Estimating sexual violence prevalence among young women and girls: a statistical analysis of demographic and health surveys from low- and middle-income countries

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Abstract

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Sexual violence is an urgent public health issue which has significant negative repercussions for the health and wellbeing of women across the globe. Existing evidence suggests that experiences of sexual violence are common early in life, with young women and girls 18 or younger at high risk of violence. However, there is limited information available for these age groups due to ethical and legal challenges associated with collecting data directly from children and adolescents. To help fill this evidence gap and estimate patterns of women's early experiences of sexual violence, data from 47 Demographic and Health Surveys in 33 low- and middle-income countries were synthesized. Using these data and women's reported ages at first exposure to sexual violence, a synthetic cohort analytical approach was employed to estimate prevalence of sexual violence among young women and girls over time. Among 34,065 women who had ever experienced sexual violence and recalled their age at first exposure, 25.4% reported experiencing their first event by age 15 and 52.4% reported experiencing sexual violence for the first time before turning 19. On average over the years estimated for each country, lifetime prevalence of

sexual violence among 15-year-olds ranged from 0.411% in Myanmar to 12.2% in Uganda. Given the life-long impacts of sexual violence, findings underscore the need for policies and prevention efforts informed by the unique experiences of young women and girls.

Introduction

Sexual violence and health

Sexual violence is a widespread human rights violation and a global public health concern. While sexual violence affects men and women of all ages, it is a largely gender-based crime and predominately affects women and girls.[1] Exposure to sexual violence has been associated with significant negative repercussions for the health and wellbeing of women across the globe, including physical injuries[2], mental health consequences such as anxiety and depression[3,4], and sexual and reproductive health outcomes, for example incident human immunodeficiency virus infection and other sexually transmitted diseases.[5] In order to better inform public health policies and interventions, timely and reliable measurement of both sexual violence prevalence and its health impacts are needed.

Definitions of sexual violence

Sexual violence includes a variety of acts and has been defined by the World Health Organization (WHO) as, "any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion, by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work."[1] It includes rape, attempted rape, coerced sex, and other forms of assault or coercion involving sexual organs.[1]

Due to the wide range of acts and circumstances captured by sexual violence, several different operational definitions can be used to describe this form of violence, which may differ in terms of the perpetrators of violence or gender and age of the at-risk population.[6] Sexual violence is both a component of intimate partner violence (IPV) and its own category of violence[7], and many global indicators focus on violence against women and girls specifically. For example, the Sustainable Development Goal Indicators 5.2.1 and 5.2.2 are dedicated to the elimination of violence against women in public and private spheres and aim to measure the proportion of women and girls 15 years and older subjected to physical, sexual, and psychological IPV as well as non-partner sexual violence (NPSV).[8] Furthermore, sexual violence directed against children is often considered a distinct indicator and is commonly measured as exposure to violence while under the age of 15 or 18 years old.[7,9]

Measuring exposure to sexual violence

There exist multiple data sources which include information on exposure to sexual violence among women and girls, including population-based surveys and administrative sources. Administrative data sources include clinical databases and governmental or legal data systems, and these sources of information can be particularly useful for measuring health and societal impacts of violence. However, they have been shown to underestimate the prevalence of sexual violence compared to surveys conducted in the same underlying population[10], and the cases of sexual violence captured by such sources are likely biased by severity of the sexual violence incident as well as an individual's access to and trust in official services. Due to these challenges, efforts to measure and synthesize information on sexual violence prevalence have instead relied upon self-reported survey data.

Although considered the preferred source of information, surveys are affected by several measurement challenges as well. Sexual violence survey estimates can be influenced by social desirability, recall, and other reporting biases[11], whereby certain groups of women may be less able or willing to disclose past experiences of sexual violence than others. In many locations, sexual violence is associated with severe stigma and survivors may be blamed for their experiences.[6] Thus, even across surveys which follow best practices, such as ensuring a private interview environment[12] and asking specific, acts-based questions[6], there are many factors which may prevent disclosure and lead to underestimates. In addition, the lack of consensus among definitions and denominators used across surveys presents further challenges in harmonizing these data to create globally comparable statistics.[6]

Existing evidence

Despite the above-described measurement challenges, in 2018, the WHO analyzed available prevalence surveys and studies measuring violence against women to estimate national, regional, and global levels of physical and/or sexual IPV and NPSV.[6] Globally, these estimates indicate that 30% (95% Uncertainty Interval [UI] = 26 – 34%) of women 15 years and older have been subjected to IPV or NPSV in their lifetime.[6] Available age-stratified estimates additionally suggest that experiences of violence are common among younger age groups, with 24% (95% UI = 21-28%) of ever-partnered women aged 15-19 years estimated to have experienced physical or sexual violence from a partner in their lifetime.[6] Data limitations and low estimated prevalence levels prevented the examination of age-specific estimates for NPSV.[6]

While the WHO combined estimates include acts of physical violence perpetrated by a partner in addition to acts of sexual violence, they suggest that sexual and gender-based violence is not only globally pervasive but begins early in life.[6] There is a paucity of comparable sexual violence data available for young women and girls; however, existing evidence supports the WHO estimates for 15-19 year olds. In 2014, a statistical analysis undertaken by UNICEF assessed data from 40 nationally-representative household surveys (i.e., Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys), finding that prevalence of ever having experienced sexual violence among 15-19 year old girls ranged from 0% in Kyrgyzstan to 22% in Cameroon.[13] Additionally, in 2007 the United States Centers for Disease Control and Prevention launched the Violence against Children and Youth Surveys (VACS), which seek to measure experiences of violence, risk and protective factors for violence, and consequences of violence among individuals aged 13-24.[14] To date, 24 VACS have been conducted in several low- and middle-income countries, and several recent country reports have estimated past-12-month prevalence of sexual violence among girls aged 13-17 to be greater than or equal to 10%, including in Botswana (2019), Kenya (2020) and Rwanda (2018).[14,15]

Gaps in the literature

Apart from VACS, there exists little comparable data on the prevalence of sexual violence among young women and girls aged less than 15 years old. While the number of population-based surveys measuring violence against women has almost doubled over the past decade[6], the majority of violence-specific surveys focus on IPV among legal adults specifically. Gathering information directly from children and adolescents is complicated by age-sensitive consent

procedures, parents not wanting their children to be interviewed about such topics, and concerns about the ability of data collectors to ensure the safety of respondents.[16–18]

In the absence of data collected directly from young women and girls, existing information surrounding childhood or adolescent experiences of sexual violence rely on survey questions asked in a recall-based format, such that current-day adults respond to questions about having experienced any sexual violence prior to a particular age threshold, commonly set as age 15 or 18. However, because these measures provide information on present-day adults' history of abuse across multiple different years of interviews, they do not allow for easily understandable comparisons on how sexual violence experienced by young women is changing over time. In addition, recall-based sexual violence questions using pre-defined age cutoffs provide low specificity in localizing the early ages at which sexual violence most commonly occurs, which can provide a useful target for policies and interventions. Indeed, surveys which ask about specific ages of exposure have shown that high proportions of adolescent girls' first experiences of sexual violence occur between the ages of 10 and 14.[13] Despite this startling finding, there are few multi-country analyses which have examined women's reports of ages at first exposure to sexual violence.

Rationale for this study

Individual-level data from detailed, population-based surveys provide the opportunity to develop statistical analyses which address the above-described measurement challenges and data gaps for sexual violence among young women and girls. The DHS are nationally-representative household surveys which constitute one of the largest sets of sexual violence data comparable across time periods and locations.[19] Data on sexual violence in the DHS come from an optional questionnaire module which asks participants about different kinds of violence perpetrated by partners and non-partners over the lifetime.[20] While the DHS sample women 15-49 years old, the violence questionnaire includes a question which asks women to recall their age at their first experience of sexual violence. Thus, information available from the DHS can be used to generate cross-nationally comparable statistics on early experiences of sexual violence.

This analysis sought to use DHS data to characterize sexual violence exposure among young women and girls, in turn improving understandings of sexual violence exposure across the life-course. Reported ages at first experience of sexual violence were quantified into country, regional and total distributions to examine the percent of women's sexual violence experiences which occur before or equal to ages 10, 15, and 18. Using reported ages at first experience, a cohort-based analytical approach was employed to construct indicators of sexual violence prevalence among young women and girls aged 10-, 15-, and 18-years-old by geography and time.

Methods

Data Identification and extraction

Available DHS sexual violence data for this analysis were identified using the Institute for Health Metrics and Evaluation's Global Health Data Exchange (GHDx).[21] In total, 106 DHS

domestic violence modules from 56 low- and middle-income countries (LMICs) were identified (figure 1).

For the DHS domestic violence module, one woman per household is randomly selected to answer the questions. Because the composition of the sample is different from that of the standard DHS question set, an indicator for participation in this specific module and distinct sample weights are provided. The domestic violence instrument includes several questions about participants' experiences of sexual violence over their lifetime (table 1). DHS central statistics guidance[20] was followed to create indicators of any lifetime sexual violence based upon a participant answering yes to any of these questions, and the denominator for this indicator was all women surveyed in the domestic violence module.

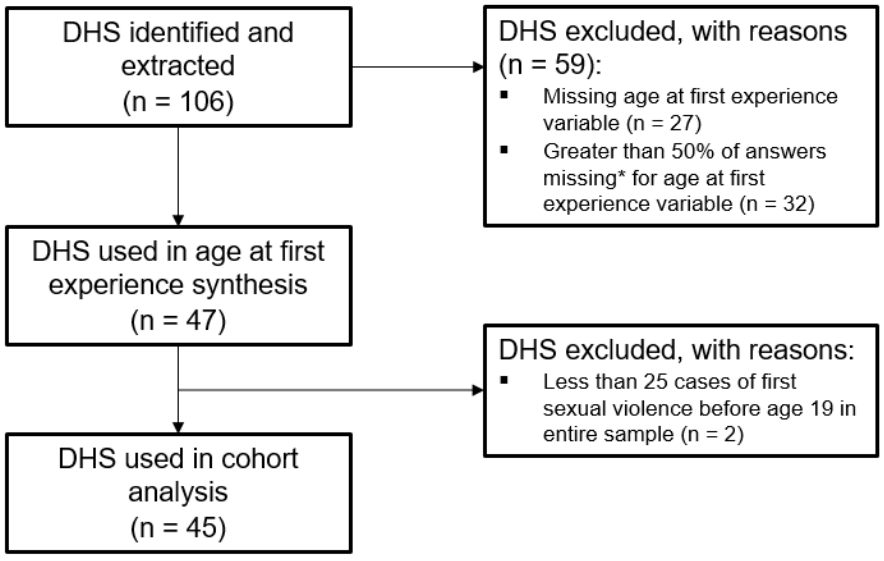
Survey Question	**Answer Options**	**Question Sample**
Does/did your (last) husband/partner ever: • Physically force you to have sexual intercourse with him even when you did not want to? • Force you to perform other sexual acts you did not want to?	EVER: Yes | No | No answer If EVER is "Yes," ask about frequency in 12 months preceding the survey: Often | Sometimes | Not in past 12 months	Ever-partnered women only
Did any previous partner physically force you to have sexual intercourse or perform any other sexual acts against your will?	EVER: Yes | No | No answer If EVER is "Yes," ask how long ago did this last happen: 0-11 months ago | more than 12 months ago	Ever-partnered women only
At any time in your life, as a child or an adult, has anyone ever forced you in any way to have sexual intercourse or perform any other sexual acts when you did not want to?	Yes | No | No answer	All (if ever-partnered, asks about non-partner)
In the last 12 months, has anyone physically forced you to have sexual intercourse when you did not want to?	Yes | No | No answer	All (if ever-partnered, asks about non-partner)
How old were you the first time you were forced to have sexual intercourse or perform any other sexual acts?	Age in completed years | No answer	Respondents who answered yes to any of sexual violence questions

Table 1. DHS sexual violence survey questions, answer options, and target sample.

Exclusion criteria

Within the DHS domestic violence module, survey respondents who reported having ever experienced sexual violence are additionally asked to report their age in completed years at the time of their first experience (table 1), which was the primary variable of interest for this analysis. Among the total number of identified surveys, 27 modules were missing this variable and were excluded. Survey modules for which greater than 50% of response options for the age at first experience of sexual violence variable were missing (defined as answers of 'do not remember' or 'do not know' or implausible values such as negative numbers or numbers greater than participant's current age) were also excluded (n = 32; figure 1). Two additional surveys (Senegal-2018, Tajikistan-2017) reported less than 25 cases of first sexual violence prior to the age of 19 across respective survey samples, and these were excluded from the cohort analysis due to unstable prevalence estimates in resultant cohorts.

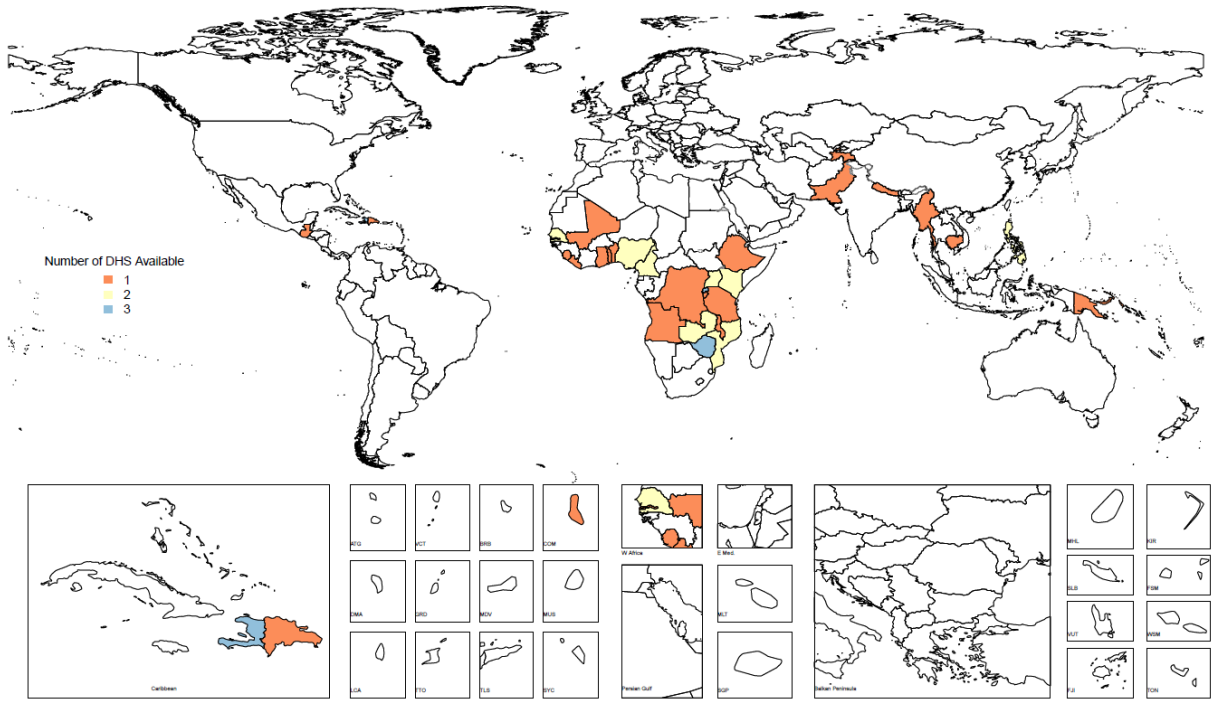
Figure 1. Demographic and Health Survey (DHS) exclusion criteria for each step of analysis.



*missing defined as missing value given by survey (98, 99) or implausible values observed in data, defined as ages less than 0 or greater than participant's current age.

The final data set for the age at first experience synthesis consisted of 47 surveys from 33 countries, which are shown in figure 2 and listed by location and survey year in the appendix (table S1). The degree of missingness in the age at first experience variable ranged from 0.8% (Rwanda-2014) to 48.3% (Kenya-2008; appendix, table S2). Summary statistics including total domestic violence module sample size, mean and standard deviation of ages included in the sample, and percent of the sample located in an urban area were calculated for each survey (appendix, table S2).

Figure 2. Geographic coverage of Demographic and Health Surveys included in analysis. The two additional surveys excluded from cohort analysis are shown in the figure.



Reported age at first sexual violence experience

Distributions of reported age at first experience were examined by survey, world region, and across the entire set of available data by calculating the percent of first experiences which occurred before or equal to ages 10, 15, and 18. Distributions reflect unweighted observations, and missing age observations (defined as answer options of 'do not remember' or 'do not know' or implausible values such as negative numbers or numbers greater than participant's current age) were not included in visualizations or percentile calculations. As a sensitivity analysis, age at first experience regional and total distributions were also calculated across survey modules with any degree of missingness in the age at first experience variable (appendix, table S3).

Cohort analysis

Data transformation

To construct time-specific indicators of lifetime sexual violence prevalence among 10-, 15-, and 18-year-olds, a synthetic cohort approach used within the field of demographics to estimate early childhood mortality[22] was adapted. First, a single row of data corresponding to each individual represented in the domestic violence module was transformed into a continuous representation of that individual over time while aged 0-18 years old (inclusive of age 18). To perform this transformation, several variables were utilized, including the participant's date of birth (century month code [CMC] date format), experience of sexual violence in the lifetime (binary event indicator), age at first experience of sexual violence (continuous age variable), and interview date (CMC date format).

Date of a participant's first sexual violence event was calculated by adding the reported age of first sexual violence event to the participant's date of birth. In order to avoid undercounting experiences of violence in this step, missing ages at first experience of sexual violence were reassigned for women who reported having ever experienced sexual violence but for whom an age at first experience was missing. Missing age observations were re-assigned by generating a random integer from that survey's distribution (mean and standard deviation) of non-missing reported ages at first experience of sexual violence. For all participants, regardless of a reported sexual violence event, follow-up time was stopped at the date an individual turned 19, which was calculated by adding 19 years to the participant's date of birth. All date calculations were performed in CMC format. Two surveys (Nepal 2016 and Ethiopia 2016) provided dates in the calendars for those countries rather than in the Gregorian calendar. These surveys were adjusted to the Gregorian calendar by applying relative conversions to the interview date and date of birth variables (appendix section 3.1). Event indicators and denominators were multiplied by participant's survey sample weight from the domestic violence module.

Because respondents only provide the age at their *first* experience of sexual violence, information on repeated exposure to violence after the age at first event but prior to an individual turning 19 was not available. Due to this limitation, the constructed indicators describe lifetime prevalence (rather than past year incidence). As a result, for each participant who reported a first event of sexual violence from the ages 0-18 (inclusive of age 18), they continued to be counted as an event for each year after their first experience. Examples of this transformation are provided for respondents without and with a reported event of sexual violence by age 18 in the appendix (figure S1A and B, respectively).

Prevalence estimation

After transforming data into year- and age-specific rows of data with an indicator for an individual's experience of a sexual violence event over time, the total number of weighted events and participants were aggregated by unique age-year categories. This aggregated dataset was then used as input to a survey-weighted Poisson regression model to estimate means and standard errors for the lifetime prevalence of sexual violence among 10-, 15-, and 18-year-olds for each year available in the data. Calculations were conducted separately by survey.

High incidence of zeros in the input data can result in overdispersion, wherein count data depart from the underlying assumption of a Poisson distribution that the variance is equal to the mean.[23] Survey input data was tested for overdispersion via Cameron and Trivedi's (1990) method.[23] For all surveys, overdispersion was found to be insignificant, and a Poisson regression was used. To account for complex survey design, a survey-weighted generalized linear model was employed. Survey clusters and strata were specified in the survey design object using the survey package in R.[24] Survey weights were already accounted for in the data aggregation process, and thus were not specified in the survey design object.

The regression model formula can be represented as:

$$log\left(\frac{event}{n}\right) = \beta_0 + \sum_{k=1}^{j} \beta_k age\_year$$

where $event$ is an age- and year-specific count of total events experienced, n is an age- and year-specific count of total sample, and age_year is a dummy variable indicating the specific age and year combination represented by the aggregated event and sample data.

The lifetime prevalence of sexual violence among 10-, 15-, and 18-year-olds for each calendar year represented in the data were calculated as the exponentiated effect size for the corresponding age_year variable (appendix section 3.2). Standard errors were calculated as the square root of the diagonal values in the variance-covariance matrix. Using these standard errors, 95% uncertainty intervals (UIs) were generated for each point estimate:

$$95\%\ Uncertainty\ Interval = mean \pm 1.96 * standard\ error$$

All analyses were performed in R version 4.0.5.

