



**Institute for International Programs
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**REAL-TIME RESULTS TRACKING
Technical Note**

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Introduction

The Real-time Results Tracking project (RRT) responds to the growing demand for measurement of short-term changes in mortality among children less than five years of age. This demand reflects new and expanded efforts to reduce child mortality and achieve the fourth Millennium Development Goal (MDG) on the part of countries, bilateral development agencies including those of Canada, Norway and the United Kingdom, and the United Nations. This need has become even more apparent in light of the recommendations of the Commission on Information and Accountability for Women's and Children's Health in May 2011, which identified under-five mortality as one of a small number of priority indicators to be monitored annually in the 75 countries that account for over 98% of deaths among women and children. In most of these countries, health systems are weak and vital registration data are not available. Commonly used demographic methods based on household surveys provide child mortality estimates for periods three to five years prior to measurement.

The objective of the RRT project is to develop and test methods that can be used by Ministries of Health, their implementing partners and donors to measure under-five mortality in recent periods of 12 months or less. The project is funded by Canadian CIDA under the Catalytic Initiative to Save a Million Lives (CI), and is being implemented by the Institute for International Programs at the Johns Hopkins Bloomberg School of Public Health (IIP-JHU). The project works in collaboration with in-country African research partners in each country, building sustainable capacity for program evaluation and the monitoring of births and deaths. In Ethiopia, Malawi and Niger, the RRT methods developed and validated under this project will also be used to produce evidence of the contributions of the Catalytic Initiative to reductions in under-five mortality.

RRT work began in 2007 with a technical consultation that brought together experts from a broad range of disciplines with experience in measuring under-five mortality, with a special emphasis on innovative methods that might hold potential for capturing deaths in "real-time". The product was a list of potentially promising approaches, and clarification of methodological issues that would need to be addressed such as seasonality in mortality patterns, the need for large sample sizes, and the challenge of obtaining data of adequate quality to support decision making. Beginning in 2008 in Malawi and continuing through 2009 as additional countries came on board, field missions were conducted to identify appropriate in-country research partners, assess existing data systems and mechanisms that might be used as a starting point for RRT in each setting, conduct meetings with stakeholders and develop detailed proposals and obtain needed ethical clearances. At least two methods are assessed in each country to take advantage of expected economies of scale.

The RRT project worked in Mozambique from 2008-2010, and developed plans for testing a method based on the use of key informants and capture-recapture methods. CIDA, UNICEF and other partners halted the RRT work in Mozambique in mid-2010 based on concerns about the strength of program

implementation and their judgment that it would be unlikely to result in changes in under-five mortality that could be measured within the time frame of the project, and replaced it with Niger. This method will therefore not be assessed within the RRT portfolio.

Interest in the RRT project and related efforts to improve vital events reporting has expanded rapidly in recent months, as the global public health community mobilizes to respond to the recommendations of the Commission on Information and Accountability for Women's and Children's Health. In 2010, additional funding for the RRT project in Ghana was provided by the Monitoring of Vital Events through the use of Information Technology (MoVE-IT) project of the Health Metrics Network (http://www.who.int/healthmetrics/move_it/en/index.html), permitting an expansion of the sample size, addition of IT components, and intensified modelling of the implementation process. This document provides an overview of the RRT methods being tested in each of the five participating countries. A list of the individuals participating in the project is available in Annex 1.

Overview of the RRT Methodological Approach

After a period of development and formative research, each RRT method is implemented for a period of at least twelve months, with careful documentation of the processes and costs. The accuracy of the results produced by each method is then tested against a well-known and established population-based method of mortality estimation (household surveys or censuses, referred to from this point forward as "gold standard" methods) as well as assessments of the feasibility and cost of implementing each method at national scale. Methods being tested include those that build on routine collection of data on vital events (pregnancy, births and deaths) to allow annual estimation of under-five mortality, and innovative indirect estimation techniques for under-five mortality based on rapid surveys in households. Some methods that were considered potentially useful, such as the collection of data in conjunction with National Immunization Days or Child Health Days, are not included in the portfolio because no opportunity for implementing them was able to be identified in the five participating countries. All RRT activities are submitted for ethical clearance both in the participating country and at JHU.

