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Secular trends in the prevalence of Female Genital Mutilation/Cuttings among girls: a systematic analysis

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Background: Current evidence on the decline in the prevalence of female genital mutilation or cutting (FGM/C) has been lacking worldwide. This study analyses the prevalence estimates and secular trends in FGM/C over sustained periods (i.e.1990-2017). Its aim is to provide analytical evidence on the changing prevalence of FGM/C over time among the 0-14 years girls, and examine geographic variations in low-and middle-income countries (LMICs).

Methods: Analysis on the shift in prevalence of FGM/C was undertaken using the DHS and MICS datasets from Africa and Middle East. A random-effects model was used to derive overall prevalence estimates. Using Poison regression models, we conducted time trends analyses on the FGM/C prevalence estimates between 1990 and 2017.

Findings: We included 90 DHS and MICS datasets for 208,195 children (0-14 years) from 29 countries spread across Africa and two countries in Western Asia. The prevalence of FGM/C among children varied greatly between countries and regions and, also within countries over survey periods. The percentage decline in the prevalence of FGM/C among the 0 to 14-year-old children was highest in East Africa, followed by North and West Africa. The prevalence decreased by 787% in East Africa, from 71.4% in 1995 to 8.0% in 2016. In North Africa, the percentage decreased from 57.7% in 1990 to 14.1 in 2015. In West Africa, the prevalence decreased from 73.6% in 1996 to 25.4 in 2017. The results of the trend analysis showed a significant shift downwards in the prevalence of FGM/C among children aged 0-14 years in such regions and sub-regions of East Africa, North Africa and West Africa. East Africa has experienced a much faster decrease in the prevalence of the practice (trend = -7.3%, 95% CI -7.5% to -7.1%) per year from 1995 to 2014. By contrast, the decline in prevalence has been much slower in North Africa (trend = -4.4%, 95% CI -4.5% to -4.3%) and West Africa (trend = -3.0%, 95 CI -3.1% to -2.9%).

Interpretation: The prevalence of FGM/C among children aged 0-14 years varied greatly between countries and regions and, also within countries over survey periods. There is evidence of huge and significant decline in the prevalence of FGM/C among children across countries and regions. There is a need to sustain comprehensive intervention efforts and further targeted efforts in countries and regions still showing high prevalence of FGM/C among children, where the practice is still pervasive.

What is already known about this topic?

- FGM/C is highly concentrated in many low-and middle-income countries particularly in Africa and western Asia.
- The practice is viewed as a child abuse and a gross violation of children's and women's human rights; and is deemed unlawful by many countries and condemned by many organisations.

- It has devastating health consequences especially in terms of sexual, childbirth and mental health.

What are the new findings?

- The prevalence of FGM/C among children varied greatly between countries and regions and, also within countries over survey periods
- We found evidence of significant decline in the prevalence of FGM/C in the last three decades among children aged 0-14 years in most of the countries and regions particularly in East and North and West Africa in the last three decades. We show that the picture looks different in Western Asia where the practice remains and affects the same age group.
- **Recommendations for policy**
- Evidence-based policies targeting socio-economic and cultural support for children at risk of FGM/C in LMICs should be pursued vigorously.
- Appropriate research design, data collection, interventions containing religious and culturally sensitive elements remains important public health policy priority.

Introduction

Recent estimates show that more than 200 million women and children around the world have undergone the female genital mutilation and cutting (FGM/C).[1,2] All the available data clearly refers to Africa and some Middle Eastern regions (including Iraq and Yemen) as areas where the practice is particularly most prevalent. Further findings from recent global research revealed the existence of such a practice in India, Indonesia, Israel, Malaysia, Thailand and the United Arab Emirates. Likewise, data from censuses and household and hospital records indicate that FGM/C constitutes a massive global health challenge in the sense that, the high burden of FGM/C is clearly not confined to African and Middle Eastern countries, but extends to Europe, North and South America, especially as a result of migration. [2-6] Incidents of FGM/C in the western world are reported particularly from among asylum seekers and immigrants who have moved from regions where FGM/C is practised in order to settle in developed countries. [3-6] Those who live in Africa have been affected by the practice as a result of socioeconomic and cultural issues. . Thus, there is an emerging consensus that more than three million children in Africa are now at risk each year.[7] In the present paper, we first offer an analytical picture of the

estimates on the prevalence of FGM/C and identify secular trends limiting the study population to the 0-14 young girls in LMICs.