Results

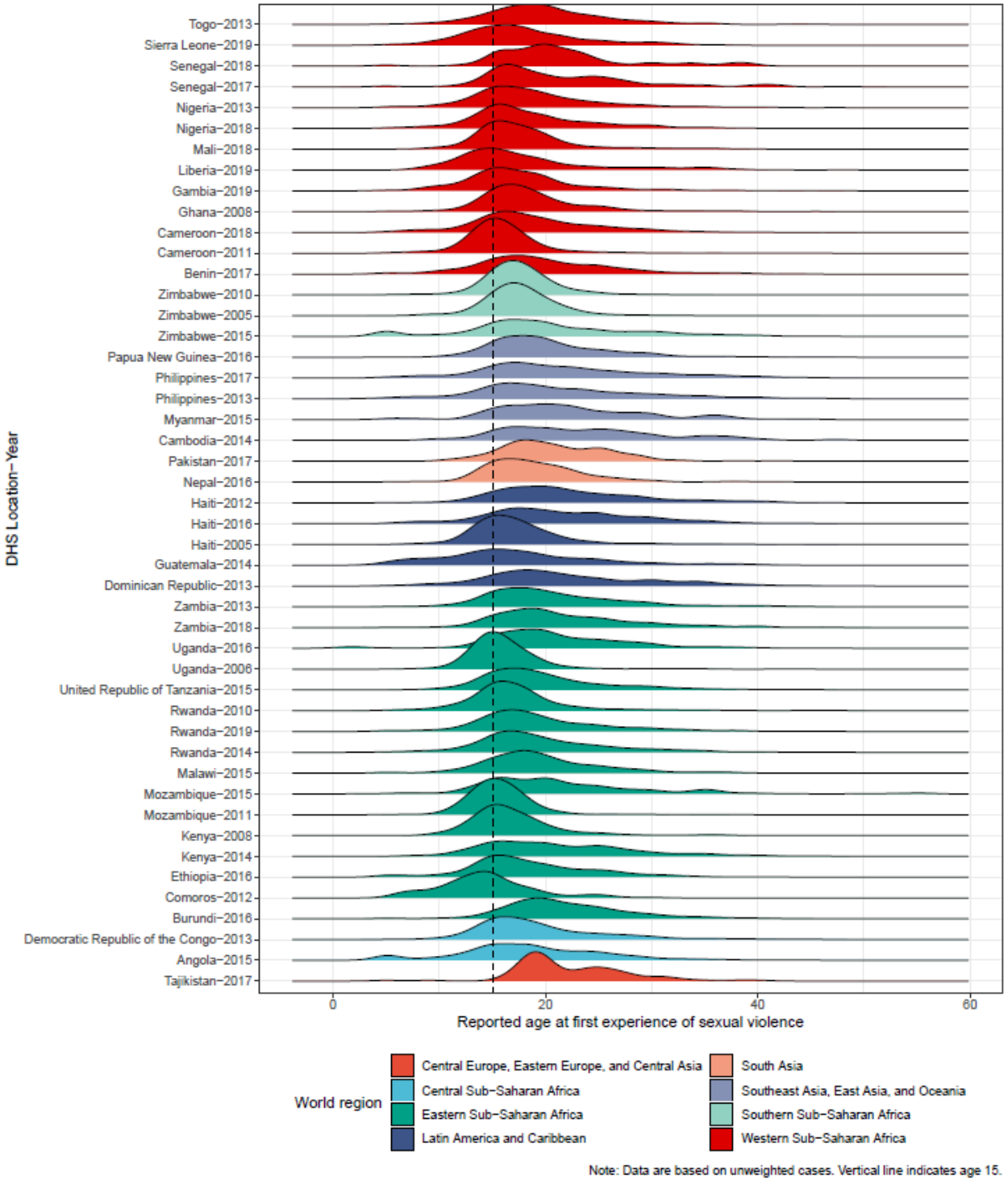
Reported ages at first experience of sexual violence

Across all countries included in the analysis, 25.4% of women who had ever experienced sexual violence and recalled their age at first exposure reported that this event had occurred before or equal to age 15 (table 2). The majority (52.4%) of recalled first events had occurred before or equal to age 18 (table 2). These results varied by country and region (figure 3). In Comoros and Guatemala, 68.8% and 43.3% of recalled first events had occurred by age 15, respectively (figure 3). By contrast, in Tajikistan, 2.2% of first events had occurred by age 15 (table 2). At the regional level, the percent of recalled events which had occurred by age 15 was highest in western Sub-Saharan Africa (32.3%) and lowest across countries in South Asia and Southeast Asia and Oceania (18.2% and 18.5%, respectively; table 2).

World Region	Percent of first experiences which happened before or equal to age:			N
	10	15	18	
Central Europe, Eastern Europe, and Central Asia*	2.2	2.2	19.6	92
Central Sub-Saharan Africa	4.4	28.5	55.0	2415
Eastern Sub-Saharan Africa	2.7	23.3	49.5	13762
Latin America and Caribbean	5.8	25.3	47.7	3730
South Asia	0.8	18.2	47.7	533
Southeast Asia, East Asia, and Oceania	4.2	18.5	41.3	2915
Southern Sub-Saharan Africa	4.2	23.5	61.8	2914
Western Sub-Saharan Africa	4.7	32.3	60.6	7704
All data	3.8	25.4	52.4	34065

Table 2. Age at first experience of sexual violence distribution percentiles by age 10, 15, and 18. Age thresholds are inclusive and missing ages were excluded from distributions. *Central Europe, Eastern Europe, and Central Asia represented by a single survey (Tajikistan-2017).

Figure S3. Distribution of age at first experience of sexual violence by survey.



Note: Data are based on unweighted cases. Vertical line indicates age 15.

Prevalence estimates by age

Country and year-specific estimates of lifetime sexual violence prevalence for 10-, 15-, and 18-year-olds are shown by region in figures 4A and B and by country in the appendix (figure S3).

Figure 4A. Estimated lifetime prevalence of sexual violence among young women aged 10, 15, and 18 by world region.

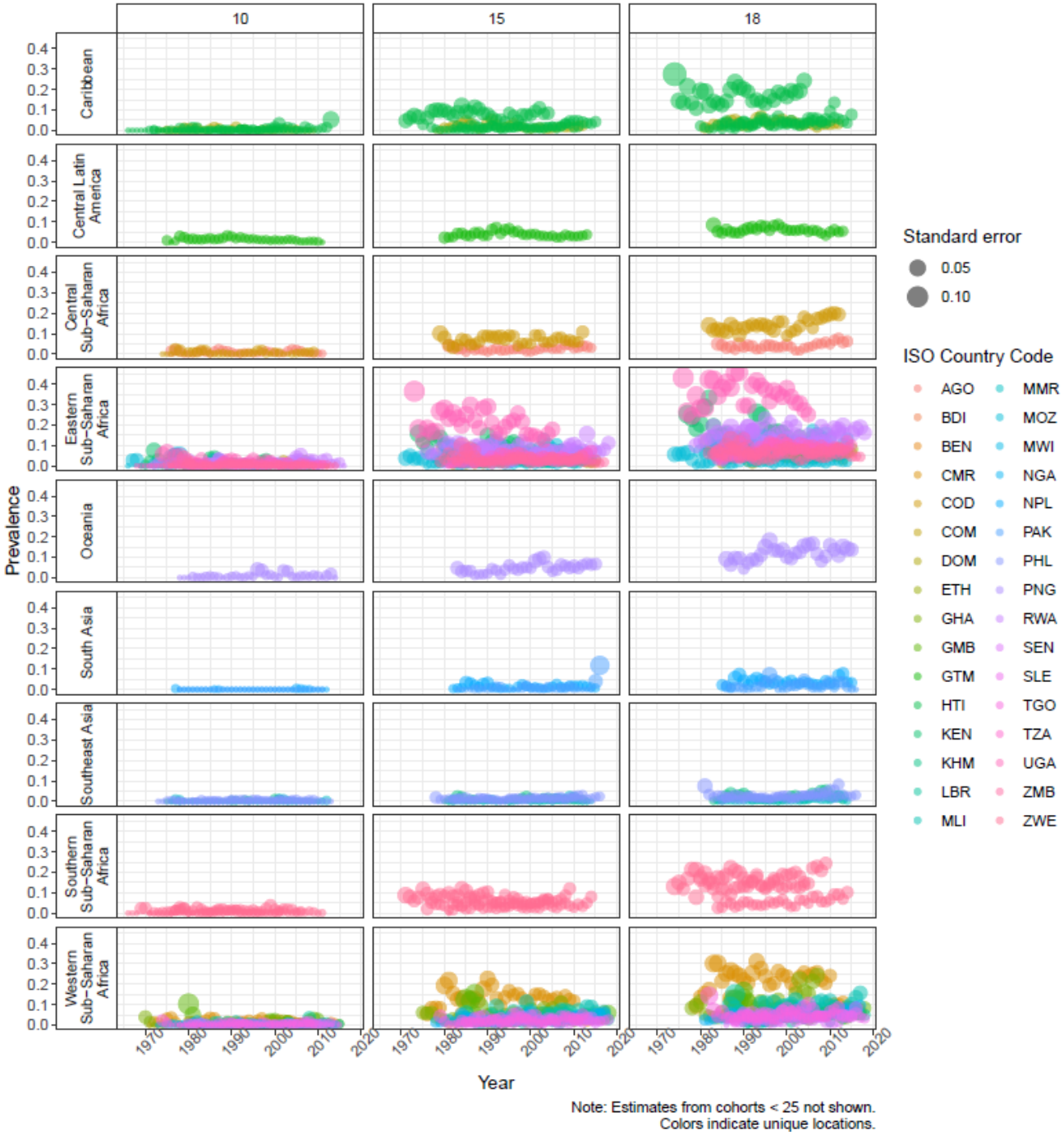
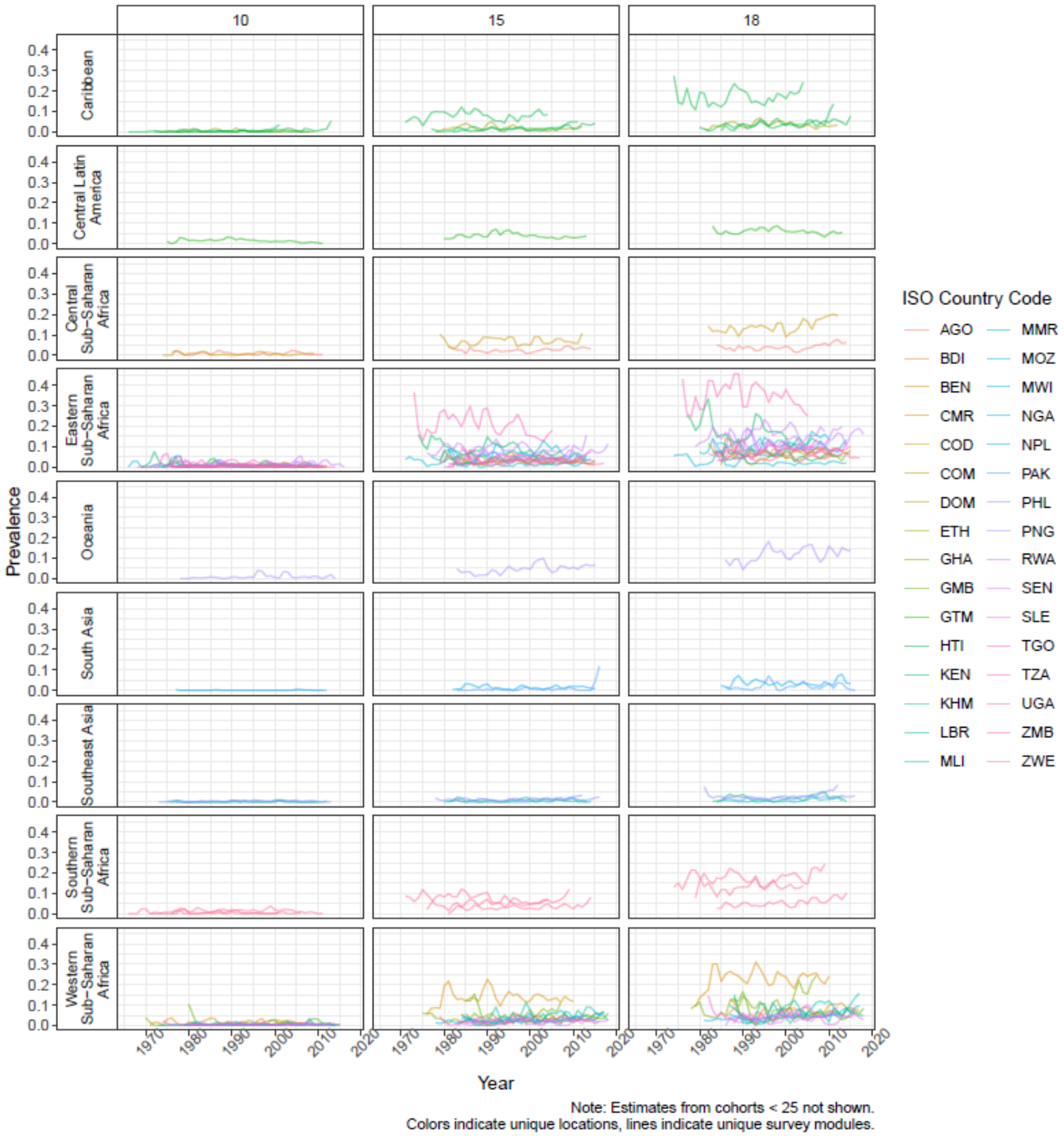


Figure 4B. Estimated lifetime prevalence of sexual violence among young women aged 10, 15, and 18 by world region.



Comparing time trends by age and country

In most countries and age groups, sexual violence prevalence estimates either remained stable or showed variation in either direction from year to year (figure 4B and appendix, figure S3). Estimates derived from multiple available surveys in Nigeria were an exception and suggested

that prevalence among 15- and 18-year-olds has increased in more recent years (appendix, figure S3). Estimates derived from a single survey in each of Democratic Republic of Congo, Ghana, and United Republic of Tanzania also suggested higher prevalence of sexual violence in more recent years, particularly among 18-year-olds (appendix, figure S3).

Comparing average estimates over time by country

Across all countries included in the cohort analysis, estimated lifetime prevalence of sexual violence among 10-year-olds was low. The highest estimated average prevalence over time for this age group was found in Guatemala (1.38%), Uganda (1.33%), Cameroon (1.13%), and Rwanda (1.11%), while estimates were close to zero in several other locations, such as Myanmar, Nepal, Cambodia, and Pakistan (appendix, figure S3).

On average over time, estimated prevalence of sexual violence among 15-year-olds ranged from 0.411% in Myanmar to 12.2% in Uganda. The highest average estimated prevalence among 15-year-olds over time was found in Sub-Saharan Africa, including in Uganda (12.0%), Cameroon (8.70%), Democratic Republic of Congo (6.92%), and Rwanda (6.63%). Furthermore, countries in Southeast Asia and South Asia were observed to have among the lowest average prevalence estimates in this age group over time, with Nepal (1.44%), Philippines (1.29%), Pakistan (0.886%), Cambodia (0.708%), and Myanmar (0.411%) falling into this category. Among the countries with the lowest average estimated prevalence among 15-year-olds over time, only Senegal (1.35%) was located outside of South Asia or Southeast Asia.

Countries with high prevalence estimates among 15-year-olds were also those with high estimates among 18-year-olds. In several locations in Sub-Saharan Africa, average estimated prevalence of sexual violence among 18-year-olds over time was greater than or equal to 10%, including in Uganda (21.7%), Cameroon (15.2%), Democratic Republic of Congo (14.2%), Rwanda (13.4%), Zimbabwe (12.3%), Papua New Guinea (11.8%), Kenya (11.4%), and Ghana (10.9%). By contrast, average estimated prevalence for 18-year-olds over time was lowest and less than 4% across countries in South Asia and Southeast Asia, including Nepal (3.70%), Philippines (2.53%), Cambodia (1.90%), Pakistan (1.81%), and Myanmar (0.780%).

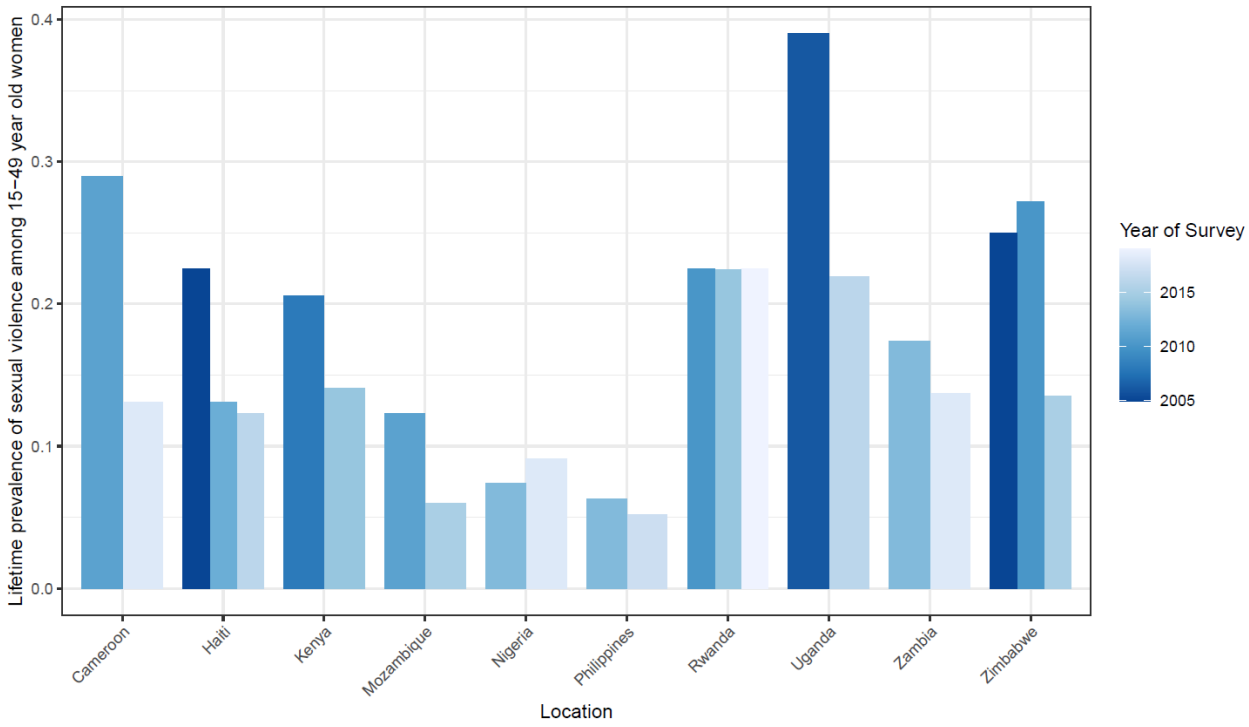
Comparing multiple survey years within a single country

In several countries, multiple years of DHS data were available, enabling comparison of estimates derived from surveys conducted in different years. In certain locations, estimated time series from different survey years were similar, for example in Nigeria, Philippines, Rwanda, Zambia (appendix, figure S3). However, in other locations (Zimbabwe, Uganda, Haiti, Mozambique, Kenya, and Cameroon), estimated prevalence from surveys conducted in more recent years was lower than that of previous years (appendix, figure S3).

These patterns aligned with those observed for cross-sectional lifetime sexual violence prevalence reported from these surveys among women aged 15-49 (figure 5). For example, estimates of women aged 15-49 who have ever experienced sexual violence in Uganda decreased from 39.0% in 2006 to 21.9% in 2016. Similarly, the 2005 Haiti DHS estimated that 22.5% of women 15-49 had ever experienced sexual violence, almost double that of the estimates from

2012 (13.1%) and 2016 (12.3%) surveys, and the 2018 Cameroon DHS estimate (13.1%) was less than half that of the 2011 survey (29%).

Figure 5. Estimated lifetime prevalence of sexual violence among 15-49 year old women for countries with multiple years of surveys available.



Source: DHS included in this analysis with multiple years of data available in a single location. Lighter colors indicate more recent years of survey.

Discussion

In this analysis, individual-level DHS data available from 47 surveys in 33 countries were used to examine ages at first experience of sexual abuse and construct time series of sexual violence prevalence in childhood and adolescence. Other methods of understanding childhood and adolescent sexual violence exposure include asking adults about their experiences prior to a given age and calculating prevalence among adults in the year of the survey. Here, a synthetic cohort approach was employed to improve upon these indicators and provide specific information on women's early experiences of violence.

While the distribution of ages at first experience of sexual violence were found to vary by geography, among 34,065 women included in this analysis who reported their age at first experience of sexual violence, approximately 25% reported that this event had occurred prior to age 16. When considered in combination with literature suggesting increased risk for consequent violence victimization[25] and negative health impacts[26] for survivors of childhood sexual violence, these results indicate an urgent need for policies and interventions focused on young women and girls. Sexual violence in childhood and adolescence is influenced by both gender and age, and an intersectional approach which considers the unique experiences of young women and girls can be used to develop focused policy interventions.[15] For example, school-based education

programs oriented around preventing childhood sexual violence have been shown to increase children's knowledge of violence and self-protective skills.[15,27] Additionally, multi-component programs which engage entire families have been found to decrease dating violence experiences among adolescents.[15,28] In parallel to prevention efforts, comprehensive services including physical and psychological healthcare and legal assistance can provide additional support and promote life-long health for survivors of childhood sexual violence.[15,29]

Overall, results from this analysis suggests that prevalence of sexual violence among younger ages is highest in countries located in Sub-Saharan Africa and comparatively lower among locations in Southeast Asia and South Asia. These regional differences align with those found in a 2011 global meta-analysis of childhood sexual abuse studies, which found prevalence of sexual violence among young girls to be lowest in Asia compared to other countries and world regions.[10] Nationally-representative VACS estimates available from Cambodia and Laos People's Democratic Republic also suggest lower rates of sexual abuse among young women and girls in these countries compared to other VACS locations.[15] These patterns may be due to true differences in prevalence driven by socioeconomic or cultural differences, by differences in rates of disclosure, or by some combination of both[10], and the continued collection of cross-nationally comparable data can help to elucidate the drivers of observed regional differences in sexual violence prevalence.

VACS estimates of physically forced sexual violence and unwanted sexual touching generally align with DHS survey questions used in this analysis (Table 1). In most locations and years where estimates from this analysis overlapped with VACS data, estimates of lifetime sexual violence prevalence among 18 year olds generated here align with VACS estimates of physically forced intercourse experienced prior to 18 among 18-24 year olds (appendix, figure S4). In Rwanda 2015, the sexual violence estimate (15.8%, 95%UI = 6.53 - 25.0%) from this analysis was significantly higher than the VACS prevalence estimates for physically forced intercourse (4.1%, 95%UI = 2.4 – 5.9%). For Haiti-2012, Kenya-2010, Uganda-2015, and United Republic of Tanzania-2009, VACS estimates of unwanted sexual touching prior to age 18 were significantly higher than those found in this analysis (appendix, figure S4). These differences emphasize the importance of carefully considering instruments and case definitions used when comparing data across surveys. VACS include a wider range of sexual acts than the DHS by specifically asking respondents about coerced, pressured, or attempted sexual assault. Importantly, experiences such as attempted and coerced sexual violence, while often left out of surveys, can be just as traumatic to individuals' development and health.[27,29] Specific estimates available from VACS may be used to further understand the relationships between different definitions and acts of sexual violence. These relationships can help further data comparability across diverse surveys, for example, by using them to adjust upwards restricted case definitions from surveys which may only ask about the most severe acts of violence (i.e., forced intercourse) and would otherwise produce lower prevalence rates.