Table 1 summarizes the methods being tested by RRT, and the remainder of this note provides additional information about each of these methods. The first gold-standard survey is under way now in the two RRT districts in Malawi; results are expected by March 2012. Full details of RRT plans, including the identification of in-country research partners and links to larger evaluations of Catalytic Initiative, are available at <http://www.jhsph.edu/dept/ih/IIP/projects/catalyticinitiative.html>. We have not included technical details on the gold standard methods in this document; they are available from IIP-JHU upon request.

Table 1: Real-time results tracking methods considered or being tested, by country

Countries	Data collection at community level		Calibration of health facility data	Vital registration program*	Repeated summary birth history	Imputed summary birth history
	Paid Gov't health workers	Unpaid Gov't health workers				
Ethiopia	✓	Unpaid volunteers generally work together with the paid CHW	Proportion of deaths in HF too low	There has been pilot of civil registration but a law from the parliament was need to roll out	✓	✓
Ghana	Insufficient coverage CHPS is a community paid worker, but coverage is much lower than volunteers)	✓	Proportion of deaths in HF likely too small in Northern region, but may be feasible in UW or UE regions, Need confirmation	✓	Could be tested in second stage, but first stage testing over 2-3 districts has insufficient baseline (MICS07 has 200 HH per district in Northern region)	✓
Malawi	✓	Not available	✓	Birth registration piloted and a bill is in the parliament but the process is too slow to allow building on RRT	✓	✓
Mali	Not available currently – paid workers planned for CCM implementation in 2010/2011, but with less coverage than volunteers	✓	Less than 2% of death occur in health facilities	No functional vital registration program is available and plans for improving VR are longer term than the RRT project	No baseline SBH available at below regional level; could be included in subsequent years (?)	✓
Niger	Not available	Not available	Not available	Not available	✓	✓

* In Ghana, the vital registration program uses unpaid government health workers for data collection

Description of RRT Methods

1. DATA COLLECTION AT COMMUNITY LEVEL

1.1. Paid government health workers reporting of vital events

a) Health Surveillance Assistant (HSA) reporting in Malawi

This method relies on community health workers – referred to as Health Surveillance Assistants (HSA) in Malawi – whose formal responsibilities already include completing village health registers that enumerate household populations, record information on pregnancies, births and deaths and other health information including antenatal care, immunization and growth monitoring. HSAs are expected to have completed Junior Secondary School, and receive basic training (10 weeks), both provided by the Ministry of Health (MoH). HSAs assigned to hard-to-reach areas receive additional training on community case management of childhood illnesses. Each HSA is responsible for a catchment area of about 1,000 people, and provides both preventive services and treatment for uncomplicated episodes of malaria, pneumonia and diarrhea among children under the age of five.

The initial RRT test is being conducted in Balaka and Salima districts (total population 657,175 from 2008 population census) in collaboration with the Malawi National Statistical Office (NSO). In these districts, all HSA catchment areas were mapped to generate a sampling frame. Eighty catchment areas were then randomly selected from each district using simple random selection. The total sample size of 160 is based on the number of recorded deaths required to obtain an under-five mortality rate that can be determined to be within 20% of that obtained through a household survey in the same two districts that will serve as the “gold-standard. All HSAs in the selected catchment areas received supplemental training in household mapping and recording of vital events in the registers, and were equipped with newly printed registers, writing instruments, backpacks, and cellphone airtime. All HSA supervisors in each district participated in the training and received additional training on how to supervise RRT activities, and were provided with backpacks, cellphones, quarterly transportation allowances and cell phone airtimes. Training began in January 2010, followed by a start-up period for household mapping and supervised practice. The official test period was July 2010 through June 2011; data collection for the gold-standard household survey began in October 2011 and preliminary results are expected in March 2012.

b) Health Extension Workers (HEWs) in Ethiopia

HEWs are stationed at health posts in each kebele, and are required by the government to maintain family folders in which they record information on each family in their communities, including the listing of all family members. The HEWs usually work with about 30 community volunteers in their kebele (about 5000 population) to identify health issues as well as pregnancies, births and deaths in their communities. These volunteers are usually team (or “garee”) leaders in their communities, working with about thirty households. The existing structure of HEWs and community volunteers in Ethiopia represents a unique platform on which RRT can be built and strengthened to provide tools to woredas and the regions for monitoring of child mortality.