The ultimate aim of this study is to inform decision-making processes and influence policy responses and public health intervention across many geographic regions and countries sharing the same socio-economic and cultural backgrounds (such as unemployment level, the level of education, and religion and ethnicity) .The focus on these backgrounds is accounted for by the large number of selected regions in which well-tailored intervention programmes may be necessary to combat the practice.

Accurate, up-to-date information on prevalence of FGM/C among children is necessary for the development of national and international health policies for prevention these practice; and would allow international public-health policy-makers to assign sufficient priority and resources to its prevention. Though there are existing systematic reviews on current prevalence estimates of FGM/C emanating from most international agencies[14-18], there are no pooled analyses of nationally representative survey data to examine the burden of FGM/C among children. Children aged 0-14 years were considered in this review partly because we wanted to understand whether the years long campaigns on FGM/C among mothers has an impact on the reduction in the prevalence among their children as children are relatively too young to understand what is best for themselves, compared to their adult women counterparts who, on personal, cultural and socio-economic grounds, may engage in FGM/C. To fill this research gap, we therefore systematically gathered all the survey datasets to asses (1) the contemporary prevalence estimates of FGM/C among children aged 0-14 years; and (2) whether significant downward trend in the prevalence estimates or not; and (3) whether burden of FGM/C among children vary across different geographical regions.

Methods

Study design and data

We used data from the DHS as developed by ICF International and the MICS directed by UNICEF. ICF International and UNICEF provide technical assistance to countries conducting these national surveys. The two surveys are highly comparable and the technical teams

developing and supporting it are in close collaboration. Both DHS and MICS surveys provide national representative data of households and estimates of adult women and children.

This study examines the secular trends in the prevalence of FGM/C, focusing on countries where DHS/MICS data is available, and on regions which significantly contribute to the global prevalence in FGM/C. Evidence suggests that international response has targeted such countries on account of the high prevalence observed in FGM/C practice or based on the number of women and girls at risk. This is the case despite evidence that prevalence may be low in those regions. Among other things, the DHS and MICS survey datasets give details about the health and well-being of children as well as women in countries affected by FGM /C practices. The surveys used a two-stage cluster and probability sampling design, with oversampling of certain categories of respondents. In the first stage, "clusters" were selected from larger regional units within countries using sample weights techniques to obtain nationally representative estimates of indicators. Subsequently, the second stage of sampling, which involved the systematic sampling of households from the selected enumeration areas, was carried out. Data collection procedures and response rates for all DHS and MICs surveys were all published in each survey report.

The datasets on FGM/C are available in 29 countries spread across five United Nations sub-regions. Based on nationally representative samples of women and children, these surveys produce data that make it possible to calculate both the FGM/C prevalence and secular trends at both the national and sub-regional levels. In many of the targeted countries, more recent surveys have been produced.[8-11] In order to provide an accurate and reliable estimate of the current FGM/C practices in these countries and regions, we searched the DHS and MICS databases (without restriction on language or date of publication) to look for FGM/C data on women and their daughters or children.

Statistical analysis

Meta-analysis of FGM/C prevalence estimates

Apparent prevalence estimates were computed using the total reported number of women and children who have undergone FGM/C in each country. The overall prevalence of FGM/C were pooled and compared by proportion across countries and regions using a meta-analysis

technique. Before making such a move, we used the Freeman-Tukey variant of the arcsine square root transformed proportion suitable for pooling. This was necessary to stabilise the raw proportions of women and children that have undergone FGM/C from each of the included data.[20] Thereafter, the DerSimonian and Laird random-effects model was used to summarize the data. [21]

The logit effect size for the prevalence of FGM/C, its standard error, and the inverse variance weight are given below:

$$ES_i = Log_e\left[\frac{p}{1-p}\right] \quad \text{.....(1)}$$

$$SE_i = \sqrt{\frac{1}{np} + \frac{1}{n(1-p)}} \quad \text{.....(2)}$$

$$W_i = \frac{1}{SEi^2} = np\ (1 - P) \quad \text{.....(3)}$$

Where ***p*** represents the proportion (percentage) of women and children that have undergone FGM/C and *n* is the total number of women and children that have undergone the practice in the sample surveyed. The final pooled ***logit*** results and 95% confidence intervals (CIs) were transformed back into proportion for ease of interpretation using:

$$P = \frac{e^{Logit}}{e^{Logit+1}} \quad \text{.....(4)}$$

To assess the variation percentage across surveys, we inspected the forest plot and used the chi-squared test and the I^2 statistics.[22] the result was presented as a forest plot with 95% confidence intervals (CIs) expressed in percentage. Study-level influence on the estimated FGM/C prevalence was also evaluated using study-level characteristics such as survey year, survey country, survey period and the type of survey (DHS/MICS) in a univariate and multivariate meta-regression. We used a significance level of 0.05 for *P*-values in all statistical analysis. The bulk of data analysis was conducted using Stata version 14 for Windows (Stata Corp, College Station, Texas). This study was conducted and reported in line with the meta-analysis of Observational Studies in Epidemiology (MOOSE) guideline.[23]

