# Eliminating Female Genital Mutilation - Is the SDG target in Reach?

## A new approach to estimate the incidence of Female Genital Mutilation

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**Introduction**

Female genital mutilation (FGM) refers to all procedures involving partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons (WHO, 2018). The United Nations campaign to end FGM began in 2008, when UNICEF and UNFPA established the joint programme on FGM, the largest global programme to accelerate abandonment of FGM and to provide support to women and girls who have experienced this harmful practice. In 2015, Female Genital Mutilation was, next to child marriage, mentioned specifically as one of two harmful practices in the Sustainable Development Goal 5.3 in which Member States of the United Nations urged for the complete elimination of both practices by 2030.

The elimination of FGM requires effective policy intervention and programming which need to be guided by reliable estimates of the expected number of girls and women to experience FGM in a given year and how the population of those at risk evolves over time. This requires a full review of global and national trends in the last decade that to our knowledge has not been attempted comprehensively. As we mark the 10-year anniversary of the joint programme on FGM, it is timely to review these estimates in the context of the 2030 Sustainable Development Agenda.

In this paper, we present new estimates of current as well as historic trends of incidence of Female Genital Mutilation at national and global level using all available data and surveys. We take into account the age-pattern of FGM, as well as the year in which a woman is born in order to estimate the decline of FGM from cohort to cohort. In other words, we estimate the risk of FGM for each cohort by single years and compare different cohort statistically. Our analysis unveils if the world is on track to achieving the Sustainable Development Goal to eliminate FGM by 2030.

In addition, we model the data hierarchically. We take into account that women observed in the data set live in clusters or communities that in turn are nested within countries. Therefore, we are accommodating for the fact that FGM is driven by social norms within communities and must be modelled as such (Devi, 2018) and are able to provide even more precise estimates.

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**Data**

Our data source are the Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS), which provide standardized micro datasets on Female Genital Mutilation as well as age-at-FGM and allow for nationally representative estimates. Overall, 66 surveys for 24 countries with sufficient data on FGM have been included in the analysis. This approach includes both self-reported data from women's questionnaires as well as data reported by mothers about their daughters aged 0-14.

By using all available modules on FGM including the daughters' and mothers' module, we are able to estimate incidence trends for cohorts born from 1955 to those born after 2009. To our knowledge this model is the first to estimate incidence globally and nationally over the last seven decades by exploiting the full wealth of data available in DHS and MICS surveys.

**Methods**

Estimating incidence, including trends, given the paucity of data FGM and the complexity of both survey design and data structure, poses significant challenges.

While questions on FGM have been included in DHS surveys since the 1990s, and since the 2000s in the case of MICS surveys, not all countries in which FGM is documented have been covered by data collection efforts, and even fewer have been covered regularly over the last decades. In some countries, surveys that include questions on FGM have only been conducted once.

An additional challenge is that DHS and MICS surveys historically suffered from the fact that the questionnaire is only directed to women aged 15-49. Consequentially, even for the youngest cohort among these women, FGM might have occurred decades ago, making it extremely hard to infer recent trends from the data. As recent as 2010, DHS and MICS introduced an FGM module covering all living daughters of women under the age of 15. This solves the problematic time lag between data collection and FGM. However, it introduces new complexities. A daughter that at the moment of the survey is observed as not having experienced FGM, might still be affected by it in future. Thus, the daughter module, however valuable, contains a large amount of right-censored information on FGM.

To deal with this censoring, we have applied survival analysis for our estimates. Survival analysis allows us to use this data structure, by acknowledging that those girls (and women) without FGM at the time of the survey, can potentially experience it in future, and thus do not provide further information. This also improves on existing FGM estimates, as it does not assume a certain cut-of-age for FGM, mostly 15, after which no more FGM is assumed to happen. Even though FGM is indeed concentrated in childhood and early adolescence, there are cases beyond this age, and our model can capture these.

As a first step, we perform a Kaplan-Meier estimator, more precisely the Horvitz-Thompson approach in order to account for the complex sample design, i. e. the multi-stage clustered sampling method from which the underlying data were obtained (Valsecchi, 2016) and allows us to obtain unbiased variance estimates. We further use a Cox proportional hazard model, including model diagnostics, in order to mathematically quantify the reduction in relative hazard of each cohort compared to the oldest cohort in the dataset.