The RRT approach in Ethiopia will build on this existing system of recording of data at community level, working with randomly-selected HEWs. The RRT work will be carried out in Jimma and West Hararge zones of Oromia region (total population 4.4 million in 2007), where a full evaluation of integrated community case management is being conducted with support from CIDA and UNICEF-Ethiopia. Ninety three rural kebeles were randomly selected from intervention and comparison areas within the evaluation zones. The HEWs and their supervisors are being trained to maintain the “family folders”, especially the recording of births and deaths, in their communities and on how to extract information on pregnancies, births and deaths from these folders onto a simple data collection form. Community volunteers are being oriented and mobilized to report promptly on pregnancies, births and deaths to HEWs. HEW supervisors have been identified and oriented to ensure proper supervision and follow-up of the activities. A local Ethiopian research firm (Miz-Hasab) is leading the implementation of the activities in full collaboration with the Ministry of Health, the Oromia Regional Health Bureau and the woreda health departments. Formative research was conducted to learn more about the roles and status of HEWs in identifying and recording vital events and how it can be improved. The method will be validated through a household survey to be conducted in the two zones in early 2013 as part of the larger CI evaluation. Results will be available by March 2014.

1.2. Unpaid government worker reporting of vital events

a) Community-based volunteers reporting in Mali

Community health volunteers (*relais communautaires*) in Mali are selected by their communities to serve as the link between the community and local health centers and to provide health education and selected preventative commodities (e.g., family planning, deworming) to their communities. Each relais is responsible for a population of about 250 to 300 individuals (~50 households), and for recording all births and deaths in their communities; however, at present the information on births and deaths lacks detail and is often incomplete. This existing structure provided an opportunity for developing an RRT approach.

The RRT project is working with a local research partner (CREDOS: Centre de Recherche et d'Etude pour la Documentation de l'Enfant) in collaboration with local health authorities and government at the district and sub-district levels to reinforce the volunteers' role in identifying vital events and to introduce a system that will result in the availability of more detailed information on births and deaths (including under-five mortality) at the sub-district level. The RRT project will document the feasibility of this system during the first six months of implementation. The reliability, accuracy and cost of community-based recording of vital events will be assessed after 18 to 24 months of implementation. A "gold-standard" approach (a census of households with full birth history) will be implemented at endline to validate the RRT method of community volunteers recording of vital events.

b) Community-based Surveillance Volunteers Reporting in Ghana

The government of Ghana's community-based surveillance volunteers (CBSV) monitor communicable diseases and deaths, and are already responsible for collecting some information on births and infant deaths. The CBSV surveillance and data collection system is an ideal platform for monitoring child mortality in the community, with minor modifications to record all pregnancies, births and under-five deaths. CBSV coverage is reported to be national, although this volunteer system functions better in the north of the country where it has been supported in the past by the Carter Center as a part of their Guinea worm eradication program.

As part of their previous activities with the Carter Center, CBSVs are expected to visit households in their area at about one- to two-week intervals to identify cases of Guinea worm and collect other disease and vital events data. Each CBSV is responsible for monitoring approximately 40-70 housing compounds and CBSVs report they spend about six hours per month conducting these activities. Every 4-7 CBSVs are supervised by a zonal coordinator who is also a CBSV, but is literate, is given a bicycle and is paid about US\$10 per month from the Carter Center. Supervisors are responsible for compiling data and providing it to the sub-district monthly. With support from the Carter Center, the CBSVs receive refresher training every quarter.

Surveillance data collected in the community by CBSVs are compiled at sub-district level by zone. A zone consists of five or six communities or villages, and each sub-district has four or five zones. Sub-district staff review all reported maternal, infant and suspected neonatal deaths using standard templates, and use the results to exclude stillbirths from the data set. The sub-district collates community-based information with facility-level information to avoid double-counting. District staff use the cleaned data sets to calculate infant mortality rates (IMRs) monthly at district and sub-district levels.