Secular trend analysis

Using Poison regression models, we conducted time trends analyses on the FGM/C prevalence estimates between 1990 and 2017. Regression analyses were conducted using annual data on prevalence with women or girls that have been mutilated as the outcome, and the Survey calendar year as the predictor. This method allows for estimation of time trends across individual calendar years to obtain the average annual percentage change (AAPC), depending on whether the rate of change over the previous year is constant.[24] The Poisson regression procedure fits a model of the following form:

$$\mathbf{Log\ (Cases_y) = b_0 + b_1 y + log\ (sample\ size) \ldots\ldots\ldots\ldots\ldots\ (1)}$$

where **'*cases*'** equals the number of FGM/C cases reported per year, '***log***' is the natural log, $\boldsymbol{b_0}$ is the intercept, $\boldsymbol{b_1}$ is the trend, **y** is the year. In the equation, each year is represented by 0, 1, 2……14 (where year 0 is 1990, year 1 is 1991, and so on until 2017). The log of ***'sample size'*** was subsequently entered as the offset. The AAPC was calculated using the following formula:

$$\mathbf{AAPC = (e^{b_1} - 1) \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2)}$$

We also chose to meta-estimate one temporal trend from all the studies, accounting for correlations among multiple time intervals within studies.[25] This indicates that the number of time points for which FCM/C was estimated varied across studies, and some of these included only one-time point.

Results

Description of included survey datasets

The countries, year of data collection, and the surveys characteristics are listed in Table 1. The surveys were conducted between 1990 and 2017. This analysis included 90 DHS and MICS datasets for 208,195 children (0-14 years) from 29 countries spread across Africa and two countries in Western Asia. Most of the surveys were DHS (n=55), and 35 were MICS. Most of the surveys were from West Africa (n=54), followed by East Africa (n=17), North Africa

(n=10), Central Africa (n=6) and West Asia (n=3) (Figure 1). Highested numbers of surveys were conduced in Nigeria (n=7), Senegal (n=7) and Mali (n=6).

Variations in prevalence of FGM/C among children by Country and geographical regions

Prevalence of FGM/C among children and 95% CIs from individual countries with a pooled estimate are shown in eFigure 1 (for Central Africa), eFigure 2 (for East Africa), eFigure 3 (for North Africa), eFigure 4 (West Africa) and eFigure 5 (West Asia) and summarized in Table 1. In Central Africa Region, the FGM/C 'annualized year average' was highest for Chad (13.9%), followed by Central Africa Republic (3.0%) and Cameroon (0.7%). The FGM/C 'annualized year average' ranged from 2.0% (Kenya) to 67.0% (Eritrea) in East Africa; from 28.4% (Egypt) to 41.9% (Sudan) in North Africa; 0.4% (Ghana) to 72.6% (Mali) in West Africa and from 6.3% (Yemen) to 21.0% (Iraq) in West Asia.

Table 1.0 DHS/MICS datasets on FGM/C among children (0-14 years) across countries and regions

Region	Country	Number of survey	Survey period	Sample size	Annualized year average (%)
Central Africa	Chad	3	2004-2015	34139	13.91 (9.60 to 18.86
Central Africa	Central African Republic	2	2006-2010	24219	3.02 (0.00 to 11.20)
Central Africa	Cameroon	1	2004	2975	0.71 (0.43 to 1.04)
East Africa	Tanzania	4	1996-2016	28718	3.17 (0.78 to 7.10)
East Africa	Somalia	1	2006	3716	45.99 (44.39 to 47.59)
East Africa	Somalia north east	1	2011	5813	30.60 (29.43) to 31.79)
East Africa	Ethiopia	3	2000-2016	22885	34.12 (15.12 to 56.26)
East Africa	Kenya	4	1998-2014	18917	10.42 (2.52 to 22.79)
East Africa	Djibouti	1	2006	1923	48.52 (46.29 to 50.75)
East Africa	Somaliland	1	2011	5729	27.70 (26.55 to 28.87)
East Africa	Eritrea	2	1995-2002	6609	67.01 (58.02 to 75.41)
North Africa	Sudan	3	1990-2014	41131	41.90 (30.88 to 53.36)
North Africa	Egypt	7	1995-2015	85036	28.40 (16.41 to 42.18)
West Africa	Burkina Faso	4	1999-2010	33021	28.00 (15.16 to 43.01)

