level of effort (LOE) of about 10 days. The quality improvements made also required background research on best practices for routine data. The analysts needed to have the technical capacity to conduct regression analyses, such as the ITS analysis. Moreover, when conducting an evaluation of the impact of an intervention on mortality, the analysts needed to learn how to use other models or tools, such as LiST. Translating healthcare use coverage from the ITS analysis results into LiST required further background research on available national-level results in Kenya, such as DHS findings. The ITS and LiST analyses required a LOE of 30 to 40 days following DHIS2 data cleaning. In addition, as was done in this study, high-level conceptualization by a PhD-level research investigator with a background in economics or health statistics, is recommended.

Conclusions

The study found that the removal of user fees for maternal health services was associated with healthcare use increases at MOH facilities and decreases at FBO and PFP facilities. Despite the limitations discussed above, the DHIS2 is one of the most useful data sources for evaluation studies because it provides a time series dataset, or a continuous sequence of monthly observations taken repeatedly at equal intervals. Analysts of routine health data, such as the DHIS2, are currently sharing approaches to correct for incomplete facility reporting (Maina, Wanjala, Soti, Kipruto, Droti, & Boerma, 2017), which can help other users assess DHIS2 quality and make necessary corrections. As this study illustrates, aggregate DHIS2 data from facilities can be used not only to assess differences in healthcare coverage following an intervention, but also as input into tools, such as LiST, to estimate impact on mortality.

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Appendix. Example of an Adjustment of ITS Results to National Coverage

We used the following formula:

$$HFD_t=((NDEL_t)/r)/(birth_t)*100\%$$

where HFD_t is the coverage of health facility delivery in year t; $NDEL_t$ is the sum of NDEL in year t; and $birth_t$ is the total number live births in year t, which was estimated by Demoj module in Spectrum 5.

$$CPP_t=HFD_t$$

Where CPP_t is the coverage of clean postnatal practices in year t. Here we assume that mothers who deliver at a health facility are to receive clean postnatal practices.

$$SBA_t=HFD_t+f_t$$

Where SBA_t is the coverage of skilled birth attendance in year t and f_t is the estimated difference between SBA_t and HFD_t in year t (calculated based on SBA_t and HFD_t from the DHS 2008 and DHS 2014 reports).

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