The RRT project works with the Noguchi Memorial Institute to test an adaptation of this method that builds on the existing Births and Deaths Registry (referred to as "BDR+"). Further information is available in Section 4 below. Plans were reviewed and agreed to by the Government and stakeholders

in March 2011, and used as the basis for generating complementary funding from the Health Metrics Network.

2. HEALTH FACILITY DATA CALIBRATED WITH COMMUNITY DATA

The total number of annual child deaths in a population is equal to the total number of annual health facility deaths divided by the proportion of annual deaths that occur in health facilities. Similarly, the total number of annual births in a population is equal to the total number of annual health facility births divided by the proportion of annual births occurring in health facilities. Therefore, knowledge of the proportion of annual births and deaths occurring in health facilities and the total number of annual births and death in health facilities should allow estimation of the annual child mortality rate in the population. In a population where these proportions are relatively constant over time, these formulas can be applied to health facility data for real-time mortality estimation. This method has been applied to estimate cause-specific mortality fractions at population level,¹ but is useful only if a reasonable proportion of deaths occur in health facilities. This was assessed in all potential RRT countries, but only in Malawi were sufficient numbers of under-five deaths reported in health facilities to serve as a basis for testing this method.

Data to test the facility calibration method are being collected at two levels: (i) from health facilities; and (ii) through household surveys. In all health facilities in the two RRT districts in Malawi, records of births and deaths were assessed in collaboration with the Health Management Information System. Data on births and total deaths were already collected through the HMIS. The RRT trained HMIS officers of the two districts to disaggregate the deaths by age and report to the National Statistical Office.

The proportion of births and deaths that occur in health facilities will then be applied to health facility data on births and deaths to estimate annual mortality rates at population level. These rates will be compared to direct rates calculated from the gold standard household survey to be conducted in the two RRT districts beginning in August 2011. The assessment will be done for all children as well as by sex. Neonatal and under-five mortality will be considered. This method has the advantage of helping build links between data sets collected in health facilities and those collected at community level, which the government has identified as an urgent priority, and should lead to improvements in the recording of vital events at health facility level. Supervision and regular quality control will be necessary to ensure that all events that are happening at the health facility level are being recorded. The results of the assessment should be available by the March 2012.

¹ Murray et al. 2007. Estimating Population Cause-Specific Mortality Fractions from in-hospital mortality: validation of a new method. *PLoS Medicine*. November 2007, Vol 4, Issue 11, e326, pp. 1754-1765

3. RAPID SURVEY METHODS

A summary birth history in its simplest form consists of asking women how many live children they have borne (children ever borne, or CEB) and the number of those children that have died (child deaths, or CD), although additional information is often collected to allow disaggregation by child sex or to support internal validity testing. For analysis purposes it is also necessary to collect information to control for the average exposure time of the woman's children, typically the woman's age or time of first birth (probably best approached by asking month and year of first birth, though often age at first birth is asked instead). A summary birth history cannot provide information about child mortality in a specific (short) recent time period because the children reported by women are spread over a number of previous years, and are therefore exposed to potentially time-varying mortality risks. The only exception would be children born to women who report their first birth as occurring in the 12 months before the interview, but these will be almost entirely first births and thus unrepresentative of all child deaths.

RRT is testing two alternative methods through which summary birth histories could be used to generate real time (i.e., annual) estimates of under-five mortality. These methods, if found to produce accurate results, would allow Governments and their partners to add summary birth histories to large-scale surveys conducted for other purposes at little or no additional cost, and to use the results to generate real-time estimates of under-five mortality and trends.

3.1. Repeated Summary Birth Histories

This method compares summary birth histories provided in two household surveys with samples drawn from the same population. Information about recent child mortality is obtained by comparing changes in children ever born and children dead from the first to the second survey. Changes in the proportion of children dead among children ever born between cohorts of women across the inter survey period in the two samples are modeled to estimate annual under-five mortality. The statistical basis for these assumptions are available from IIP-JHU; preliminary tests based on DHS data from 106 surveys in 33 countries show promising results.

RRT will assess the repeated summary birth history method in 3 countries:

1. In **Ethiopia**, by comparing summary birth histories from baseline RRT rapid survey and the RRT endline survey in 2012.
2. In **Malawi**, by comparing summary birth histories from the census 2008 and RRT gold standard survey in 2011.