A novel aspect of this analysis is the ability to examine estimate prevalence of childhood and adolescent sexual violence exposure over time. For most countries investigated, consistent time trends were not observed. However, in certain locations, such as Nigeria, prevalence estimated

from multiple surveys suggested that sexual violence prevalence among 15- and 18-year-olds has increased in recent years. These trends may be due to underlying contextual factors; for example, it is well-established that sexual violence among women and girls increases during times of conflict or emergency.[30,31] In Nigeria, ongoing violence by Boko Haram since 2009 may contribute to these increases and has introduced additional socioeconomic strain within the country, which can also lead to increases in young women's involvement in transactional sex and consequent vulnerabilities to sexual violence.[32] In addition, other public health emergencies – such as the COVID-19 pandemic – may cause increases in sexual and gender-based violence due to several interconnected factors, for example restricted services and mobility as well as increased financial and psychological stress.[33] Increases in gender-based violence have been documented across several countries not just during COVID-19 but during other epidemics as well, such as during the 2013-2015 Ebola outbreak in West Africa.[34] As DHS data collection efforts resume after the past several years of COVID-19-related impacts, it will be crucial to monitor if and for which populations prevalence of sexual violence increases.

Limitations

The results from this analysis should be interpreted in light of certain limitations. First, although the DHS follow safety and ethical guidelines in collecting data on violence exposure, these surveys likely still underestimate the true prevalence of sexual violence among women and girls. Beyond measurable aspects such as case definitions and survey methodologies, women's reporting of sexual violence may be impacted by a number of other factors. Even within the same country and survey series, this analysis showed that sexual violence estimates drastically decreased within periods of 10 years or less in locations such as Uganda, Haiti, and Cameroon. It is unexpected for a measure of lifetime prevalence to change so quickly, and these observations reinforce the need for continued data collection and methods development to triangulate the prevalence of sexual violence, both in younger age groups and across the lifespan.

Second, while DHS data covers multiple countries and time periods, these surveys are conducted exclusively in LMICs, and therefore results are not representative of high-income regions. Existing meta-analyses of childhood sexual abuse prevalence indicate that rates in regions such as high-income North America and Australia are comparable to those found in Africa.[10] The methods demonstrated here may be applied to available specialized violence surveys in high-income locations in order to compare trends across geographies, and future analyses may investigate the utility of indirect measures which are predictive of sexual violence prevalence to assist in understanding rates for locations without direct data available.

Third, the vast majority of available DHS domestic violence modules are asked of women only, precluding the ability to systematically examine sexual violence prevalence among other genders. While most existing data suggest that girls are at higher risk for sexual violence prior to age 20[13], less information is available for boys, transgender, and gender-diverse populations. A few high-quality data sources from Asia and the pacific[36,37] as well as several Balkan countries[38] have suggested that prevalence of sexual violence among boys is comparable to or higher than that found among girls, and further data collection efforts and analyses are needed to better understand sexual violence prevalence among all young people.

Fourth, it is possible that reports of the age at first exposure to sexual violence are affected by recall and other reporting biases, which may have differential impacts based upon time passed since a sexual violence experience or background characteristics of the respondent. For example, older individuals may be less likely to remember or accurately report sexual violence events if they occurred in childhood or adolescence, which could contribute to prevalence estimates which decrease with increasing time from the date of the survey.[11] Alternatively, younger respondents may be less likely to report if they have had less time to process their experience.[13] It has not been well-established how these age-specific trends may impact reporting and recall biases in relation to sexual violence, and thus, time trends and age at first experience percentile distributions shown here should be interpreted with these underlying factors in mind.

Finally, the survey instrument used for the analyses presented here does not provide information on repeated exposure to violence in younger ages and thus cannot be used to construct indicators of sexual violence incidence in those younger than 15 years old. To fill this information gap, future data collection efforts can include questions surrounding the frequency and duration of early sexual violence experiences in addition to the age at first exposure.

Conclusions

Challenges surrounding the collection of data on sexual violence among younger age groups can prevent this population from being included in research and hinder the development of evidence-based interventions which specifically focus on young women and girls. Using comparable survey data from various time periods and countries, this analysis shows that an alarming proportion of women's sexual violence experiences occur at early ages. These findings not only motivate the need for renewed efforts to prevent sexual violence among young women and girls but demonstrate the value of continuing to develop survey and statistical techniques which can improve our understandings of this complex public health issue.

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Appendix: Supplemental methods and results

This appendix provides further methodological details and supplementary results for "Estimating sexual violence prevalence among young women and girls: a statistical analysis of demographic and health surveys from low- and middle-income countries"

Contents

Section 1: List of abbreviations

Abbreviation	Full phrase
CDC	United States Centers for Disease Control and Prevention
DHS	Demographic and Health Surveys
IPV	Intimate partner violence
NPSV	Non-partner sexual violence
SDG	Sustainable Development Goal
UI	Uncertainty Interval
VACS	Violence Against Children and Youth Surveys
WHO	World Health Organization

Section 2: Data inputs, locations and time period of analysis

Data providing information on sexual violence exposure among women and girls were sourced from DHS with information available on sexual violence and age at first experience of sexual violence. Citations and time period covered for each of these survey are provided in section 4, table S1.

Section 3: Methods

Section 3.1: Data transformation

Data from each individual were transformed into cohort space using participant's date of birth (century month code [CMC] date format), experience of sexual violence in the lifetime (binary event indicator), age at first experience of sexual violence (continuous age variable), and interview date (CMC date format). Examples of this transformation are provided for respondents with (figure S1B) and without (figure S1A) a reported event of sexual violence by age 18.

Two surveys (Nepal-2016 and Ethiopia-2016) provided dates in the calendars for those countries rather than the Gregorian calendar. These surveys were adjusted to the Gregorian calendar by applying relative conversions to the interview date and date of birth variables, which are listed below.

Country	Calendar transformation to CMC format
Nepal	-681
Ethiopia	+92

Section 3.2: Prevalence estimation

Lifetime prevalence of sexual violence among 10-, 15-, and 18-year olds for each calendar year in the data were calculated as the exponentiated effect size for the corresponding age_year dummy variable:

$$\log(event) = \beta_0 + \beta_1 age_{year_1} + \log(n)$$

$$\log(event) = (-1)\beta_0 + \beta_1 age_{year_1} + \log(n)$$

$$\left(\frac{event}{1}\right) = e^{\beta_1}$$

Section 4: Tables

Table S1. Demographic and Health Survey citations and time periods covered.

Title	Time period covered	Geography	Citation
Cameroon Demographic and Health Survey 2011	01/2011 to 08/2011	Cameroon	ICF International, Ministry of Economy, Planning and Regional Development (Cameroon), Ministry of Public Health (Cameroon), National Institute of Statistics (Cameroon), Pasteur Center of Cameroon. Cameroon Demographic and Health Survey 2011. Fairfax, United States of America: ICF International.
Haiti Demographic and Health Survey 2005-2006	10/2005 to 06/2006	Haiti	Haitian Institute of Childhood (IHE), Haitian Institute of Statistics and Informatics, Macro International, Inc. Haiti Demographic and Health Survey 2005-2006. Fairfax, United States of America: ICF International.
Uganda Demographic and Health Survey 2006	04/2006 to 10/2006	Uganda	Macro International, Inc, Uganda Bureau of Statistics. Uganda Demographic and Health Survey 2006. Fairfax, United States of America: ICF International.
Zimbabwe Demographic and Health Survey 2005-2006	08/2005 to 02/2006	Zimbabwe	Central Statistical Office (Zimbabwe), Macro International, Inc. Zimbabwe Demographic and Health Survey 2005-2006. Fairfax, United States of America: ICF International.
Ghana Demographic and Health Survey 2008	09/2008 to 11/2008	Ghana	Ghana Statistical Service, Macro International, Inc, Ministry of Health (Ghana). Ghana Demographic and Health Survey 2008. Fairfax, United States of America: ICF International.
Kenya Demographic and Health Survey 2008-2009	11/2008 to 02/2009	Kenya	ICF Macro, Kenya Medical Research Institute (KEMRI), Kenya National Bureau of Statistics, Ministry of Public Health and Sanitation (Kenya), National AIDS and STI Control Programme (NASCOP) (Kenya), National Association of County and City Health Officials (NACCHO) (United States), National Coordinating Agency for Population and Development (Kenya). Kenya Demographic and Health Survey 2008-2009. Fairfax, United States of America: ICF International.
Mozambique Demographic and Health Survey 2011	05/2011 to 11/2011	Mozambique	ICF Macro, Manhica Health Research Center (CISM), Ministry of Health (Mozambique), National Institute of Statistics (INE) (Mozambique). Mozambique Demographic and Health Survey 2011. Fairfax, United States of America: ICF International.
Zimbabwe Demographic and Health Survey 2010-2011	09/2010 to 03/2011	Zimbabwe	ICF Macro, Zimbabwe National Statistics Agency. Zimbabwe Demographic and Health Survey 2010-2011. Calverton, United States of America: ICF Macro, 2012.
Rwanda Demographic and Health Survey 2010-2011	09/2010 to 03/2011	Rwanda	ICF Macro, Ministry of Health (Rwanda), National Institute of Statistics of Rwanda. Rwanda Demographic and Health Survey 2010-2011. Fairfax, United States of America: ICF International.
Haiti Demographic and Health Survey 2012	01/2012 to 06/2012	Haiti	Centers for Disease Control and Prevention (CDC), Haitian Institute of Childhood (IHE), Haitian Institute of Statistics and Informatics, Macro International, Inc. Haiti Demographic and Health Survey 2012. Fairfax, United States of America: ICF International.
Comoros Demographic and	07/2012 to 01/2013	Comoros	General Directorate of Statistics and Forecasting (Comoros), ICF International. Comoros Demographic and Health Survey 2012-2013. Fairfax, United States of America: ICF International.

Health Survey 2012-2013			
Democratic Republic of the Congo Demographic and Health Survey 2013-2014	11/2013 to 02/2014	Democratic Republic of the Congo	ICF International, Ministry of Planning and Monitoring Implementation of the Revolution of Modernity (Congo, DR), Ministry of Public Health (Congo, DR), National Institute of Statistics (Congo, DR). Democratic Republic of the Congo Demographic and Health Survey 2013-2014. Fairfax, United States of America: ICF International, 2014.
Nigeria Demographic and Health Survey 2013	02/2013 to 06/2013	Nigeria	ICF International, National Population Commission of Nigeria. Nigeria Demographic and Health Survey 2013. Fairfax, United States of America: ICF International.
Togo Demographic and Health Survey 2013-2014	11/2013 to 04/2014	Togo	Directorate General of Statistics and National Accounts (Togo), ICF International, Ministry of Health (Togo), Ministry of Planning, Development and Zoning (Togo). Togo Demographic and Health Survey 2013-2014. Fairfax, United States of America: ICF International, 2015.
Zambia Demographic and Health Survey 2013-2014	08/2013 to 04/2014	Zambia	Central Statistical Office (Zambia), ICF International, Ministry of Health (Zambia), Tropical Diseases Research Centre, University Teaching Hospital (Zambia), University of Zambia. Zambia Demographic and Health Survey 2013-2014. Fairfax, United States of America: ICF International.
Dominican Republic Demographic and Health Survey 2013	07/2013 to 10/2013	Dominican Republic	Center for Social and Demographic Studies (Dominican Republic) (CESDEM), ICF International, Ministry of Public Health and Social Assistance (Dominican Republic). Dominican Republic Demographic and Health Survey 2013. Fairfax, United States of America: ICF International, 2014.
Philippines Demographic and Health Survey 2013	08/2013 to 10/2013	Philippines	ICF International, Philippines Statistics Authority. Philippines Demographic and Health Survey 2013. Fairfax, United States of America: ICF International, 2014.
Cambodia Demographic and Health Survey 2014	06/2014 to 12/2014	Cambodia	ICF International, Ministry of Health (Cambodia), National Institute of Statistics (Cambodia). Cambodia Demographic and Health Survey 2014. Fairfax, United States of America: ICF International, 2017.
Guatemala Demographic and Health Survey 2014-2015	10/2014 to 04/2015	Guatemala	ICF International, Institute of Nutrition of Central America and Panama, Ministry of Public Health and Social Assistance (Guatemala), National Statistics Institute (Guatemala), Secretary of Planning and Programming of the Presidency (SegeplÃ¡n) (Guatemala). Guatemala Demographic and Health Survey 2014-2015. Fairfax, United States of America: ICF International, 2017.
Kenya Demographic and Health Survey 2014	05/2014 to 10/2014	Kenya	ICF International, Kenya Medical Research Institute (KEMRI), Kenya National Bureau of Statistics, Ministry of Health (Kenya), National AIDS Control Council (Kenya), National Council for Population and Development (Kenya). Kenya Demographic and Health Survey 2014. Fairfax, United States of America: ICF International.
Mozambique AIDS Indicator Survey 2015	05/2015 to 10/2015	Mozambique	Centers for Disease Control and Prevention (CDC), ICF International, Ministry of Health (Mozambique), National Institute of Health (Mozambique), National Institute of Statistics (INE) (Mozambique). Mozambique AIDS Indicator Survey 2015. Fairfax, United States of America: ICF International, 2018.
Myanmar Demographic and	12/2015 to 07/2016	Myanmar	ICF International, Ministry of Health and Sports (Myanmar). Myanmar Demographic and Health Survey 2015-2016. Fairfax, United States of America: ICF International, 2017.

Health Survey 2015-2016			
Rwanda Demographic and Health Survey 2014-2015	11/2014 to 04/2015	Rwanda	ICF International, Ministry of Health (Rwanda), National Institute of Statistics of Rwanda. Rwanda Demographic and Health Survey 2014-2015. Fairfax, United States of America: ICF International, 2016.
Zimbabwe Demographic and Health Survey 2015	07/2015 to 12/2015	Zimbabwe	ICF International, National Microbiology Reference Laboratory, Harare Central Hospital (NMRL) (Zimbabwe), Zimbabwe National Statistics Agency. Zimbabwe Demographic and Health Survey 2015. Fairfax, United States of America: ICF International, 2016.
Angola Demographic and Health Survey 2015-2016	10/2015 to 03/2016	Angola	ICF International, Ministry of Health (Angola), National Institute of Statistics (Angola), United Nations Children's Fund (UNICEF). Angola Demographic and Health Survey 2015-2016. Fairfax, United States of America: ICF International, 2017.
Benin Demographic and Health Survey 2017-2018	11/2017 to 02/2018	Benin	Hubert Koutoukou Maga National University Hospital Center (CNHU-HKM)(Benin), ICF International, National Institute of Statistics and Economic Analysis (INSAE) (Benin), National Malaria Control Program, Ministry of Health (Benin), Permanent Secretariat of the Food Council and Nutrition (SP-CAN)(Benin). Benin Demographic and Health Survey 2017-2018. Fairfax, United States of America: ICF International, 2018.
Ethiopia Demographic and Health Survey 2016	01/2016 to 06/2016	Ethiopia	Central Statistics Agency (Ethiopia), ICF International. Ethiopia Demographic and Health Survey 2016. Fairfax, United States of America: ICF International, 2017.
Haiti Demographic and Health Survey 2016-2017	11/2016 to 04/2017	Haiti	Haitian Institute of Childhood (IHE), Haitian Institute of Statistics and Informatics, ICF International, Ministry of Public Health and Population (Haiti). Haiti Demographic and Health Survey 2016-2017. Fairfax, United States of America: ICF International.
Malawi Demographic and Health Survey 2015-2016	10/2015 to 02/2016	Malawi	Emory University and Centers for Disease Control & Prevention Collaboration, ICF International, Ministry of Health (Malawi), National Statistical Office of Malawi. Malawi Demographic and Health Survey 2015-2016. Fairfax, United States of America: ICF International, 2017.
Tanzania Demographic and Health Survey 2015-2016	08/2015 to 02/2016	United Republic of Tanzania, Zanzibar Central/South, Zanzibar North, Zanzibar Urban/West	ICF International, Ministry of Health (Zanzibar), Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDEC) (Tanzania), National Bureau of Statistics (Tanzania), Office of the Chief Government Statistician (OCGS) (Zanzibar). Tanzania Demographic and Health Survey 2015-2016. Fairfax, United States of America: ICF International, 2016.
Burundi Demographic and Health Survey 2016-2017	10/2016 to 03/2017	Burundi	Burundi Institute of Statistics and Economic Studies, ICF International, Ministry of Public Health and the Fight Against AIDS (Burundi). Burundi Demographic and Health Survey 2016-2017. Fairfax, United States of America: ICF International, 2018.
Uganda Demographic and Health Survey 2016	06/2016 to 11/2016	Uganda	ICF International, Uganda Bureau of Statistics. Uganda Demographic and Health Survey 2016. Fairfax, United States of America: ICF International, 2018.
Nepal Demographic and	06/2016 to 01/2017	Nepal	ICF International, Ministry of Health (Nepal), New ERA. Nepal Demographic and Health Survey 2016-2017. Fairfax, United States of America: ICF International, 2017.

Health Survey 2016-2017			
Pakistan Demographic and Health Survey 2017-2018	11/2017 to 04/2018	Pakistan	ICF International, Ministry of National Health Services, Regulations & Coordination (Pakistan), National Institute of Population Studies (Pakistan). Pakistan Demographic and Health Survey 2017-2018. Fairfax, United States of America: ICF International, 2018.
Philippines Demographic and Health Survey 2017	08/2017 to 10/2017	Philippines	ICF International, Philippines Statistics Authority, United States Agency for International Development (USAID). Philippines Demographic and Health Survey 2017. Fairfax, United States of America: ICF International, 2018.
Tajikistan Demographic and Health Survey 2017	08/2017 to 11/2017	Tajikistan	ICF International, Statistical Agency under the President of the Republic of Tajikistan. Tajikistan Demographic and Health Survey 2017. Fairfax, United States of America: ICF International, 2018.
Senegal Continuous Demographic and Health Survey 2017	04/2017 to 12/2017	Senegal	ICF International, Ministry of Health and Social Action (Senegal), National Agency of Statistics and Demography (Senegal), Unit for the Fight Against Malnutrition (Senegal). Senegal Continuous Demographic and Health Survey 2017. Fairfax, United States of America: ICF International, 2018.
Mali Demographic and Health Survey 2018	09/2018 to 11/2018	Mali	ICF International, National Institute of Statistics (INSTAT) (Mali). Mali Demographic and Health Survey 2018. Fairfax, United States of America: ICF International, 2019.
Nigeria Demographic and Health Survey 2018	08/2018 to 12/2018	Nigeria	Federal Ministry of Health (Nigeria), ICF International, National Population Commission (NPC). Nigeria Demographic and Health Survey 2018. Fairfax, United States of America: ICF International, 2020.
Zambia Demographic and Health Survey 2018-2019	07/2018 to 01/2019	Zambia	Central Statistical Office (Zambia), ICF International, Ministry of Health (Zambia), University Teaching Hospital (Zambia), University of Zambia. Zambia Demographic and Health Survey 2018-2019. Fairfax, United States of America: ICF International, 2020.
Cameroon Demographic and Health Survey 2018-2019	06/2018 to 01/2019	Cameroon	ICF International, Ministry of Public Health (Cameroon), National Institute of Statistics (Cameroon). Cameroon Demographic and Health Survey 2018-2019. Fairfax, United States of America: ICF International.
Sierra Leone Demographic and Health Survey 2019	05/2019 to 08/2019	Sierra Leone	ICF International, Ministry of Health and Sanitation (Sierra Leone), Statistics Sierra Leone. Sierra Leone Demographic and Health Survey 2019. Fairfax, United States of America: ICF International, 2020.
Papua New Guinea Demographic and Health Survey 2016-2018	09/2016 to 12/2018	Papua New Guinea	ICF International, National Statistical Office (Papua New Guinea). Papua New Guinea Demographic and Health Survey 2016-2018. Fairfax, United States of America: ICF International, 2019.
Senegal Continuous Demographic and Health Survey 2018	06/2018 to 12/2018	Senegal	Directorate of Forecasting and Statistics, Ministry of the Economy, Finance and Planning (Senegal), ICF International, Ministry of Health and Social Action (Senegal), United States Agency for International Development (USAID). Senegal Continuous Demographic and Health Survey 2018. Fairfax, United States of America: ICF International, 2020.
Liberia Demographic and Health Survey 2019-2020	10/2019 to 02/2020	Liberia	ICF International, Liberia Institute for Statistics and Geo-information Services (LISGIS), Ministry of Health and Social Welfare (Liberia). Liberia Demographic and Health Survey 2019-2020. 2021.

Gambia Demographic and Health Survey 2019-2020	11/2019 to 03/2020	Gambia	Gambia Bureau of Statistics (GBOS), ICF International, Ministry of Health and Social Welfare (The Gambia). Gambia Demographic and Health Survey 2019-2020. Fairfax, United States of America: ICF International, 2021.
Rwanda Demographic and Health Survey 2019-2020	11/2019 to 07/2020	Rwanda	Ministry of Health (Rwanda), National Institute of Statistics (Rwanda), Rwanda Biomedical Center (RBC). Rwanda Demographic and Health Survey 2019-2020. Fairfax, United States of America: ICF International, 2021.

Table S2. Demographic and sample information by DHS domestic violence module. Age and urbanicity summary statistics are unweighted. Modules with greater than 50% missingness in age at first experience variable are listed.

