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CLINICAL ARTICLE

Estimation of maternal and neonatal mortality at the subnational level in Liberia

Heidi Moseson^{a,*}, Moses Massaquoi^b, Luke Bawo^c, Linda Birch^{c,d}, Bernice Dahn^c, Yah Zolia^c, Maria Barreix^b, Caitlin Gerdtz^e^a Department of Epidemiology and Biostatistics, University of California San Francisco, San Francisco, CA, USA^b Clinton Health Access Initiative, Monrovia, Liberia^c Ministry of Health and Social Welfare, Monrovia, Liberia^d Bomi County Health Team/Ministry of Health and Social Welfare, Tubmanburg, Liberia^e Bixby Center for Global Reproductive Health, University of California San Francisco, San Francisco, CA, USA

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ABSTRACT

Objective: To establish representative local-area baseline estimates of maternal and neonatal mortality using a novel adjusted sisterhood method. **Methods:** The status of maternal and neonatal health in Bomi County, Liberia, was investigated in June 2013 using a population-based survey (n = 1985). The standard direct sisterhood method was modified to account for place and time of maternal death to enable calculation of subnational estimates. **Results:** The modified method of measuring maternal mortality successfully enabled the calculation of area-specific estimates. Of 71 reported deaths of sisters, 18 (25.4%) were due to pregnancy-related causes and had occurred in the past 3 years in Bomi County. The estimated maternal mortality ratio was 890 maternal deaths for every 100 000 live births (95% CI, 497–1301). The neonatal mortality rate was estimated to be 47 deaths for every 1000 live births (95% CI, 42–52). In total, 322 (16.9%) of 1900 women with accurate age data reported having had a stillbirth. **Conclusion:** The modified direct sisterhood method may be useful to other countries seeking a more regionally nuanced understanding of areas in which neonatal and maternal mortality levels still need to be reduced to meet Millennium Development Goals.

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1. Introduction

As the deadline for the 2015 Millennium Development Goals (MDGs) approaches, a concerted global effort is underway to reduce high levels of neonatal and maternal mortality (MDGs 4 and 5). Despite much forward momentum with regard to reforming and revitalizing health services, Liberia continues to face high levels of maternal and neonatal mortality [1]. Maternal and neonatal mortality in Liberia continue to rank among the 10 highest in the world [2–6]. As in many low-income settings, the majority of these deaths are due to preventable or treatable conditions.

The Liberian government, along with governments in many other low-income countries, is working to implement locally tailored initiatives to reduce maternal mortality based on the unique needs at the

subnational level [1]. However, to date, there are no representative, area-specific data in Liberia that can be used to inform the implementation of these efforts. Although the challenges of measuring maternal deaths in low-income settings and in small geographical areas have been well established [7,8], obtaining data on the magnitude of the health problem and its causes at the subnational level is crucial for effective policy and program development [9,10].

The aims of the present study were to pilot-test a method for measuring levels of maternal and neonatal mortality at the county-level using an adjusted direct sisterhood approach to record the location of the maternal death, and to determine the feasibility of extending this county-specific method to the rest of Liberia and in other low-income countries with high maternal and neonatal mortality.

2. Materials and methods

The status of maternal and infant health in Bomi County, Liberia, was investigated between May 20 and June 10, 2013. A population-based survey was used that included questions about deaths, knowledge of and access to family planning services, incidence of abortion, and basic demographic information. Approximately half the enumeration areas

* Corresponding author at: Department of Epidemiology and Biostatistics, University of California San Francisco, 185 Berry Street, Lobby 5, Suite 5700, San Francisco, CA 94158, USA. Tel.: +1 503 550 8076; fax: +1 415 514 8150.

E-mail address: heidi.moseson@ucsf.edu (H. Moseson).

were to be sampled. A random sample of 126 (46%) of 273 enumeration areas in Bomi County (Fig. 1) was selected with probability proportional to size [11] using a program in the R statistical package (<http://www.R-project.org/>). Within each sampled enumeration area, survey teams randomly selected every fourth household using global positioning system (GPS)-enabled maps.

In these enumeration areas, a household was eligible if at least one woman of reproductive age (15–49 years) lived there or if a child had been born there in the past 3 years. Within each eligible household, one woman aged 15–49 years was randomly selected for interview based on which woman had most recently celebrated her birthday [12]. Verbal informed consent was obtained from both the household head and the female respondent. The study protocol was approved by the Institutional Review Board of the National Ethical Committee of the Liberian Ministry of Health and Social Welfare.