As a final step, we fit a three level hierarchical model in order to mimic the actual data structure of the data as well as the sample design. We nest individual observations within clusters, or communities of several households, and these clusters within countries.

Vast research has shown that FGM is driven by social norms within a community (Bettina Shell-Duncan, 2018). Individual FGM probability among women in the same cluster and country are likely to be correlated, which would violate the basic independence assumption of observations. We additionally suggest that this is necessary in order to account for the complex survey design when applying multi-level models (Carle, 2009). This is evident as we cannot scale the weights (Asparouhov, 2006) given that information on the sampling fraction at each level of sampling is not available in DHS and MICS surveys. However, this can be alleviated when survey and modeling structure match proving us with unbiased and robust estimates (Jean-Paul Lucas, 2014).

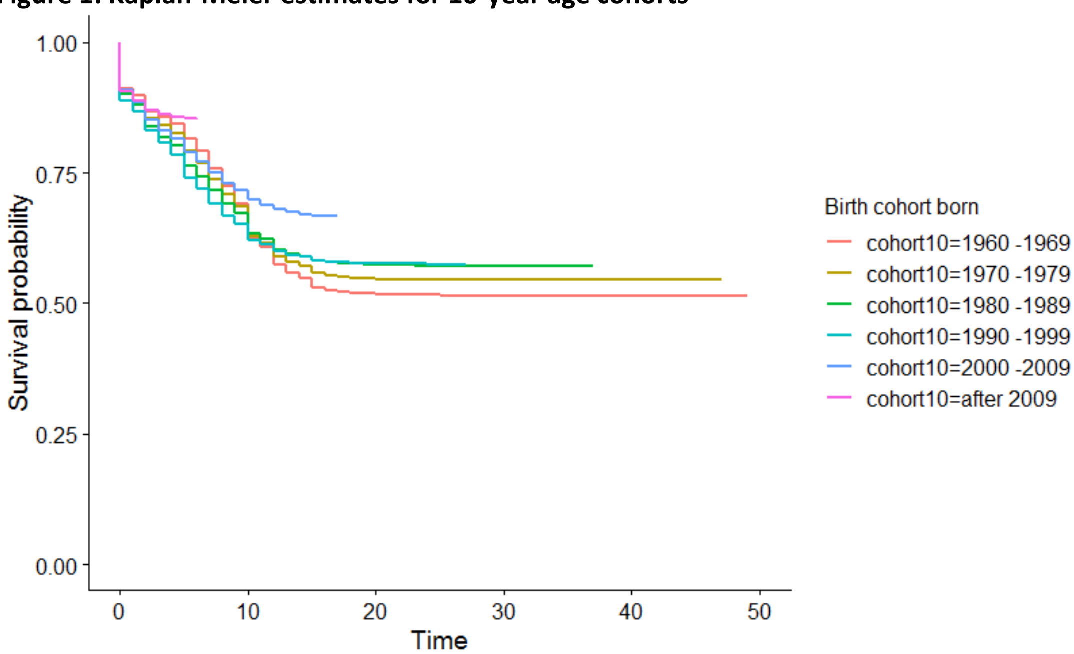
**Implementation**

The estimates are conducted in R. While we use Thomas Lumley's survey package (Lumley, 2018) to implement both the Kaplan-Meier and Cox proportional hazard analysis for our data taking into account the complex survey design, we use the 'coxme' package for the multi-level analysis (Therneau T. M., 2018).

**Preliminary results**

Our preliminary results demonstrate that the decline of risk between different age cohorts is large and indeed statistically significant (see figure 1).

**Figure 1: Kaplan-Meier estimates for 10-year age cohorts**




We compare birth cohorts from 1955 to today with Kaplan-Meier, Cox proportional hazard and multi-level analysis that and show that on a global level, there has been a steady and significant decline in FGM. This, however, is not true for all countries and notable exceptions include Guinea and Sudan where there is no evidence for decline in FGM over the last decade.

This demonstrates despite impressive reduction in FGM risk in some areas, this progress is spread unevenly across countries, and we cannot expect to eliminate the praxis in all countries within the era of the Sustainable Development Goals.

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