Country-year	Sample size	Age Mean (Standard Deviation)	Percent of sample in urban areas	Percent of reported ages at first exposure missing
Afghanistan-2015	21324	31 (8.46)	24.9	61.5
Angola-2015	10519	28 (8.92)	58.3	18.1
Armenia-2015	4592	32 (8.89)	59.1	77.1
Azerbaijan-2006	5617	32 (9.68)	53.3	95.3
Burundi-2016	10188	29 (8.92)	18	22.5
Benin-2017	5408	30 (9.03)	44.7	10.8
Cameroon-2011	5043	29 (9.2)	48.6	27.8
Cameroon-2018	6682	29 (9.09)	54.6	4.54
Democratic Republic of the Congo-2013	6811	29 (8.91)	31.6	12.1
Colombia-2009	52952	29 (10.76)	72.6	62.4
Colombia-2015	38087	29 (10.72)	74.8	63.2
Comoros-2012	3341	28 (8.75)	41	36.4
Dominican Republic-2007	10140	30 (9.64)	59.3	60.4
Dominican Republic-2013	6996	30 (9.64)	71.7	34.1
Ethiopia-2016	5860	29 (8.7)	30.4	15.8
Gabon-2012	5557	30 (9.59)	65.1	53.6
Ghana-2008	2442	30 (9.21)	43.1	12.8
Gambia-2019	2470	29 (9.07)	57.3	6.61
Gambia-2013	4525	28 (8.79)	46.2	55.9
Gambia-2013	4525	28 (8.79)	46.2	55.9
Guatemala-2014	8595	29 (9.21)	43.2	1.48
Honduras-2011	15833	29 (9.26)	40.5	54.4
Haiti-2005	3568	29 (9.64)	44.2	22.7
Haiti-2016	6321	30 (9.51)	36.8	2.47
Haiti-2012	9367	29 (9.52)	41.5	16.4
India-2005	83703	30 (8.87)	45.3	74.2
Kenya-2014	5657	30 (8.82)	36.9	8.85
Kenya-2008	6318	29 (9.01)	30.2	48.3
Kyrgyzstan-2012	6022	31 (9.69)	33	94.9
Cambodia-2014	4307	31 (9.19)	27.2	12.7

Liberia-2006	4913	30 (9.18)	39.6	72.9
Liberia-2019	3120	30 (9.65)	38.3	17.1
Maldives-2016	3971	32 (8.88)	11.1	72
Mali-2018	3784	29 (8.78)	30.8	16.5
Mali-2012	3459	29 (8.62)	30.4	91.2
Myanmar-2015	4530	32 (9.34)	26.7	12
Mozambique-2011	6835	29 (9.23)	37.2	42.2
Mozambique-2015	3690	34 (11.46)	40	32
Mauritania-2019	4184	29 (9.31)	46	51.7
Malawi-2010	6229	29 (8.89)	12.6	67
Malawi-2015	6379	28 (8.75)	19.8	43.1
Namibia-2013	2931	30 (9.41)	50.7	61.2
Nigeria-2008	23752	29 (9.16)	31.3	52.3
Nigeria-2018	10678	30 (9.04)	41.9	13.6
Nigeria-2013	27634	29 (9.35)	39.9	15.5
Nepal-2011	4197	29 (9.12)	27.7	88.8
Nepal-2016	4444	30 (9.1)	63.4	0.84
Pakistan-2017	4085	33 (8.18)	48.4	17.1
Philippines-2013	10963	31 (9.72)	44.6	4.23
Philippines-2008	9316	31 (9.51)	46.7	53.2
Philippines-2017	17968	31 (9.69)	34.7	9.47
Papua New Guinea-2016	4873	30 (9.05)	21.6	44.7
Rwanda-2014	2679	30 (8.83)	22.1	0.816
Rwanda-2019	2788	30 (9.26)	21.2	3.26
Rwanda-2010	5008	29 (9.13)	15.6	38
Senegal-2017	3415	29 (9.21)	43.4	41.3
Senegal-2018	1957	29 (9.46)	37.6	39.5
Senegal-2019	1865	29 (9.39)	37.4	77.6
Sierra Leone-2013	5185	30 (9.23)	36.1	68.9
Sierra Leone-2019	5248	30 (9.24)	36.6	21.1
Sao Tome and Principe-2008	1980	30 (9.2)	42.5	72
Chad-2014	4283	29 (9.04)	23.3	62.5
Togo-2013	6701	30 (8.95)	37.7	6.14
Tajikistan-2017	6353	31 (9.13)	41.8	16.4
Tajikistan-2012	5547	30 (9.42)	39.1	95.2
Timor-Leste-2009	2951	30 (9.49)	23.5	72.6
Timor-Leste-2016	5122	30 (9.62)	30.1	50.6
United Republic of Tanzania-2009	7047	30 (9.19)	23.5	51.6

United Republic of Tanzania-2015	9322	30 (9.25)	29.1	3.2
Uganda-2006	2087	29 (8.89)	15.7	42.3
Uganda-2016	9232	29 (8.98)	22.6	20
Uganda-2011	2056	29 (8.94)	27.2	68.3
Ukraine-2007	2903	34 (9.14)	63.1	69.3
South Africa-2016	4357	33 (8.79)	58	87
Zambia-2007	5236	28 (8.72)	39.5	63.5
Zambia-2018	9503	29 (9.11)	36.6	30.1
Zambia-2013	11778	29 (8.85)	44.6	18.6
Zimbabwe-2015	7223	29 (8.96)	43.5	9.23
Zimbabwe-2005	6293	28 (9.03)	33.4	40.1
Zimbabwe-2010	6542	29 (8.86)	34.3	27.9

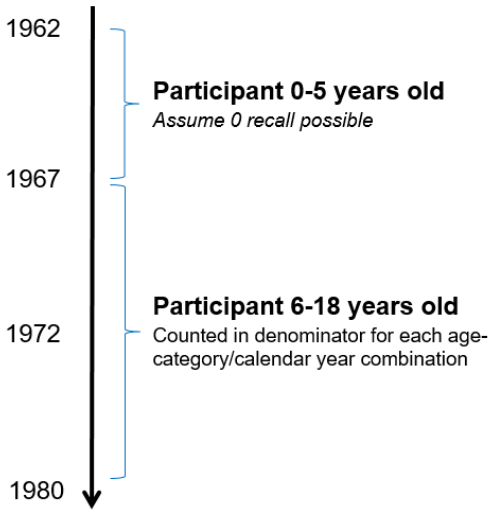
Table S3. Sensitivity analysis of age at first experience of sexual violence distribution percentiles by age 10, 15, and 18, where surveys with >50% missingness in the age at first experience variable were included.

World Region	Percent of first experiences which occurred before or equal to age:			N
	10	15	18	
Caribbean	3.8	24.7	47.8	3381
Central Asia	10.1	13.8	31.2	138
Central Latin America	22.2	54.2	72.2	5205
Central Sub-Saharan Africa	8	35.5	60.5	3025
Eastern Europe	3.4	20.2	73	89
Eastern Sub-Saharan Africa	3	25.8	52.8	15509
North Africa and Middle East	1.1	19.2	53.4	704
Oceania	1	15.6	44.3	732
South Asia	2.1	28.8	61	2234
Southeast Asia	8.2	23.8	45.2	2957
Southern Sub-Saharan Africa	4.2	23.3	60.6	3036
Western Sub-Saharan Africa	5.1	33.8	62.2	9502
All data	6.3	30.7	57.3	46512

Section 5: Figures

Figure S1. Data transformation examples.

A) Example of a 47-year-old respondent who reported no sexual violence exposure prior to age 19 and was interviewed in 2010.

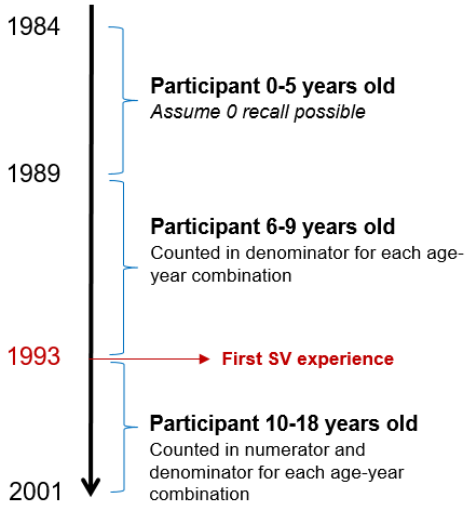


DOB	Time stop	Interview	Event	Weight
1962	1980	2010	0	0.89

+18 years

Year	Age	Event	N
1968	6	0	0.89
1969	7	0	0.89
1970	8	0	0.89
1971	9	0	0.89
1972	10	0	0.89
1973	11	0	0.89
1974	12	0	0.89
1975	13	0	0.89
1976	14	0	0.89
1977	15	0	0.89
1978	16	0	0.89
1979	17	0	0.89
1980	18	0	0.89

B) Example of a 26-year-old respondent who reported first experience of sexual violence occurring at age 9 and was interviewed in 2010.



DOB	Time stop	Interview	Event	Weight
1984	2001	2010	1	1.7

+18 years

Year	Age	Event	N
1989	6	0	1.7
1990	7	0	1.7
1991	8	0	1.7
1992	9	1.7	1.7
1993	10	1.7	1.7
1994	11	1.7	1.7
1995	12	1.7	1.7
1996	13	1.7	1.7
1997	14	1.7	1.7
1998	15	1.7	1.7
1999	16	1.7	1.7
2000	17	1.7	1.7
2001	18	1.7	1.7

Figure S2. Histogram of percent missing in age at first experience of sexual violence variable across all survey modules identified for analysis (n = 106).

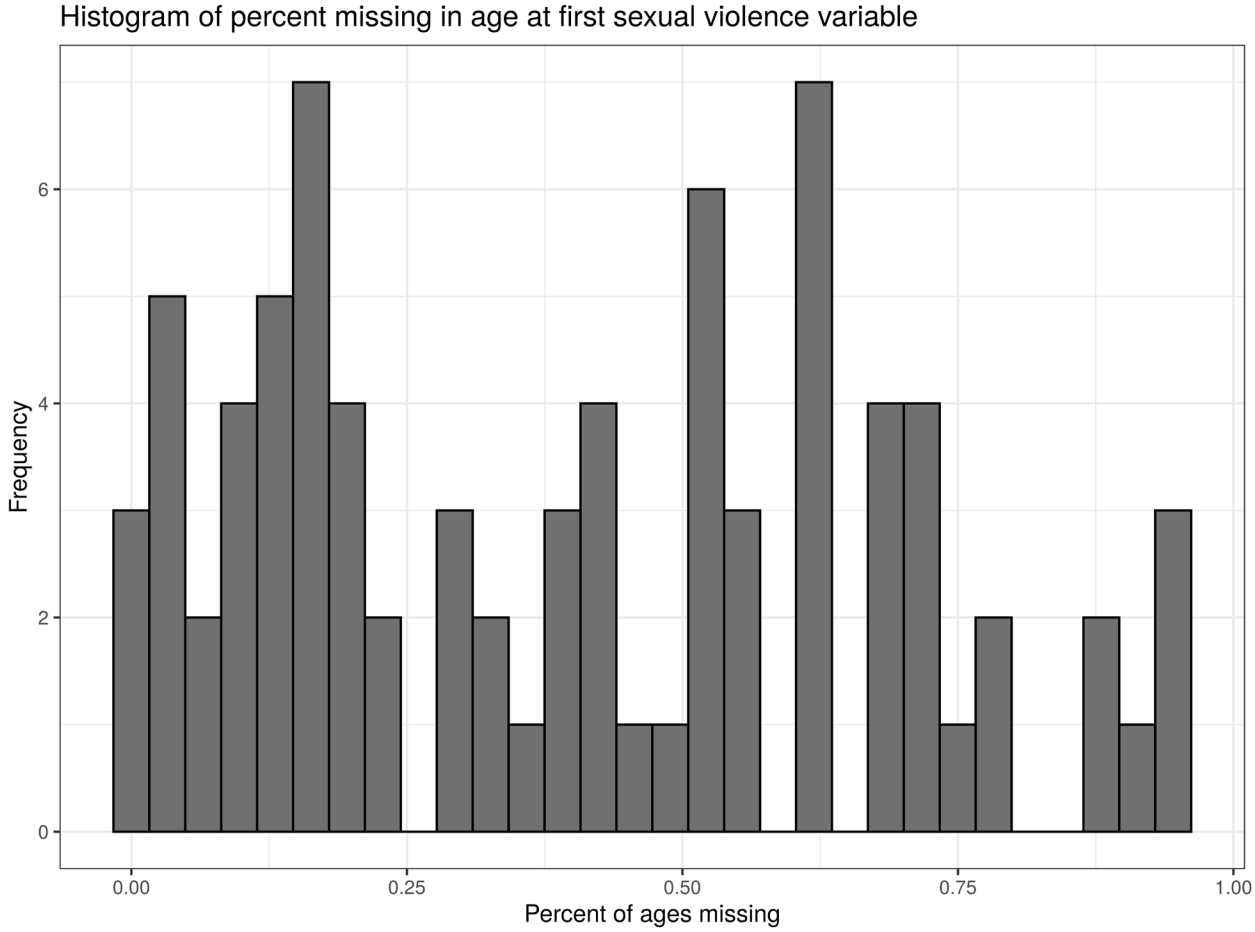
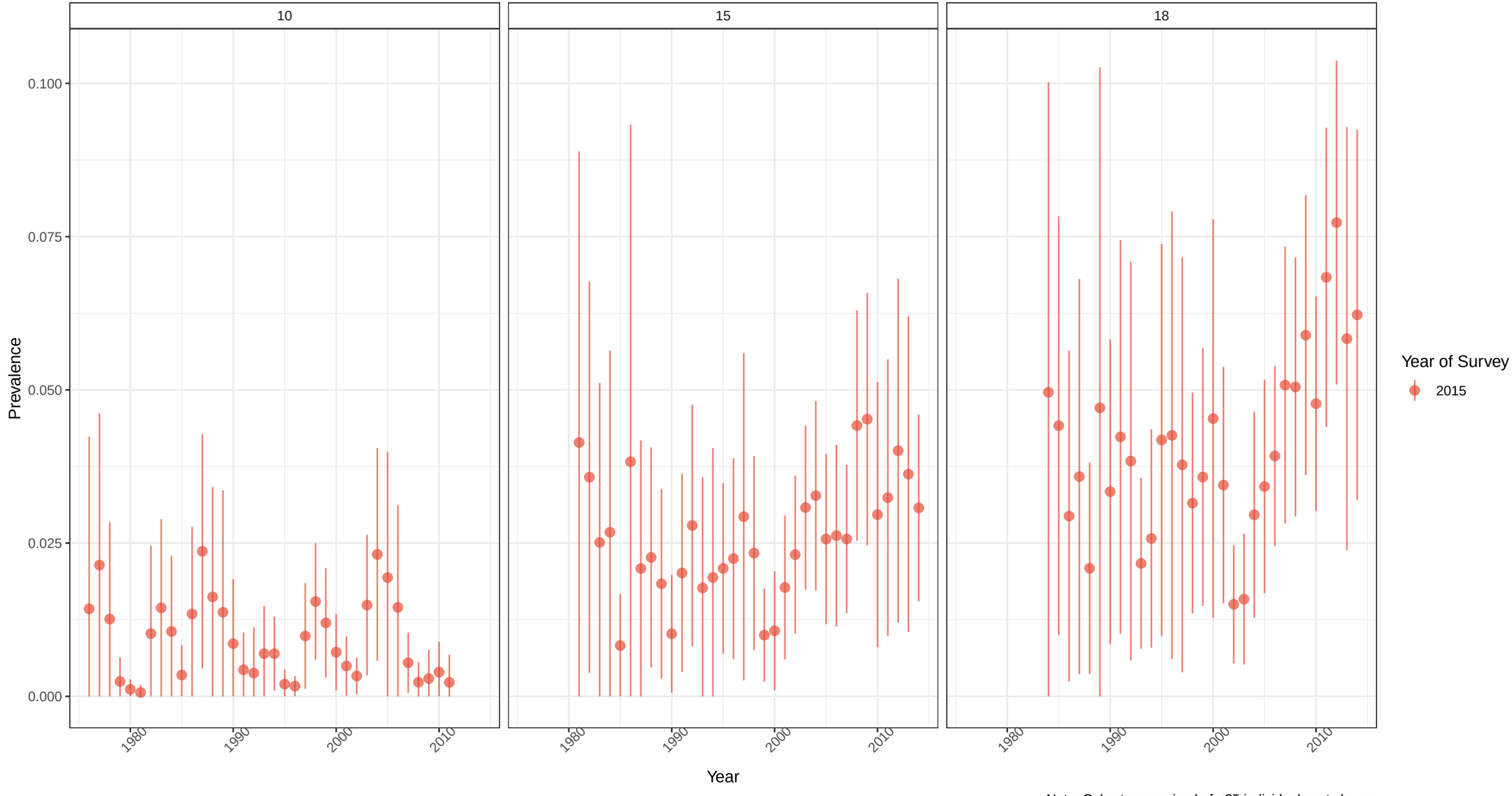


Figure S3 − Prevalence Estimates by Time and Geography

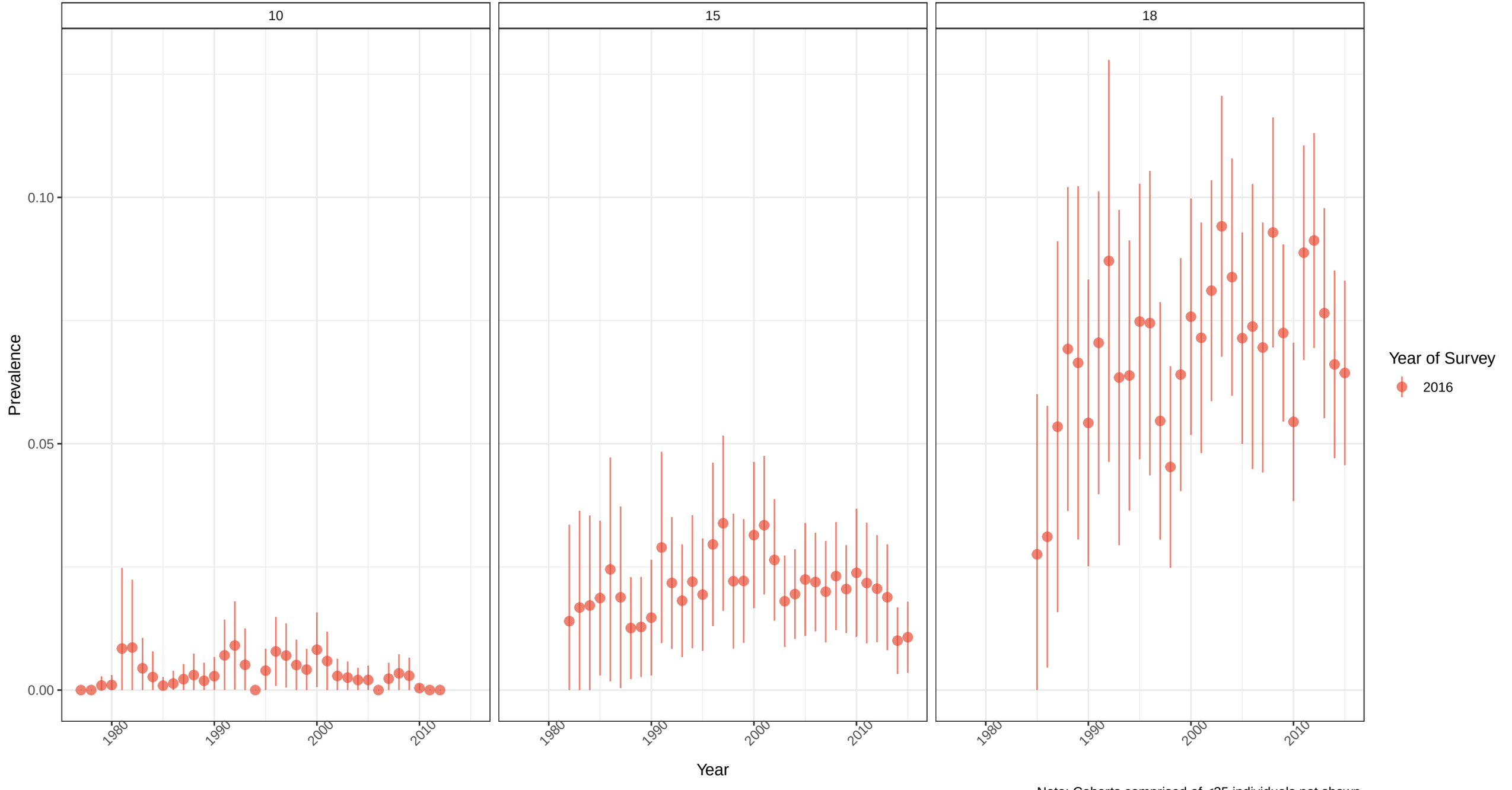
Angola: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