The planned sample size was 2400 households and was calculated on the basis of the total fertility rate [5], the most recent estimate of the maternal mortality ratio [2], an inflation factor to accommodate a margin of error [13], and subsequent adjustment for the proportion of the female population represented by women in Bomi County. The survey was designed using the Open Data Kit software platform (<http://opendatakit.org>) and installed on 12 tablet computers. The survey was conducted by 12 enumerators (six male and six female) who were divided into six teams of two.

In accordance with the 10th revision of the International Classification of Diseases, a pregnancy-related death was defined as “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death” [14]. The main indicators of maternal mortality measured were: the maternal mortality ratio (MMR), defined as the number of maternal deaths for every 100 000

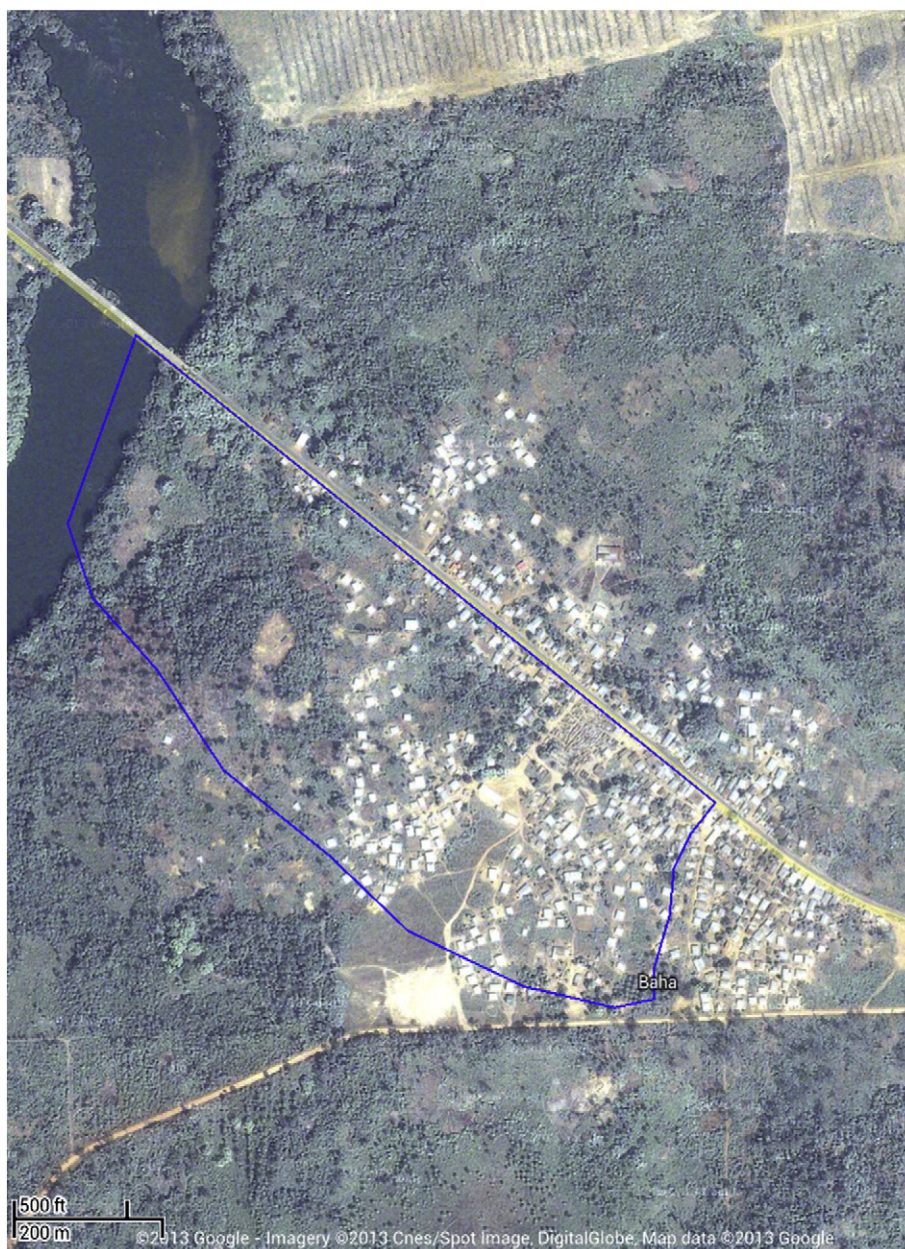


Fig. 1. Satellite map delineating the boundary of a selected enumeration area (blue line). Taken as a screenshot from a tablet used by the enumerators during the survey. Copyright 2013 Google–Imagery. Copyright 2013 Cnes/Spot Image, DigitalGlobe, Map data copyright 2013 Google.

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