West Africa	Guinea	4	1999-2016	26576	50.35 (44.75 to 55.95)
West Africa	Ghana	1	2011	8276	0.40 (0.27 to 0.55)
West Africa	Benin	4	2001-2014	34399	1.80 (0.25 to 4.68)
West Africa	Senegal	7	2005-2016	37087	12.96 (8.63 to 18.03)
West Africa	Niger	2	1998-2006	7521	5.67 (0.00 to 25.15)
West Africa	Guinea-Bissau	3	2006-2016	23414	34.29 (28.63 to 40.19)
West Africa	Mauritania	4	2001-2015	34100	61.20 (53.61 to 68.53)
West Africa	Sierra Leone	3	2006-2010	24268	24.67 (8.87 to 45.18)
West Africa	Mali	6	1996-2015	67404	72.59 (69.98 to 75.13)
West Africa	Togo	3	2006-2014	16777	0.53 (0.21 to 0.97)
West Africa	Cote d' Ivoire	4	1999-2016	19837	13.61 (9.25 to 18.65)
West Africa	Gambia	2	2006-2010	21972	53.43 (32.14 to 74.08)
West Africa	Nigeria	7	1999-2017	104030	18.83 (14.66 to 23.39)
Western Asia	Yemen	2	1997-2013	16037	6.31 (0.00 to 28.23)
Western Asia	Iraq	1	2011	8759	21.00 (20.15 to 21.85)

Secular trend in the prevalence of FGM/C among children aged 0-14 years

Table 2 and Figure 2 show the trends in the prevalence of FGM/C among children within 0-14 age range who have been subjected to FGM/C. The percentage decline in the prevalence of FGM/C among the 0 to 14-year-old children was highest in East Africa, followed by North and West Africa. The prevalence decreased by 787% in East Africa. This is, from 71.4% in 1995 to 8.0% in 2016. In North Africa, the percentage decreased from 57.7% in 1990 to 14.1 in 2015. In West Africa, the prevalence decreased from 73.6% in 1996 to 25.4 in 2017. This is to be contrasted with the picture in the Western Asia, where the percentage increased only by 1.0% in 1997 and 15.9% in 2013.

The results of the trend analysis showed a significant shift downwards in the prevalence of FGM/C among children aged 0-14 years in such regions and sub-regions of East Africa, North Africa and West Africa. East Africa has experienced a much faster decrease in the prevalence of the practice (trend = -7.3%, 95% CI -7.5% to -7.1%) per year from 1995 to 2014. By contrast, the decline in prevalence has been much slower in North Africa (trend = -4.4%, 95% CI -4.5%

to -4.3%) and West Africa (trend = -3.0%, 95 CI -3.1% to -2.9%). However, in Western Asia, between 1997 and 2015, the prevalence of FGM/C among children aged 0-14 increased by +19.2% (95% CI +16.9% in +21.7) per year. A non-statistically significant uptrend was also observed in Central Africa (trend = +0.2%, 95% CI -0.7% to +1.0).

Table 2: Regional trends in percentage of girls aged 0-14 circumcised

Region	Number of surveys	Period		Percentage relative changes (%)	Average annual percentage changes: AAPC (95% CI)
		Start	End		
Central Africa	4	2004	2015	-8.1%	+0.2 (-0.7 to +1.0)
East Africa	13	1995	2014	-787.0%	-7.3 (-7.5 to -7.1)
North Africa	9	1990	2015	-309.2%	-4.4 (-4.5 to -4.3)
West Africa	17	1996	2017	-190.3%	-3.0 (-3.1 to -2.9)
Western Asia	3	1997	2013	+94.0%	+13.7 (+12.3 to +15.0)

Discussion

Main Findings

We found that prevalence of FGM/C among children varied greatly between countries and regions and, also within countries over survey periods. Specifically, West, East, and North African countries including Mali, Mauritania, Gambia, Guinea, Djibouti and Sudan have pooled prevalence estimates well over 40%. These rates may be consistent with the influence of different predictors including geographical mobility, socioeconomic and cultural factors acting at individual, family and tertiary levels. Our study found a huge and significant decline in the prevalence of FGM/C among children aged 0-14 years across countries and regions. This current evidence points towards the success of the national and international investment and policy

intervention in the last three decades. One possible explanation in the decrease of FGM/C among young girls (0-14 years) may be due to the legal ban on FGM/C among children currently in place in most of these countries with strong cultural and traditional influence may have acted as an effective deterrent as seen in the decline among these cohorts.