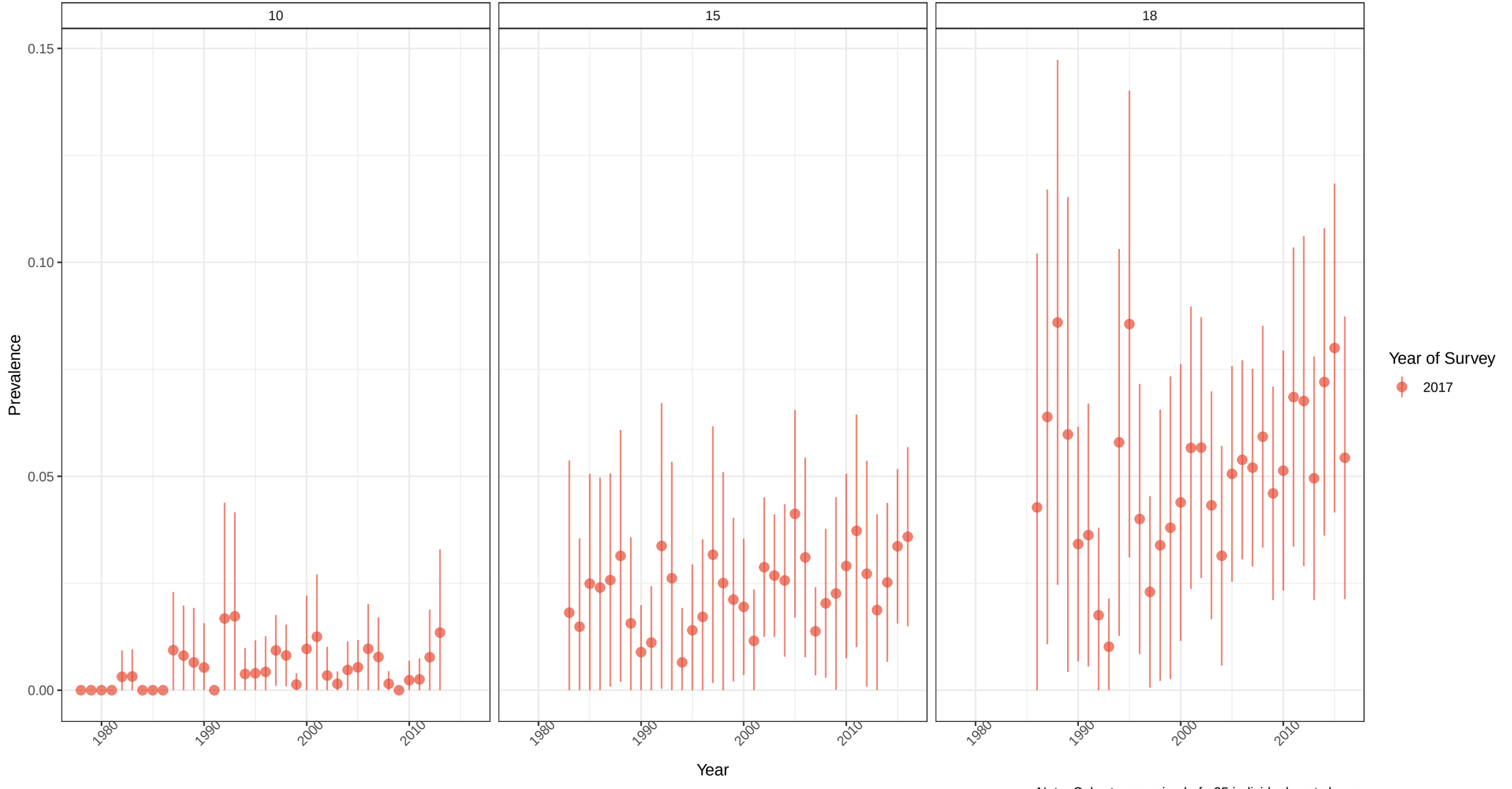
Burundi: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

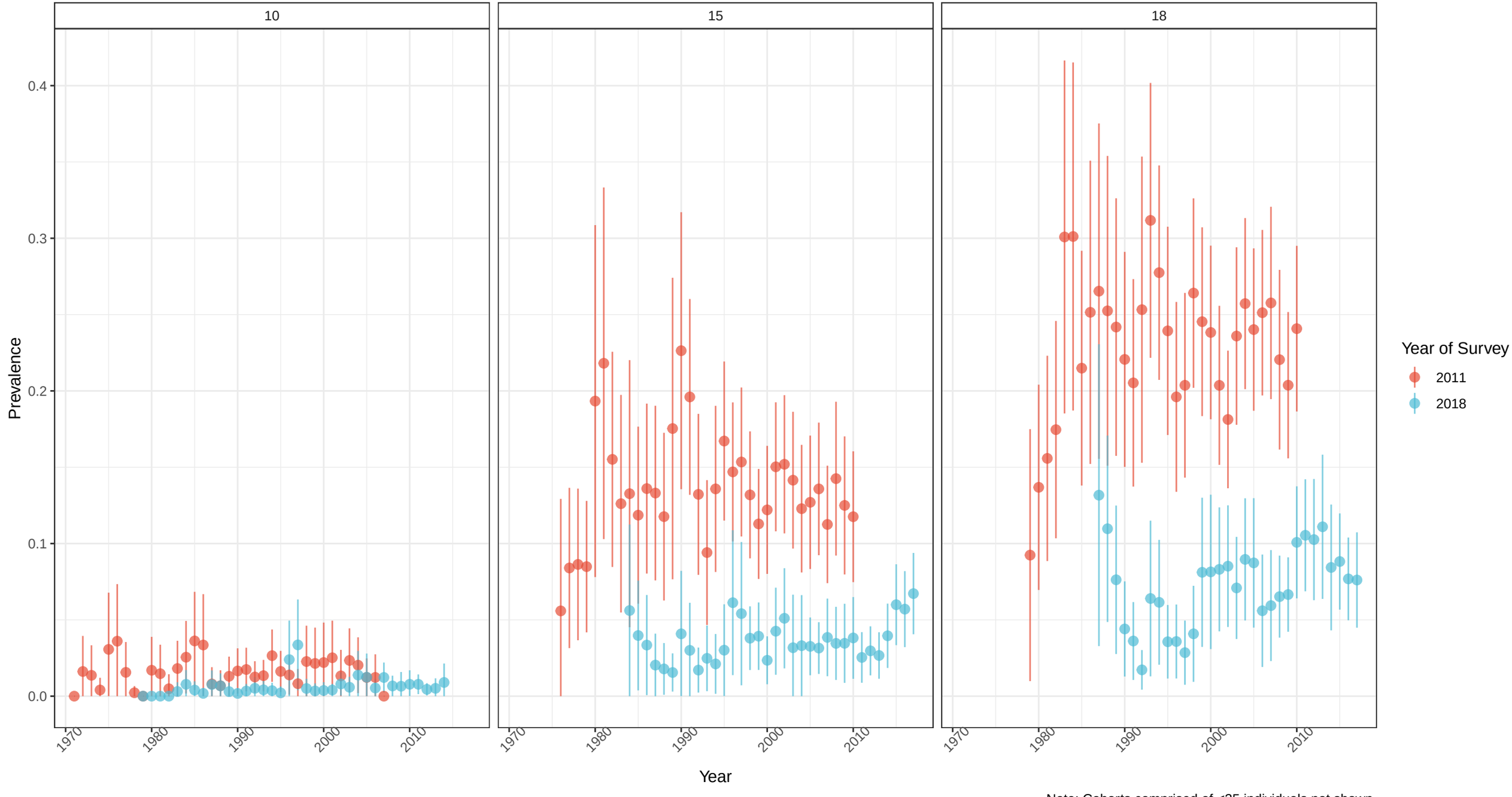
Benin: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

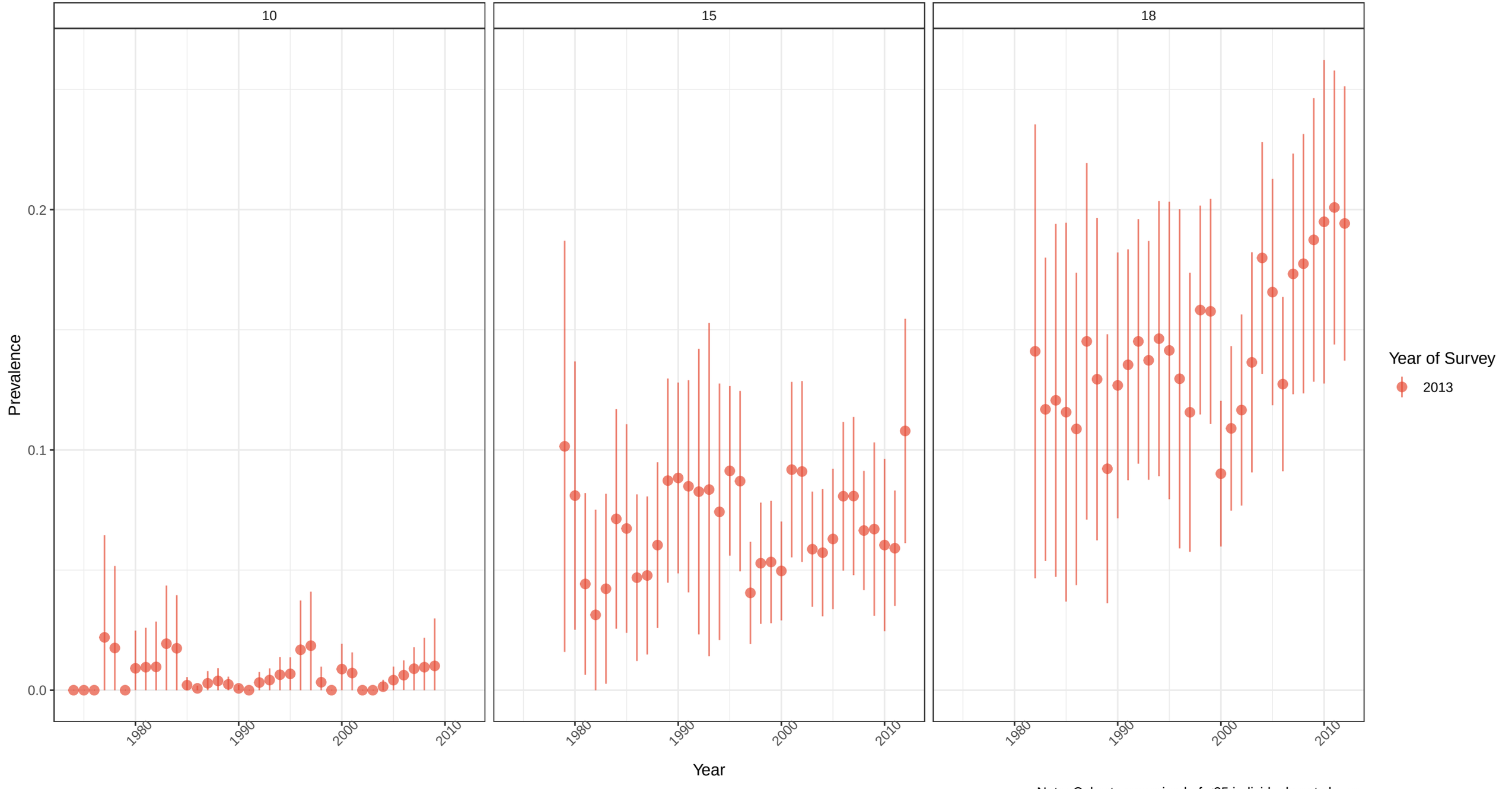
Cameroon: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

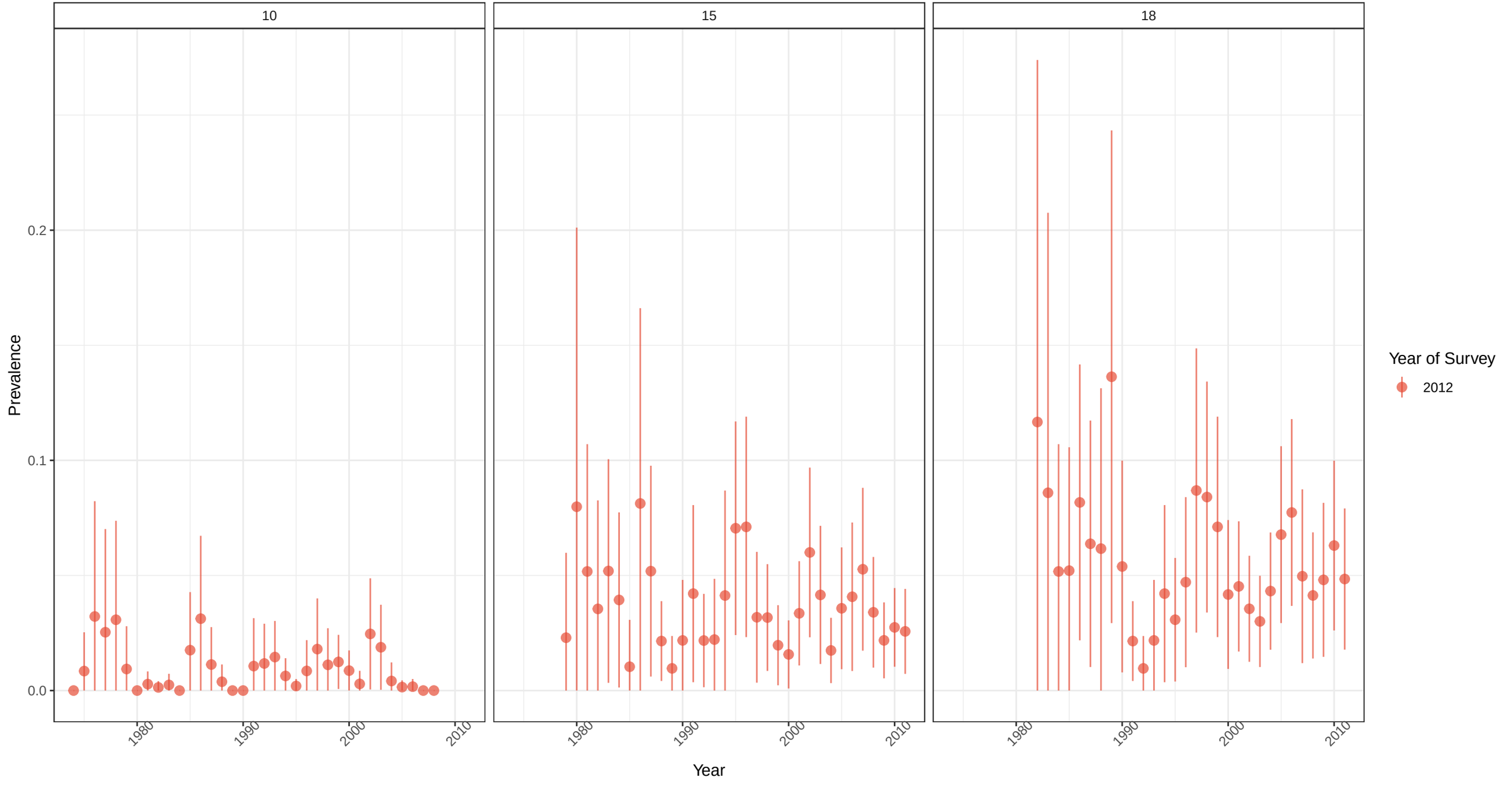
Democratic Republic of the Congo: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

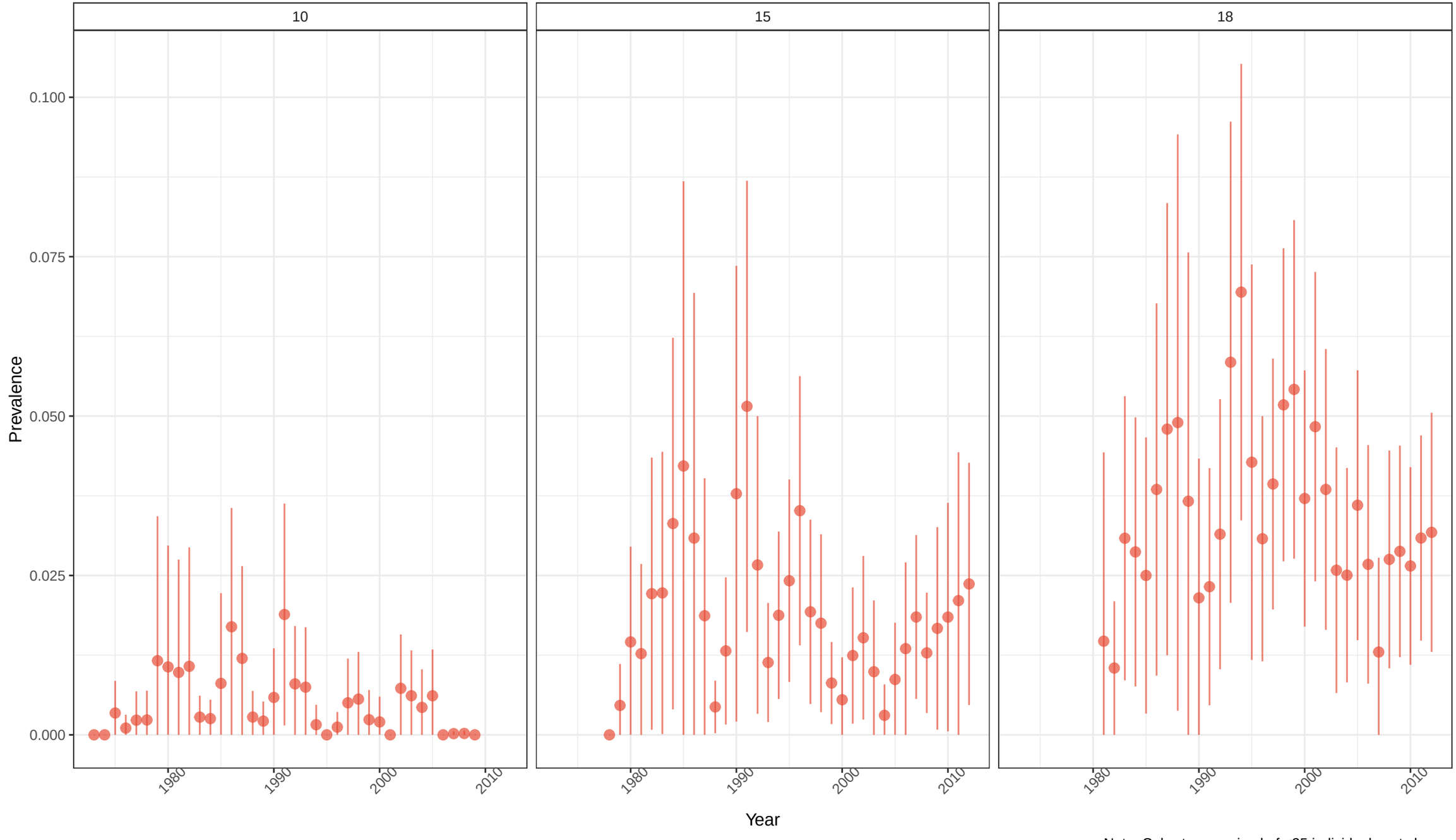
Comoros: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

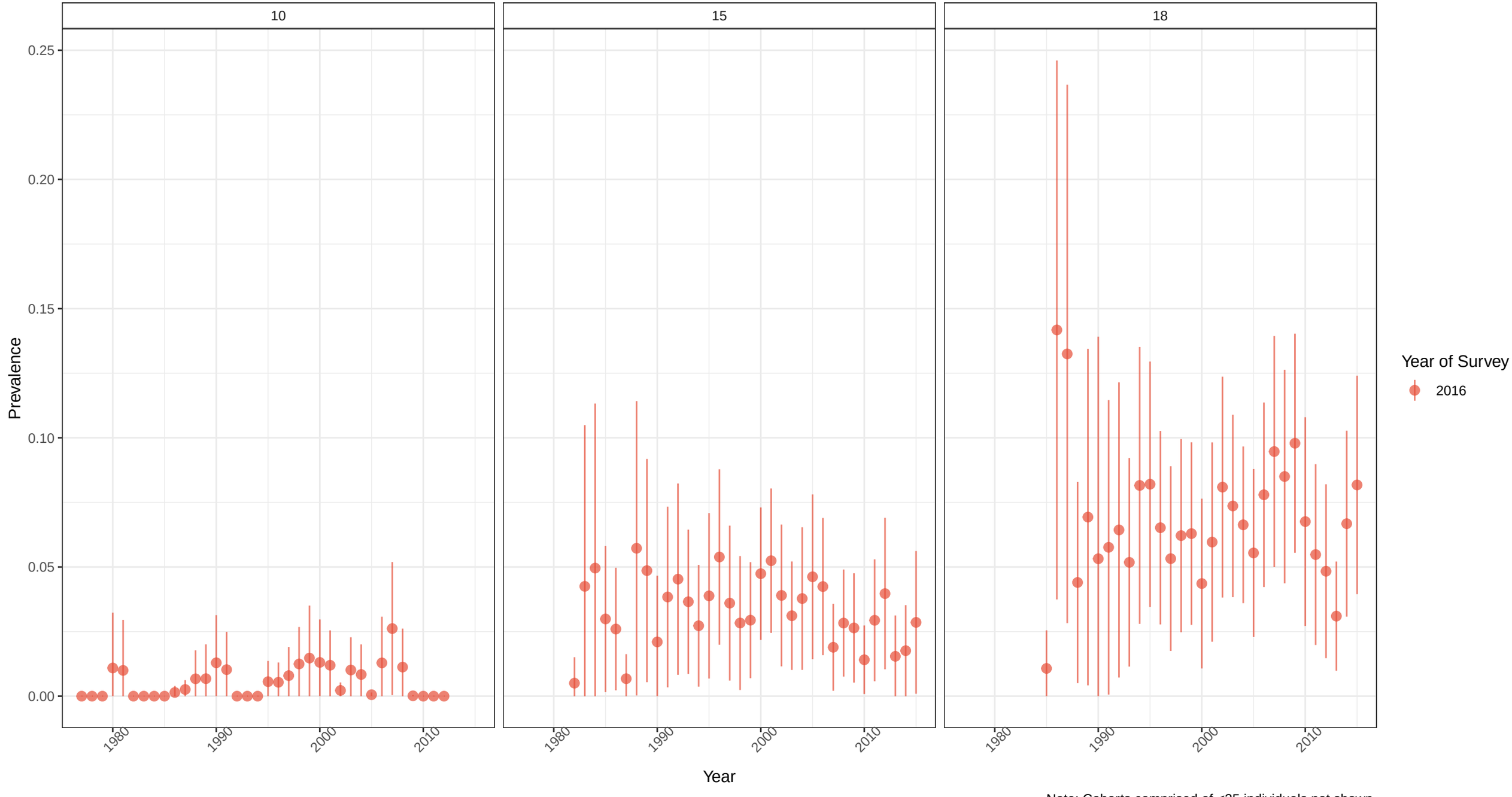
Dominican Republic: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