3. In *Niger*, by comparing summary birth histories from a nationally-representative survey conducted in 2010 with those collected in a DHS/MICS planned for 2012 and potential (if found to produce accurate results and the Government agrees) with summary birth histories in the national census planned for 2012.

3.2. Imputing Full Birth Histories from Summary Birth Histories

This approach matches each woman who responds to the two summary birth history questions (Woman “A”) to a woman with similar characteristics (age, fertility characteristics) for whom a full birth history was completed in the same or another survey – for example, a DHS survey (Woman “B”). The details of Woman “B” are then imputed to Woman “A” and used to calculate under-five mortality.

The suggested matching variables are total children ever born, total children dead, and some measure of childbearing exposure (preferred is the number of years since the woman’s first birth, but age can also be used; we have not fully explored the relative performance of these two indicators as yet but expect time since first birth to perform better). Each summary birth history would have (say) 10 randomly-selected full histories with the same matching characteristics attached to it to reduce noise. Some relatively small proportion of summary histories will not have an exact match on all three items in the full histories, in which case the match can be on children ever born and children dead only. Because the imputed history would reflect any changes in overall mortality since the full birth history was collected (since the distribution of women by children ever born and children dead would change) the mortality estimates derived from the imputed history should capture recent mortality (and fertility) trends. Preliminary tests of the performance of this method using successive country DHSs, or DHSs from neighboring countries suggest that the technique works very well in some within-country cases (Bolivia, Egypt, Indonesia) but works less well for Kenya, and doesn’t work well at all for cross-country applications. It is not clear why this is the case, but may be the result of using inappropriate sample weights. Further work to explore this is required. Further work is also required to explore whether time since first birth works better as the matching characteristic than age of mother. Many existing data sets only have age, so it would increase the value of the technique if age turned out to be a reasonable matching characteristic (even if not as good). If time since first birth turns out to be substantially better, steps need to be taken to promote the inclusion in censuses and other large household surveys of a question about the month and year of each woman’s first birth; experience with the DHS has shown that such a question can be used, since it is the starting point of the full birth history.

RRT will assess the repeated summary birth history method in 4 countries:

1. In *Ethiopia*, by imputing summary birth histories from the RRT baseline survey and endline survey in 2012 with full birth histories collected in the DHS 2010.

2. In **Malawi**, by imputing information from the full birth histories collected in the DHS 2010 onto summary birth histories collected in the 2008 population census and in the gold standard RRT survey in 2011.
3. In **Mali**, by imputing information from the DHS 2006 (forward) and DHS 2011-12 (backward) onto summary birth histories collected in the 2009/10 MICS.
4. In **Niger**, by imputing information from a the DHS 2006 onto summary birth histories from a nationally-representative mortality survey conducted in 2010 at the request of RRT, as well as additional tests made possible by the DHS 2011 and the census in 2012, assuming the Government agrees to allow the inclusion of summary birth histories.

4. VITAL EVENTS REGISTRATION

In developed countries, real-time data on births and child deaths are obtained through civil registration systems, and there is growing interest in the possibility of strengthening such systems in developing countries. The RRT project was able to identify only one country in which there was the opportunity to assess, strengthen and test a vital registration system as a basis for RRT – Ghana. In Ghana the vital registration system has recently been boosted by new resources. Based on denominator estimated using 2000 census projections, birth registration by the age of 12 months has increased rapidly, to 77% of births nationally and 106% of births in the Upper West region. Death registration has not been as successful. For example, only an estimated 5-7% of total deaths (all ages) are reported in the Upper West region. Those responsible for the vital registration system in Accra report numerous barriers to improving death registration, including the regulation that any deaths occurring outside the hospital must be reported to the police or the local coroner before a death certificate can be issued. Officials at the vital registration office reported that death registration might improve under the new Ghana health insurance scheme, which requires annual enrolment and payment. Working with the vital registration system and associated authorities, and with complementary resources obtained through a competitive selection process from the Health Metrics Network, RRT will test a strengthened vital registration program in Ghana. Results from a full year of testing will be available in early 2013.

Annex 1: RRT Project Participants

Project team based at IIP-JHU

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