Although there is clear evidence of significant decline in the prevalence among the population studied here (0-14 year-old children), the FGM/C risk factors still prevails and potentially heightening the possibility of reverse trend in some countries. These risk factors include lack of, or poor education, poverty and continued perception of FGM/C as a potential marriage market activity. [29,43] The health and socioeconomic consequences of FGM/C coupled with its risk factors may mean growing underinvestment and Gross Domestic Product (GDP) losses, which itself reflects increased loss in productivity and reduced labour efficiency in LMICs. Moreover, those regions and sub-regions showing high prevalence of FGM/C should be the focus on renewed government and donors' policy efforts. If the goal of public policy is to ensure that the practice is completely eliminated, further efforts and interventions as well as service planning are urgently needed. This is package of comprehensive intervention could include legislation, advocacy, education and multimedia communication; in order to come up with more culturally-sensitive and community-engaging strategies such as forging partnership with religious and community leaders, youths and health workers to drive the practice downward.[16,18,35-41]

Strengths and limitations

There are a number of caveats to be considered when interpreting these results. The main limitation of the study is risk of reporting bias as similar studies of this kind. It is possible that responses to culturally sensitive issues such as FGM/C will have distorted the findings; it may be under-reported. In fact, a recent body of evidence suggests that under-reporting of FGM/C cases could occur[44-46]. Such an underreporting may be due to fear that new legislation banning the practice across many jurisdiction would lead to prosecution of relatives if disclosure was made about their FGM/C status. Another limitation is that we did not consider study-level participants' characteristics, which may have further increased the knowledge of the dynamics of FGM/C practices.

Despite these limitations, the study strengths are significant. It is a large, population-based study with national coverage. In addition, data of the DHS are widely perceived to be of high quality, as they were based on sound sampling methodology with high response rate. DHS also adhere to stringent ethical rules in the collection of sensitive topic such as FGM/C. Another important strength of this study is the number of included countries and geographic and socioeconomic diversities constitute a good yardstick for the region, and help to strengthen the findings from the study.

Conclusion

The prevalence of FGM/C among children aged 0-14 years varied greatly between countries and regions and, also within countries over survey periods. There is evidence of huge and significant decline in the prevalence of FGM/C among children across countries and regions. There is a need to sustain comprehensive intervention efforts. In addition, further targeted culturally sensitive policy intervention and other effective strategies for preventing FGM/C should be a major public health priority in in countries and regions still showing high prevalence of FGM/C among children, where the practice is still pervasive.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

N-BK conceived of the study; interpreting the results and was involved in conducting the literature review and drafting the article. ME conducted the data analysis and was involved in conducting the literature review, interpreting the results and drafting the article. OU was involved in conducting the literature review, interpreting the results and drafting the article. PK contributed to the interpretation of the results and revised the manuscript by producing the final article. All authors performed critical revisions for important intellectual content, read, and approved.