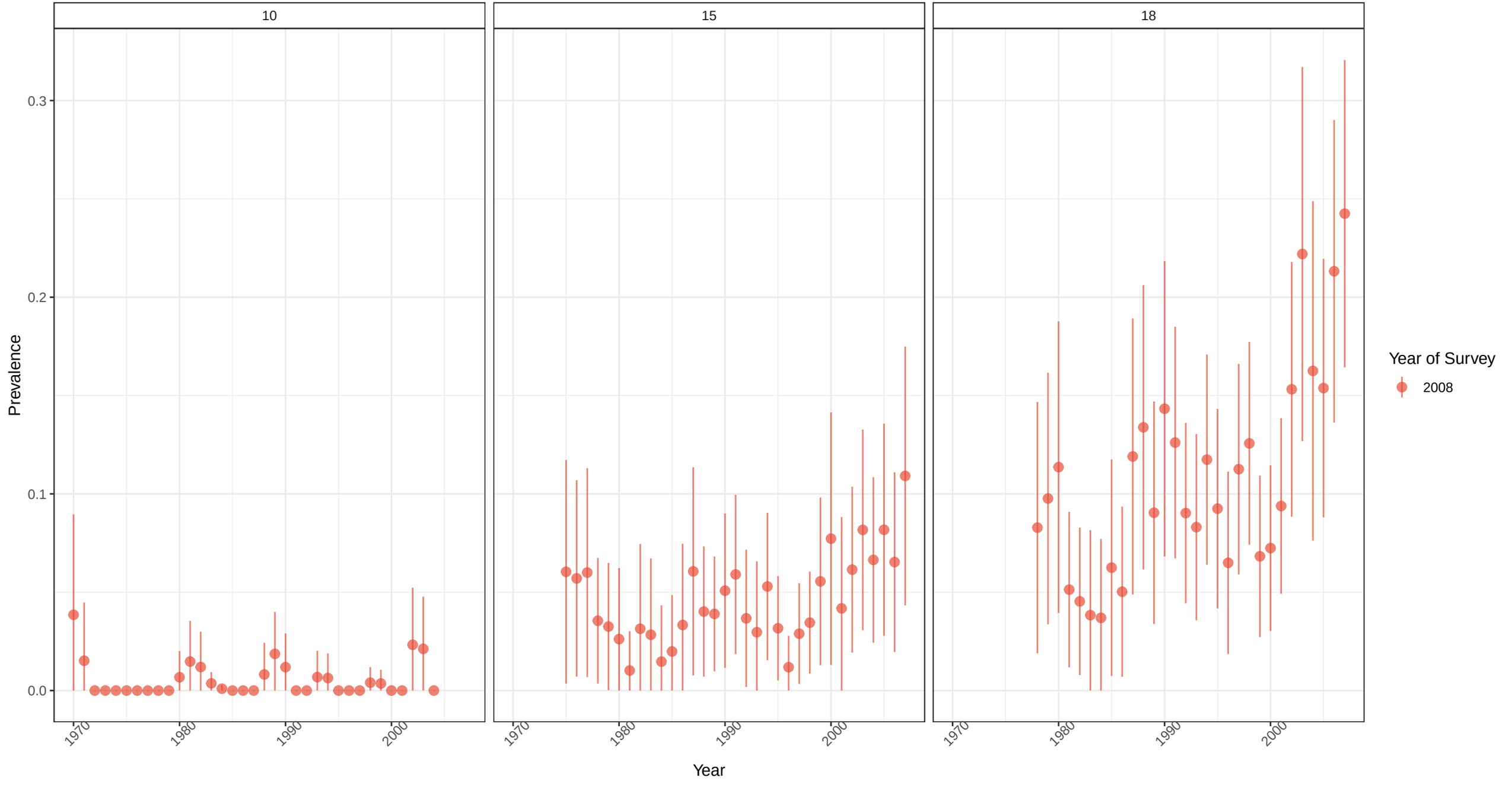
Ethiopia: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

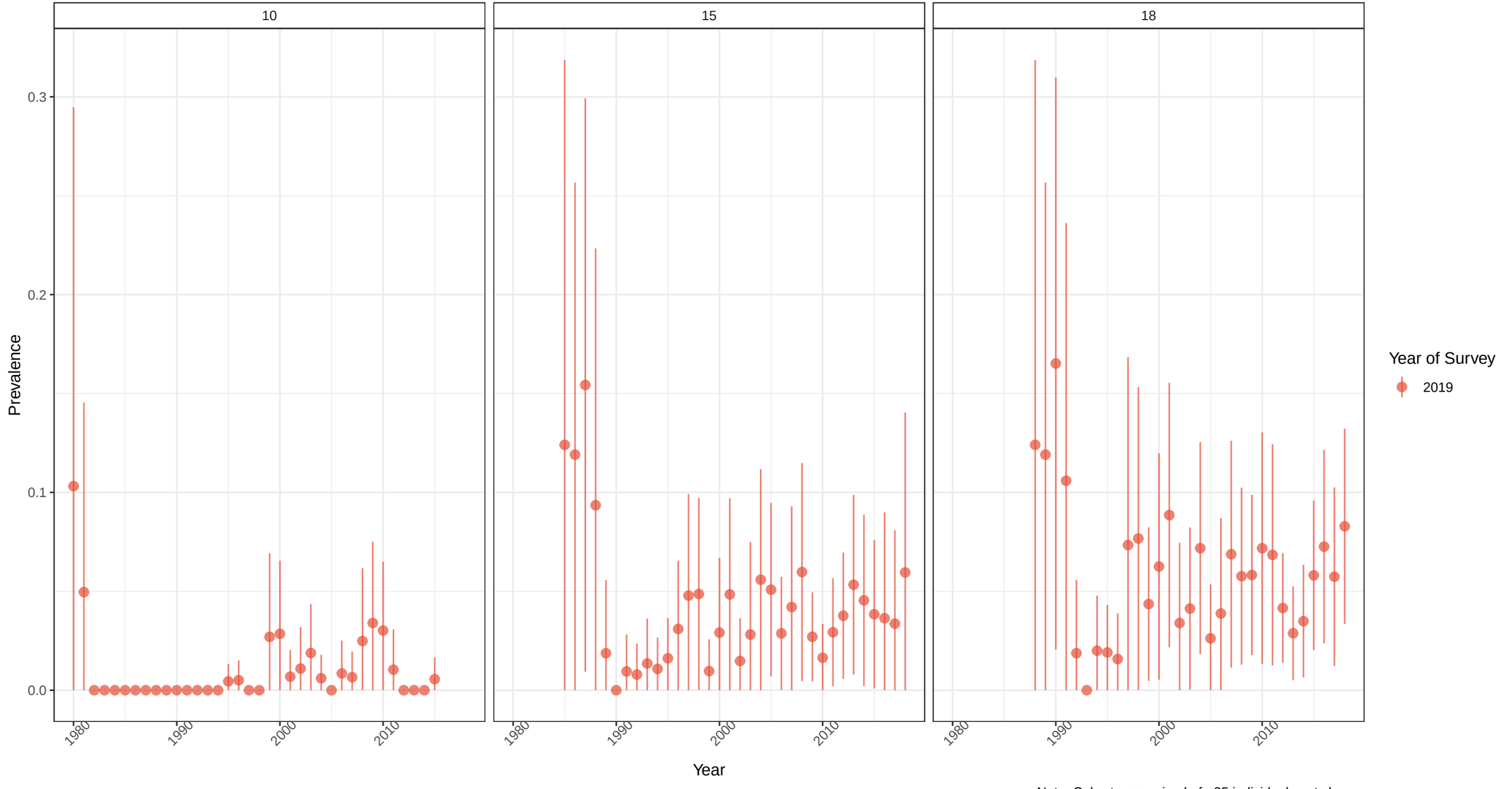
Ghana: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Gambia: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Guatemala: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Haiti: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

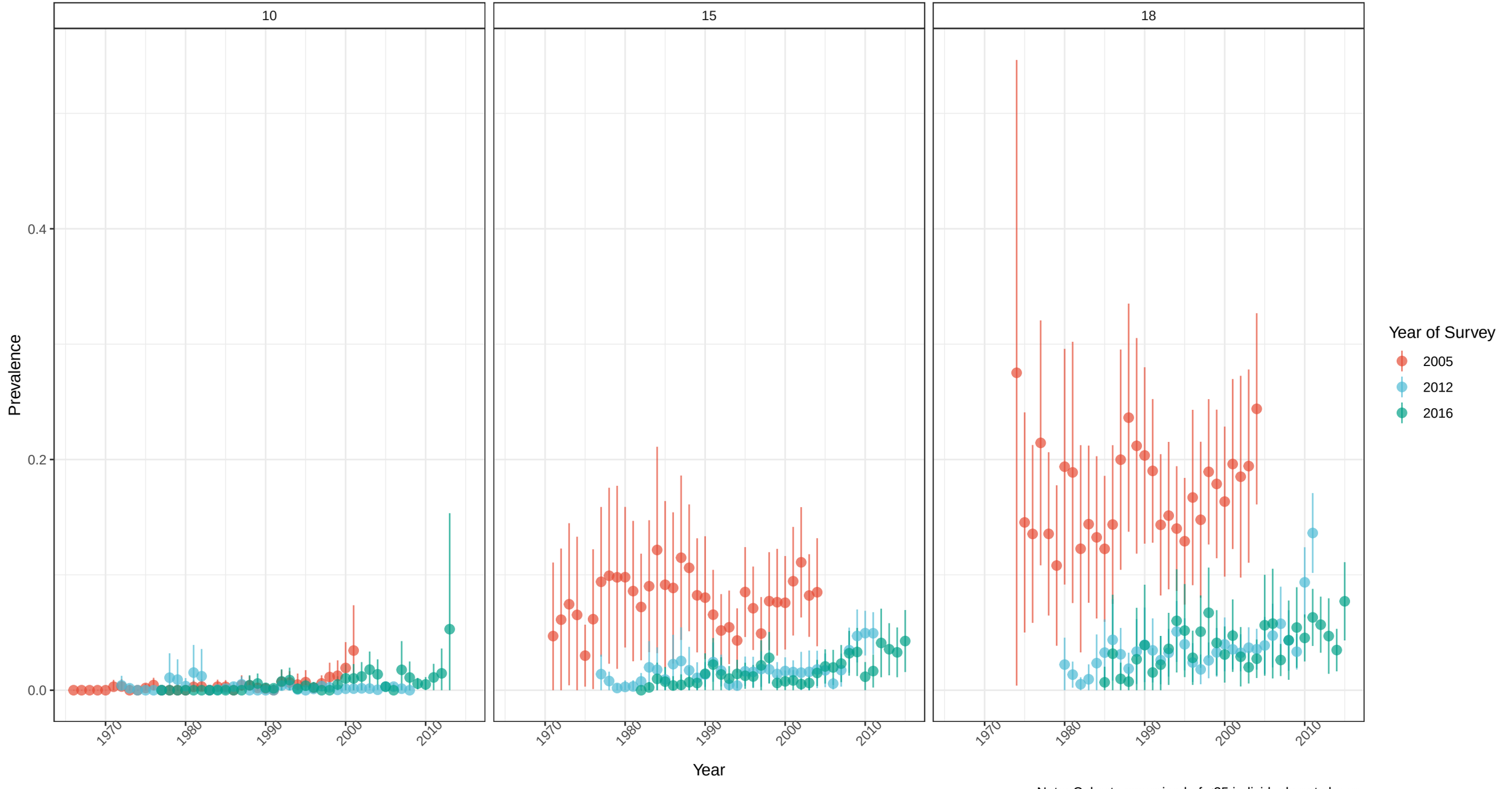


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Figure S3 − Prevalence Estimates by Time and Geography

Kenya: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

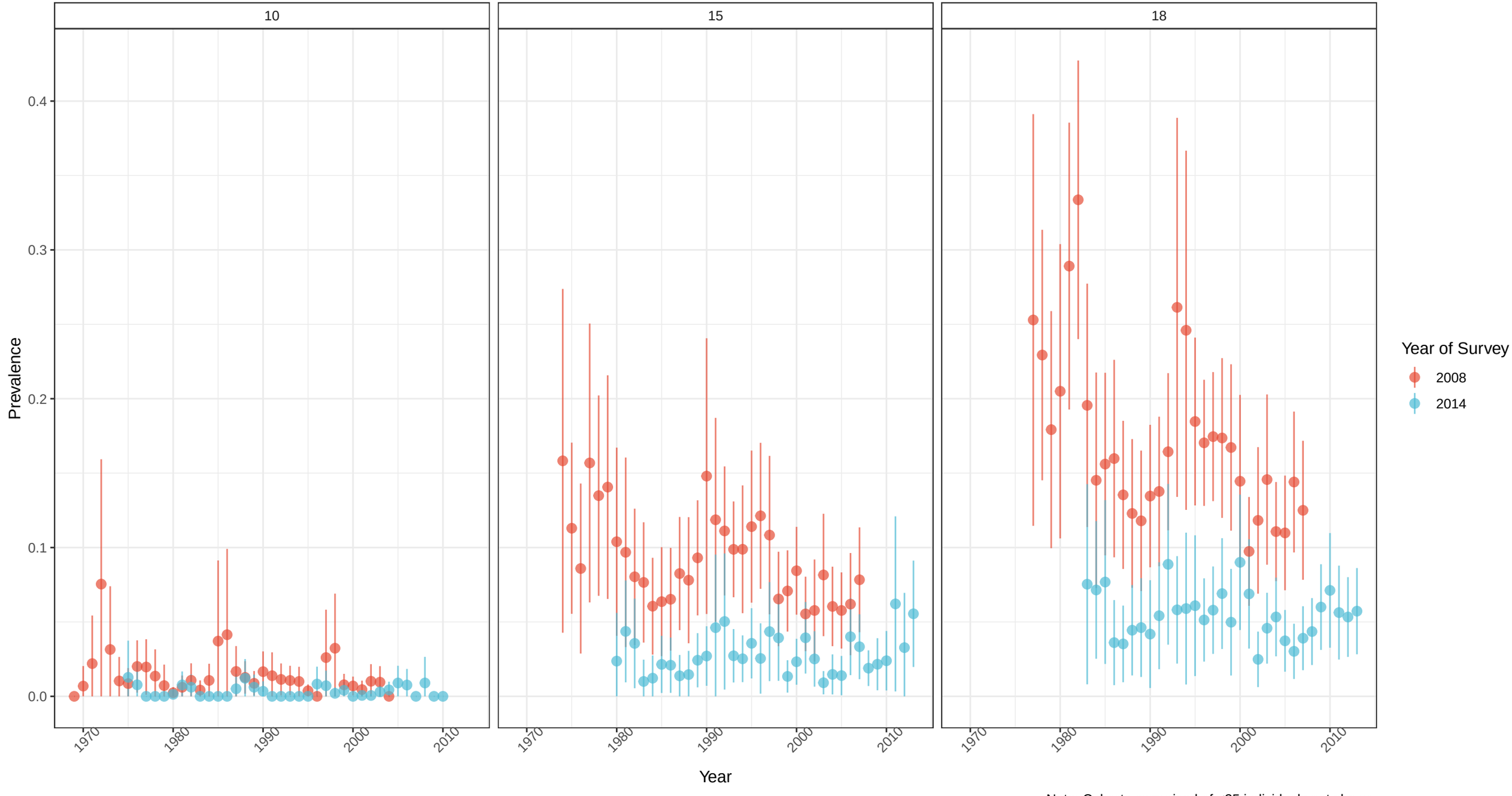

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Figure S3 − Prevalence Estimates by Time and Geography

Cambodia: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

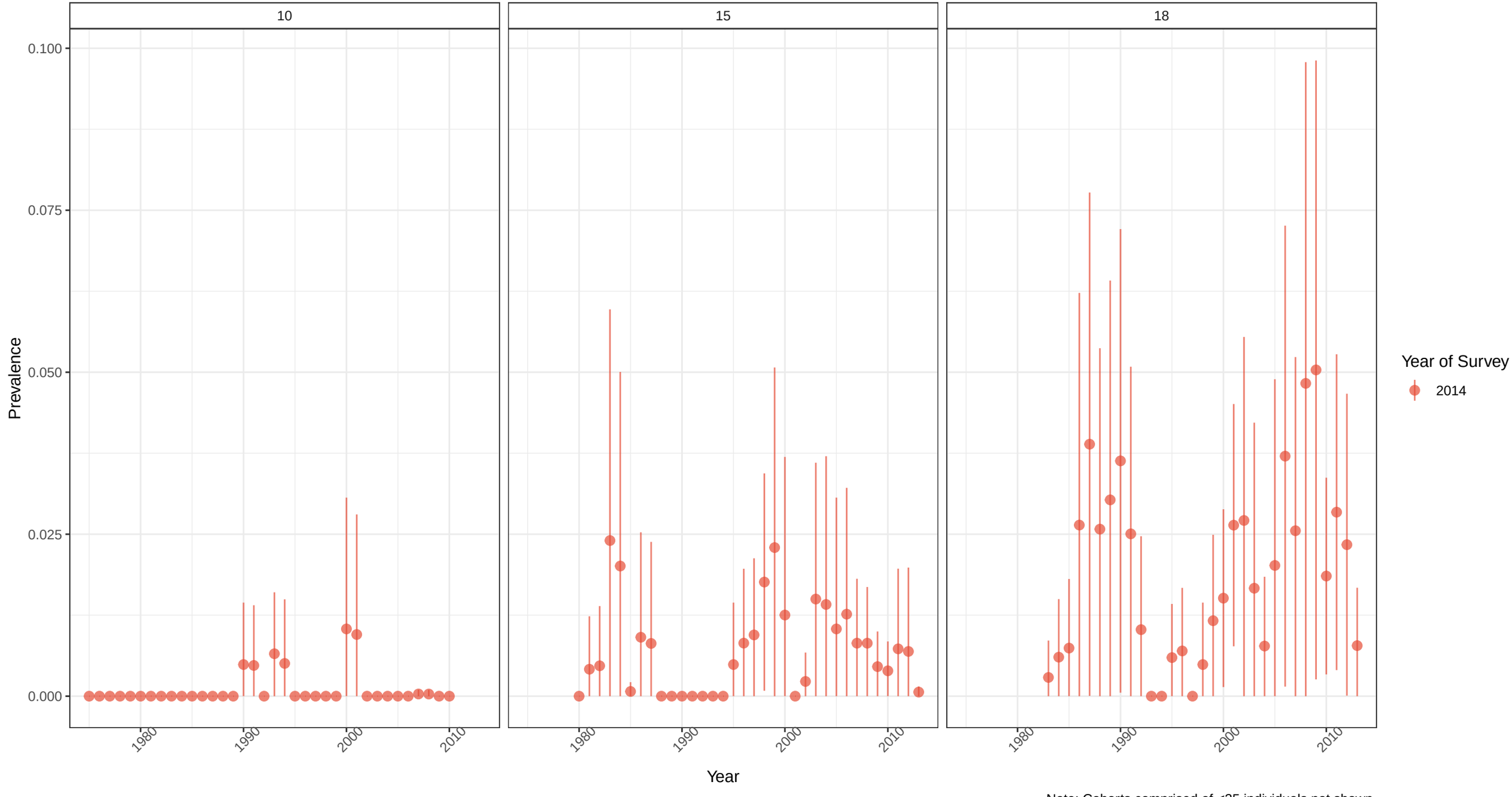

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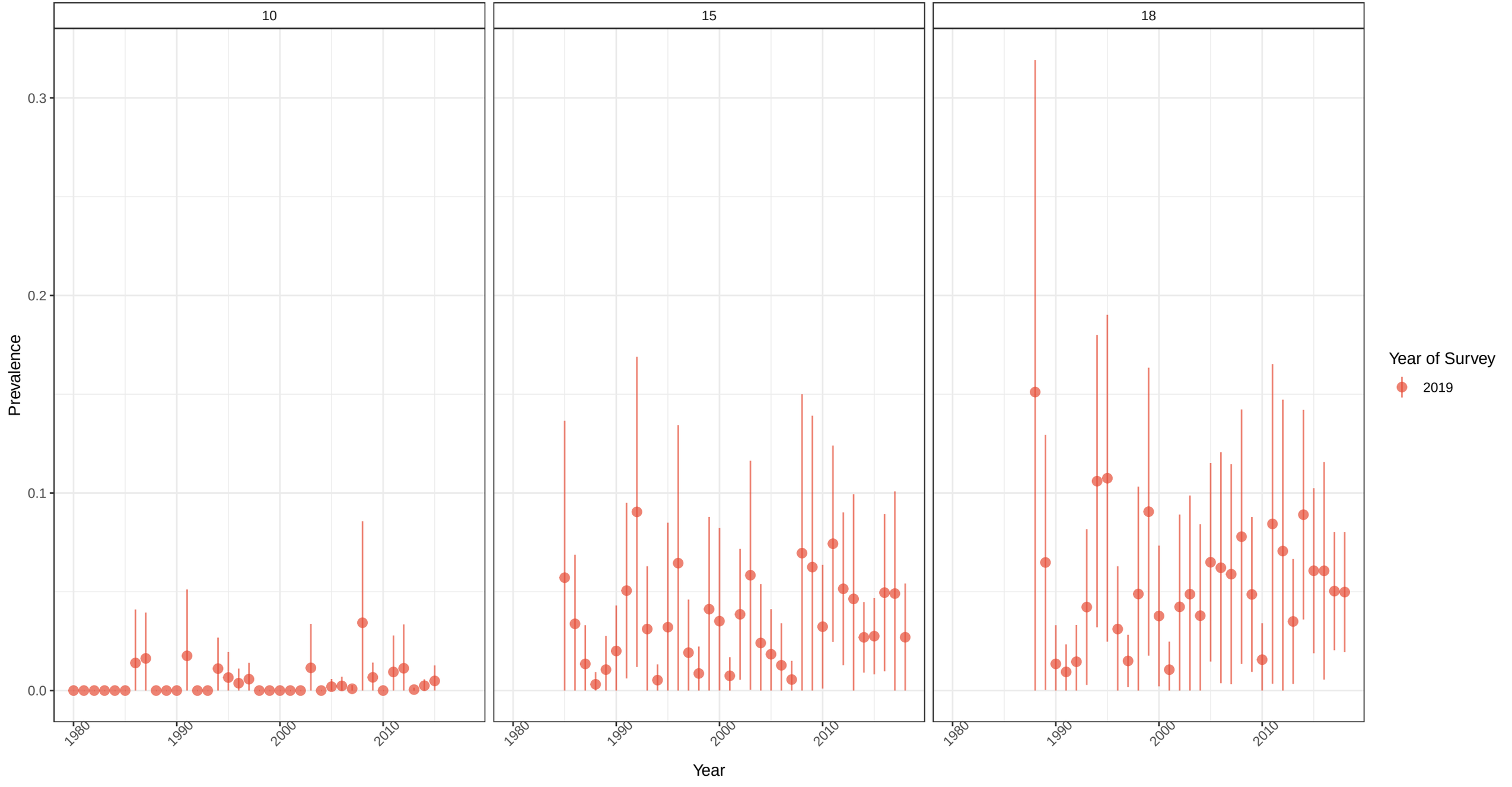
Figure S3 − Prevalence Estimates by Time and Geography