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Figure legends

Figure 1: Location of included studies

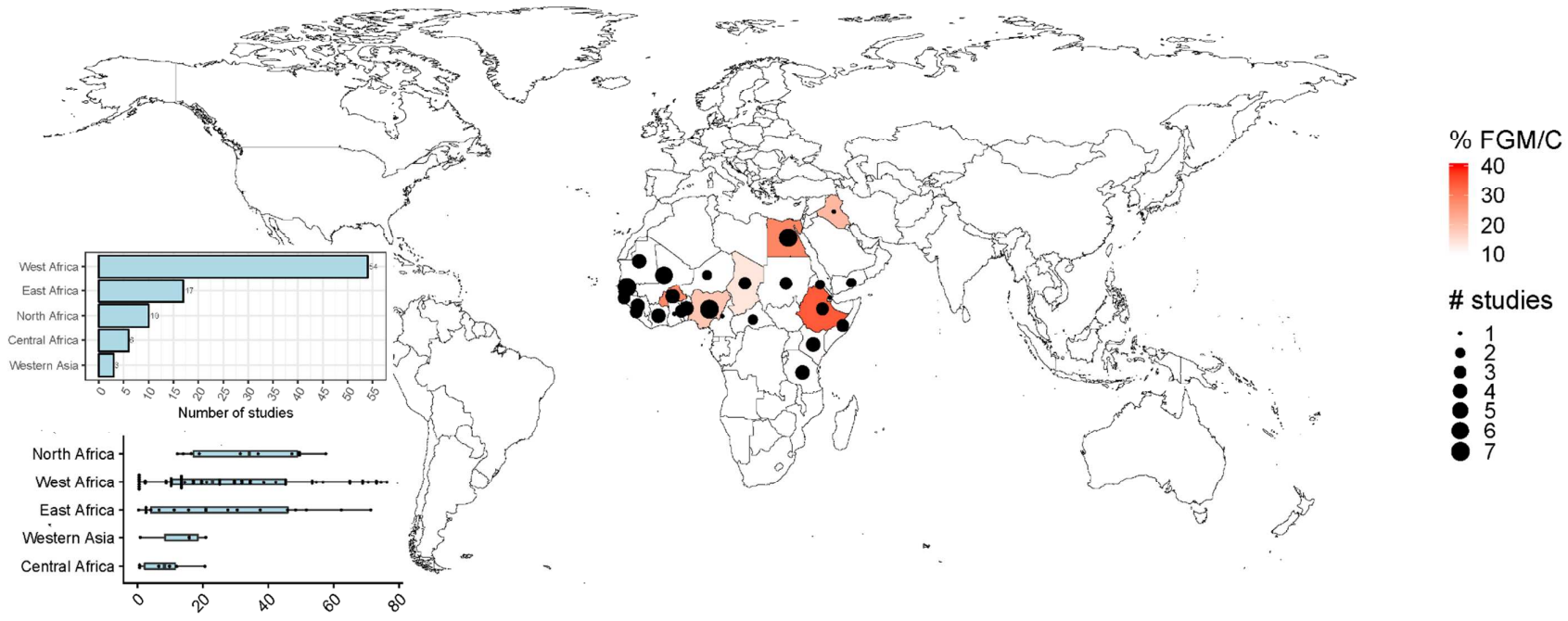
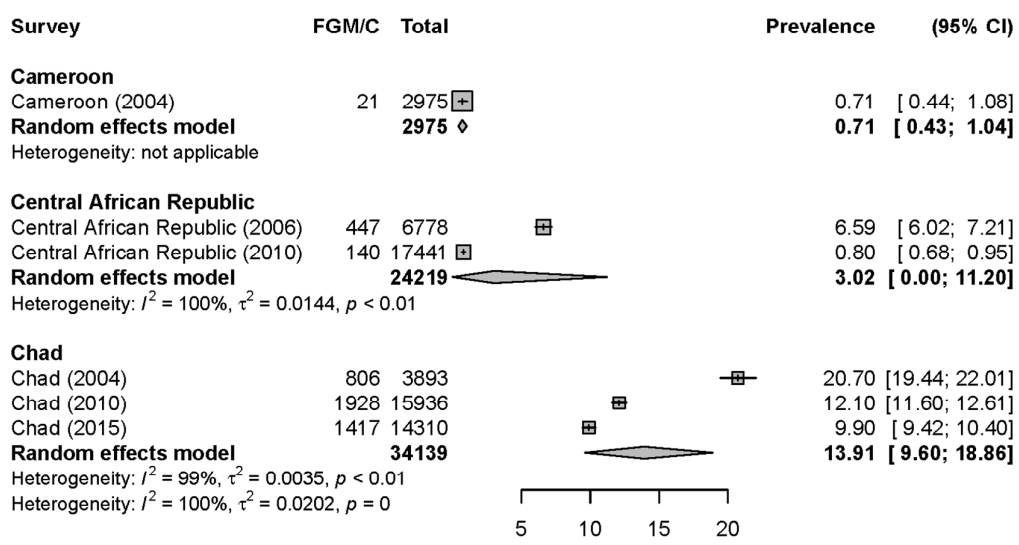