Liberia: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Mali: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

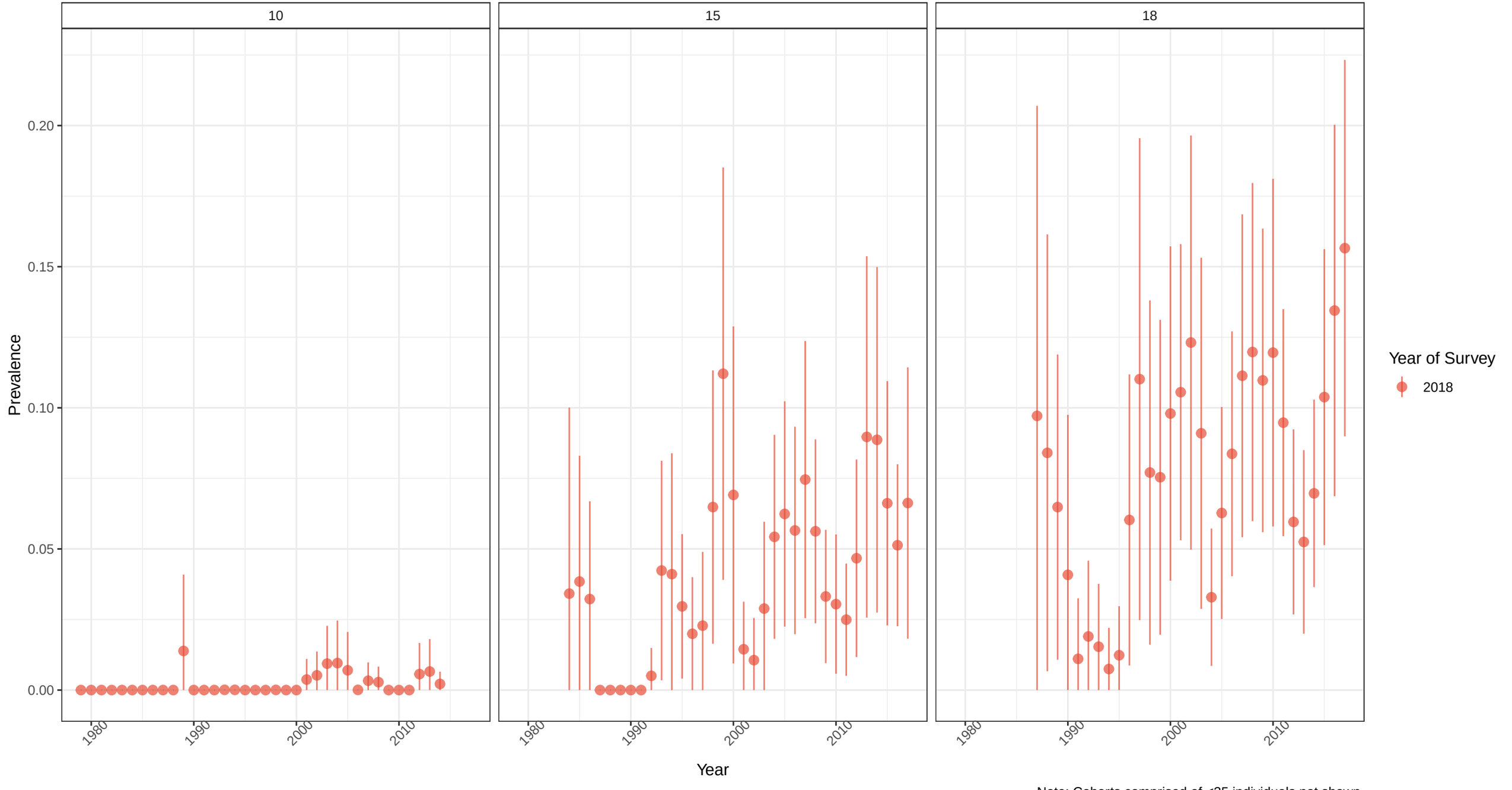


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Figure S3 − Prevalence Estimates by Time and Geography

Myanmar: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

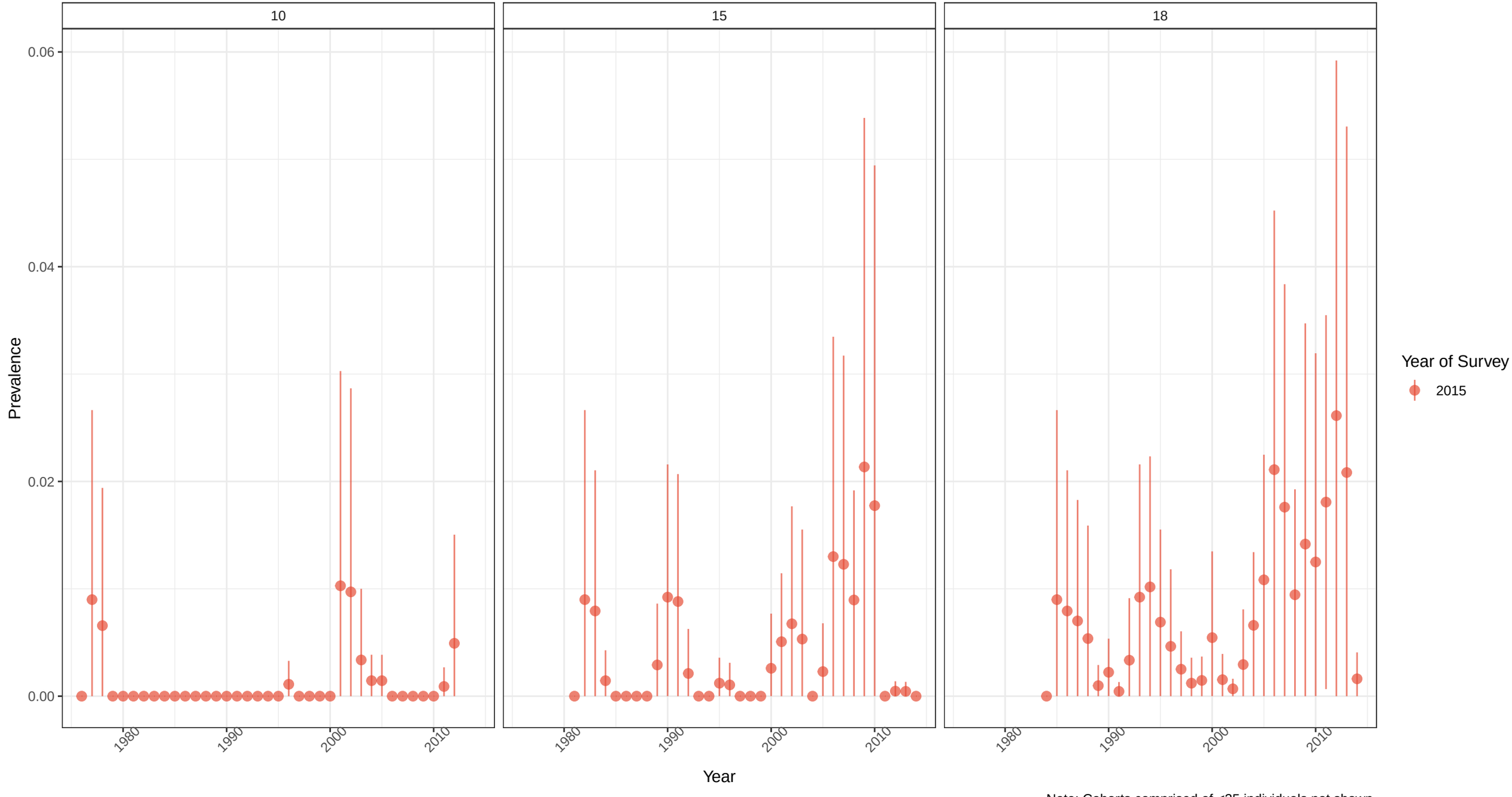

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Figure S3 − Prevalence Estimates by Time and Geography

Mozambique: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

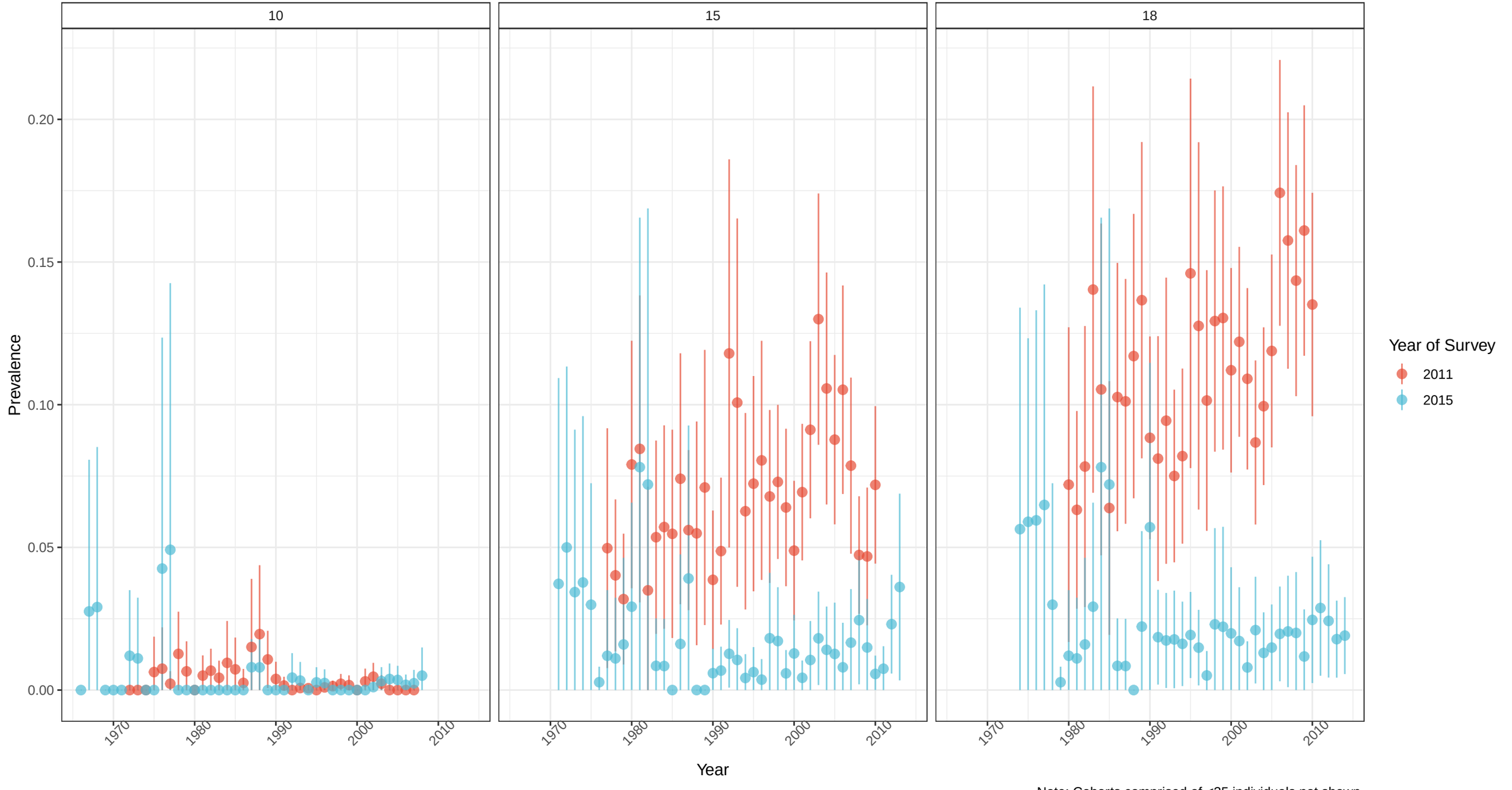

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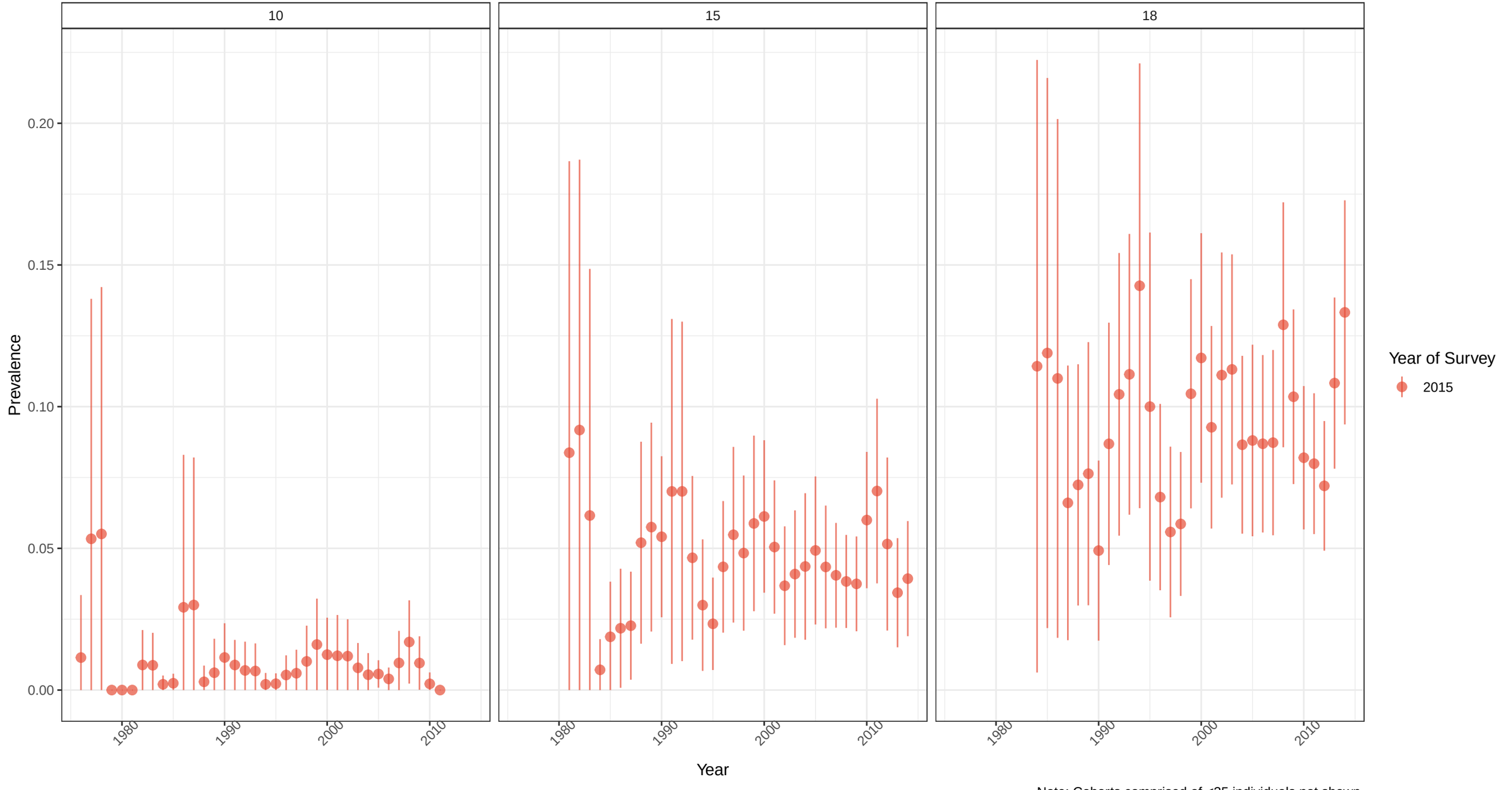
Figure S3 − Prevalence Estimates by Time and Geography

Malawi: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Nigeria: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

Note: Cohorts comprised of <25 individuals not shown.

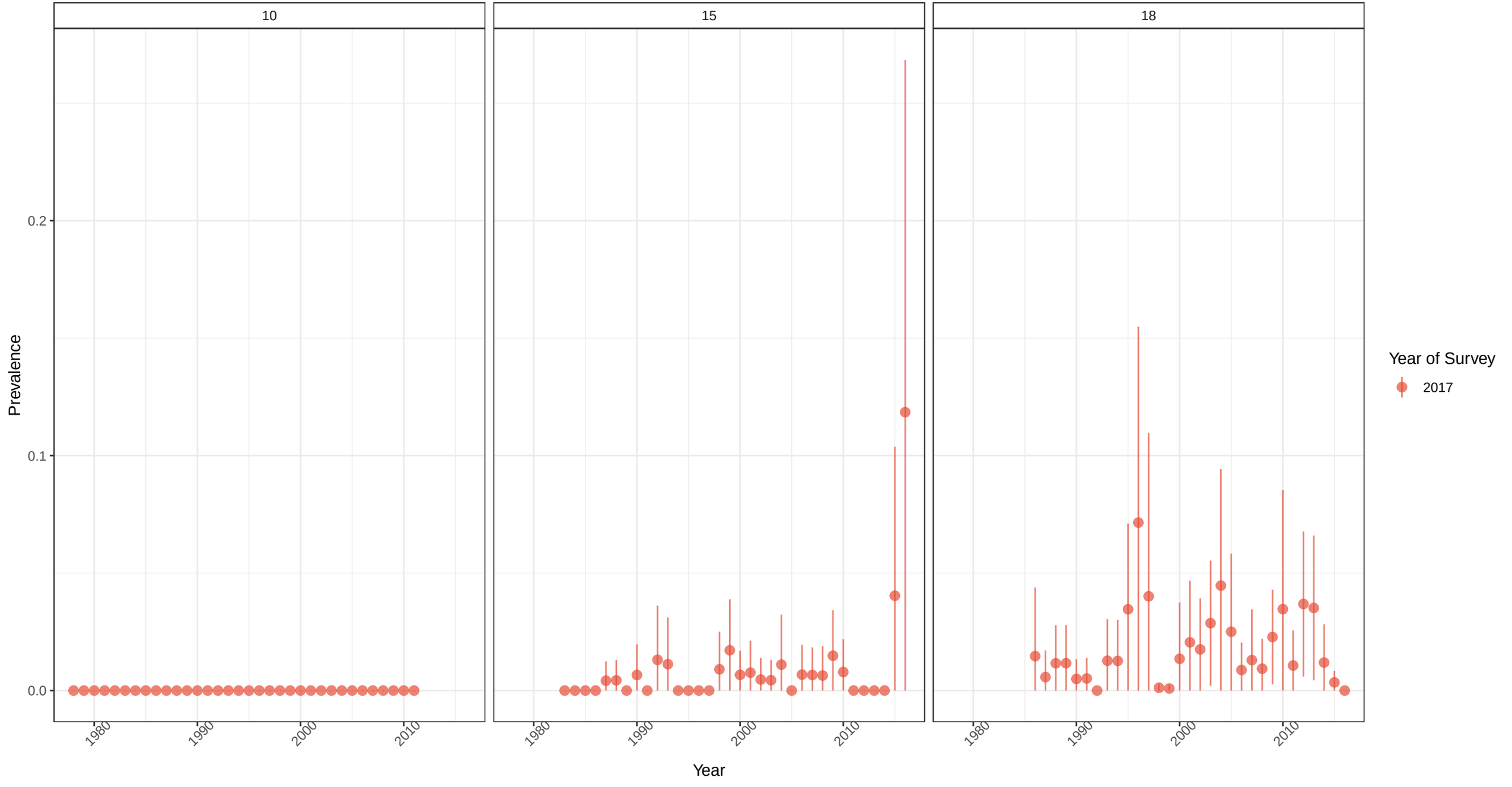
Figure S3 − Prevalence Estimates by Time and Geography