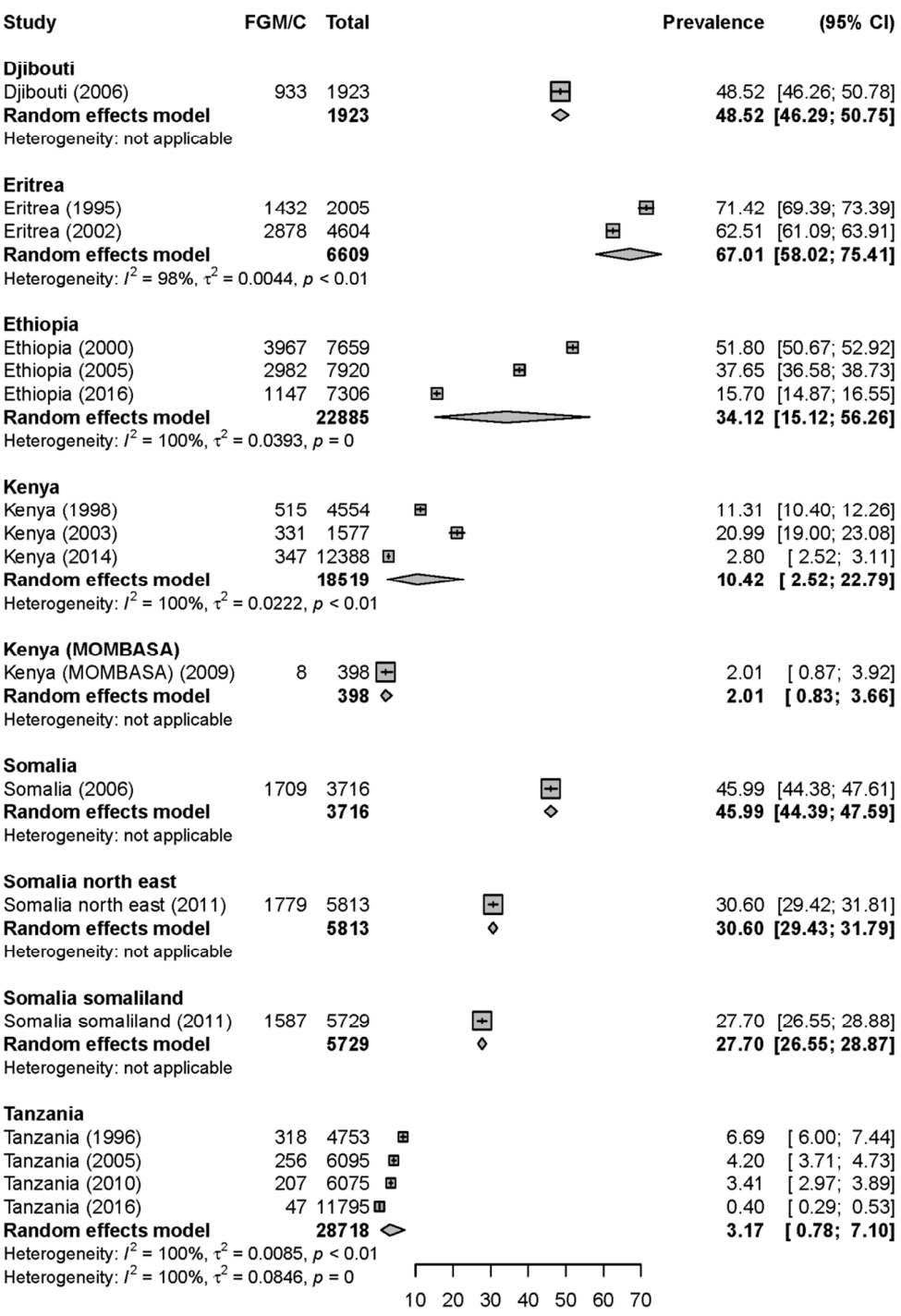
Figure 2: Secular trends in prevalence FGM/C among children

Online Only Figures

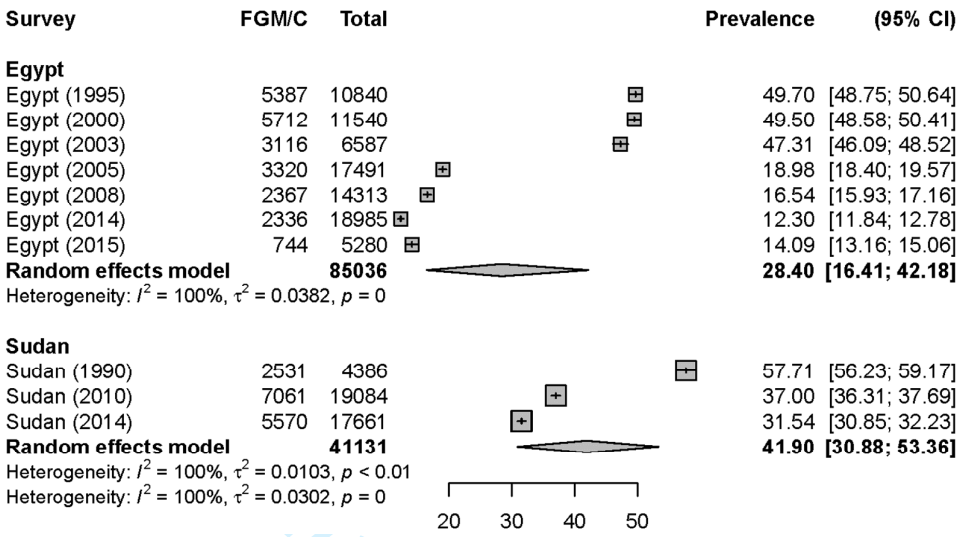
eFigure 1: Forest of prevalence of FGM/C among children, Central Africa



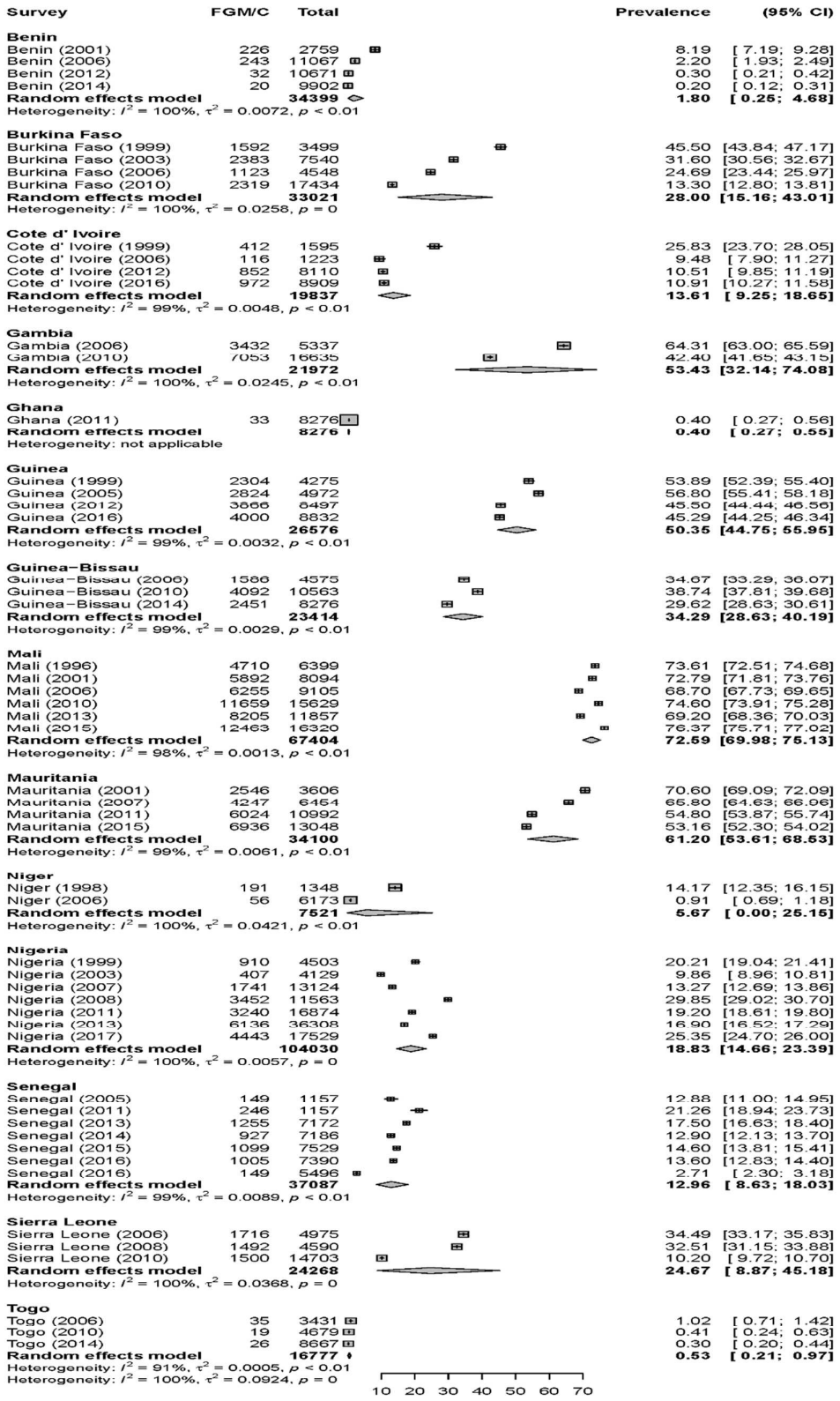
eFigure 2: Forest of prevalence of FGM/C among children, East Africa



eFigure 3: Forest of prevalence of FGM/C among children, North Africa



eFigure 4: Forest of prevalence of FGM/C among children, West Africa



eFigure 5: Forest of prevalence of FGM/C among children, West Asia