Nepal: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

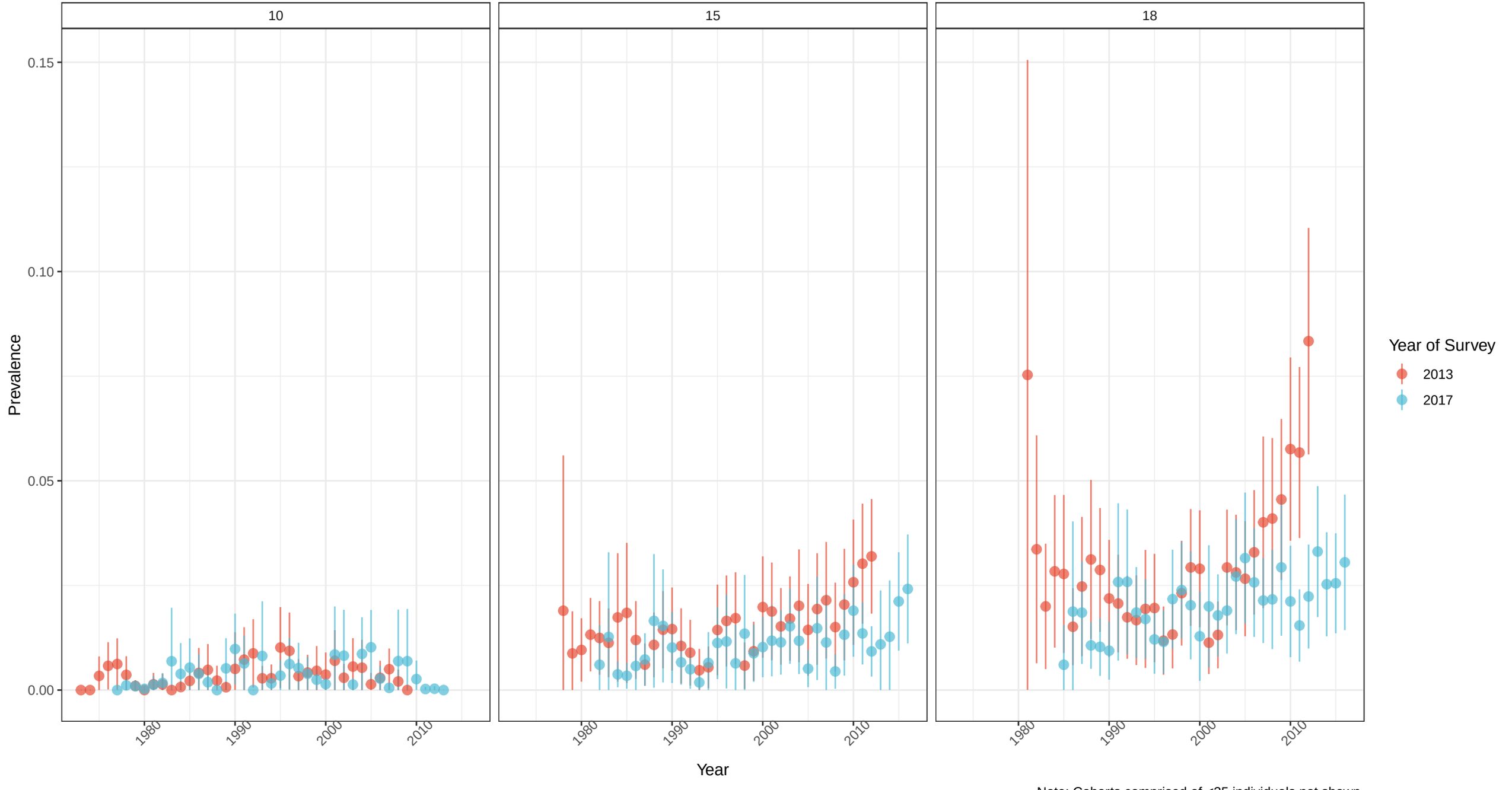
Pakistan: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

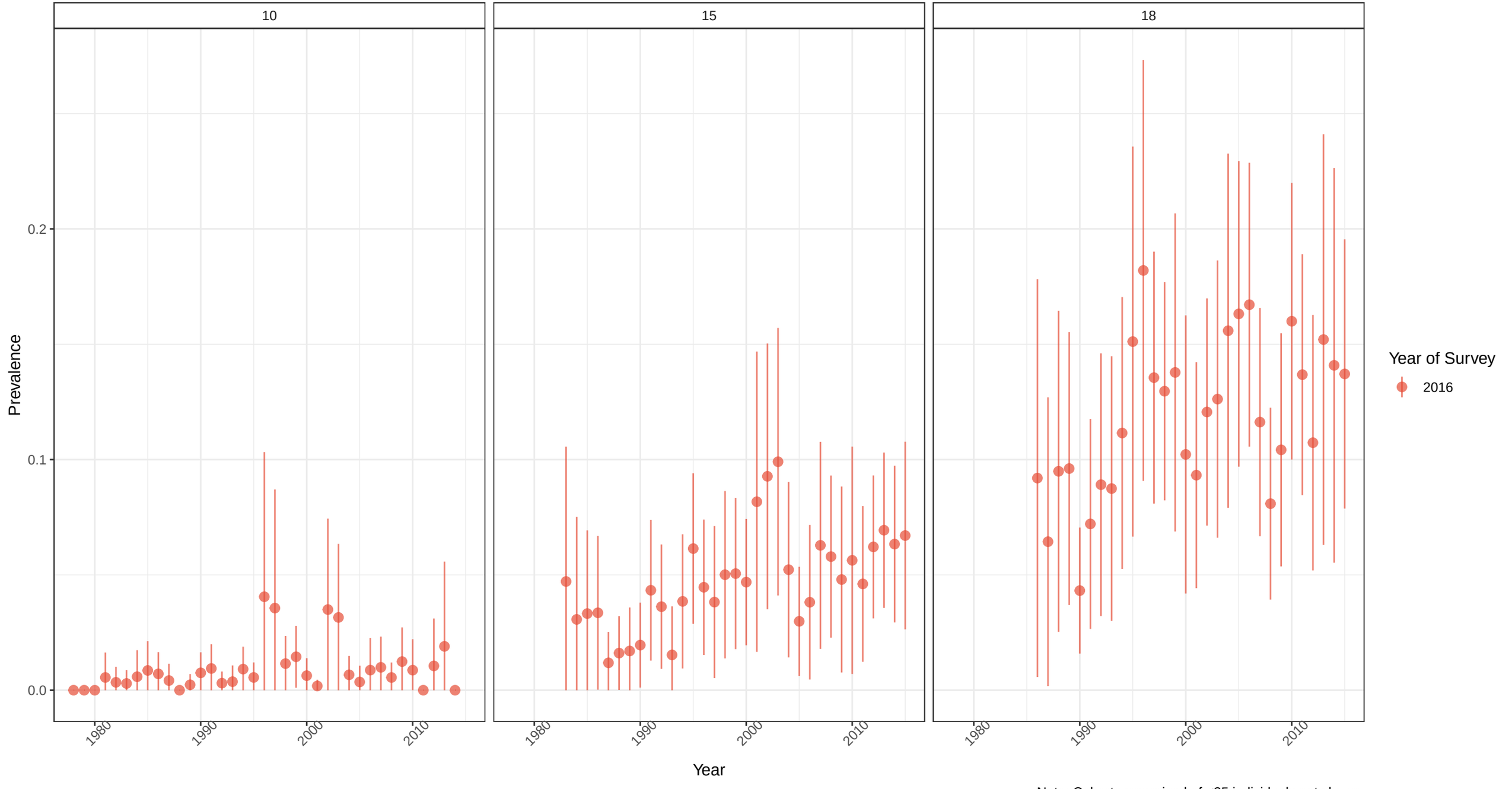
Philippines: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

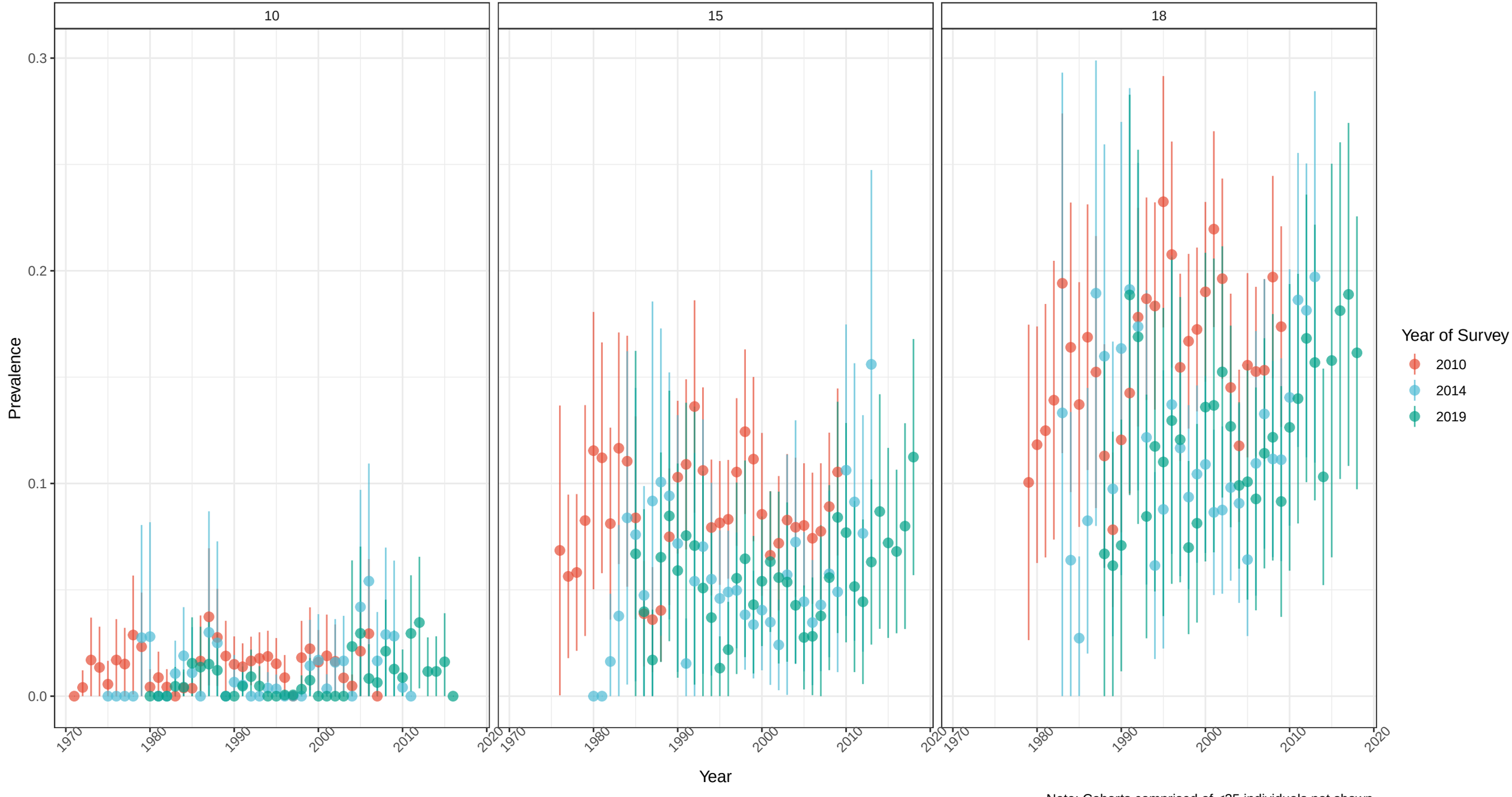
Papua New Guinea: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

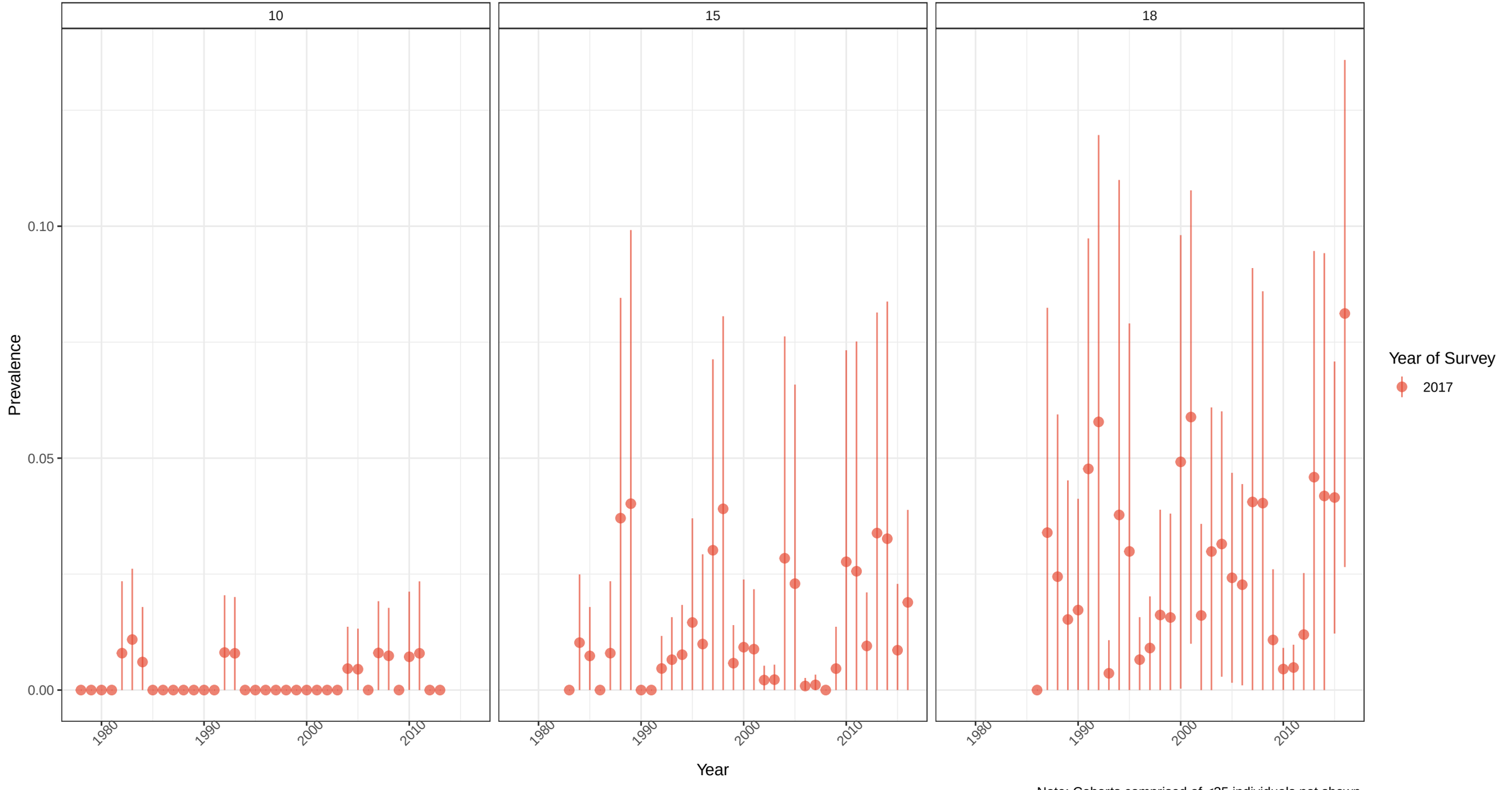
Rwanda: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

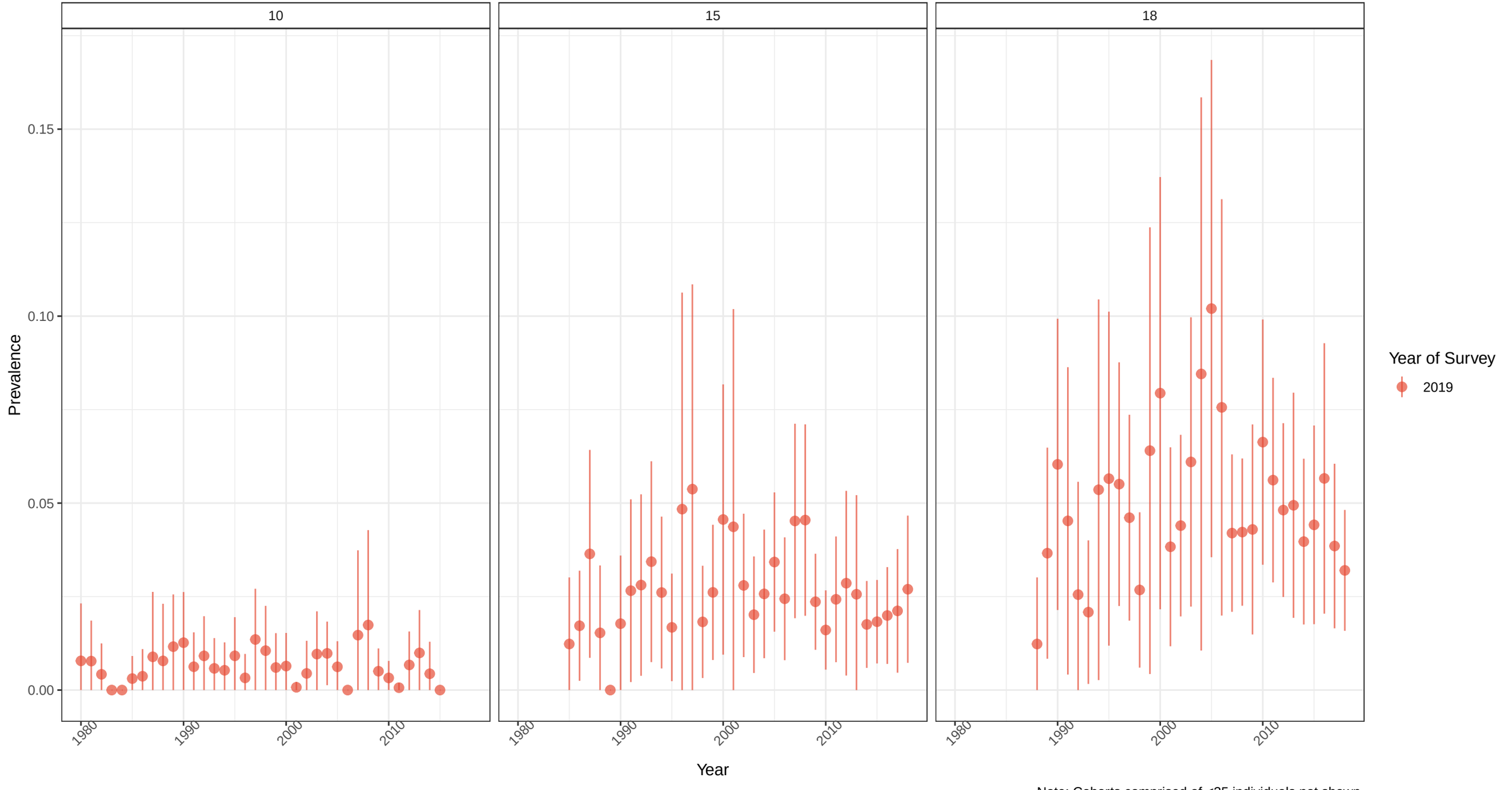
Senegal: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

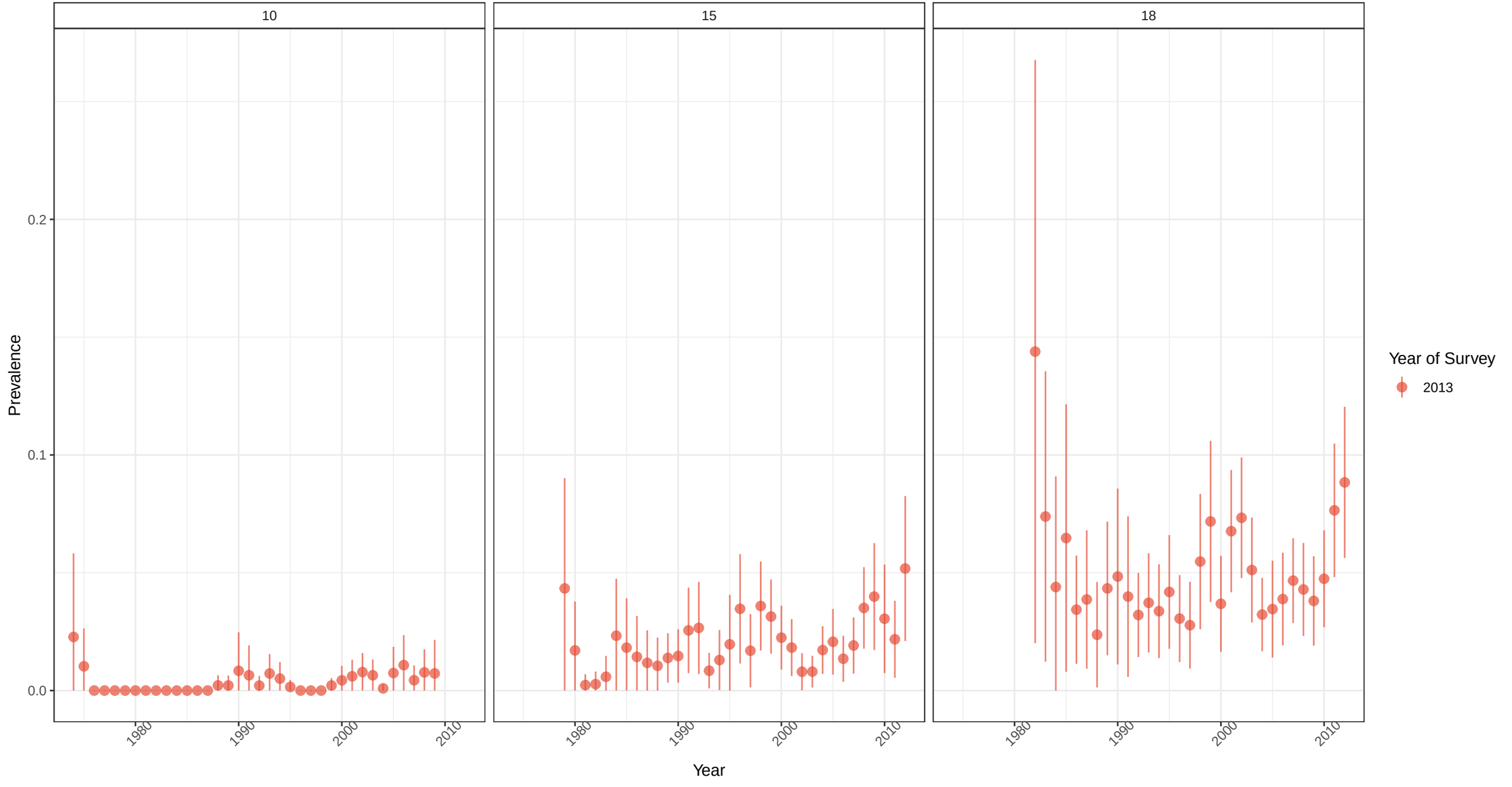
Sierra Leone: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Togo: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

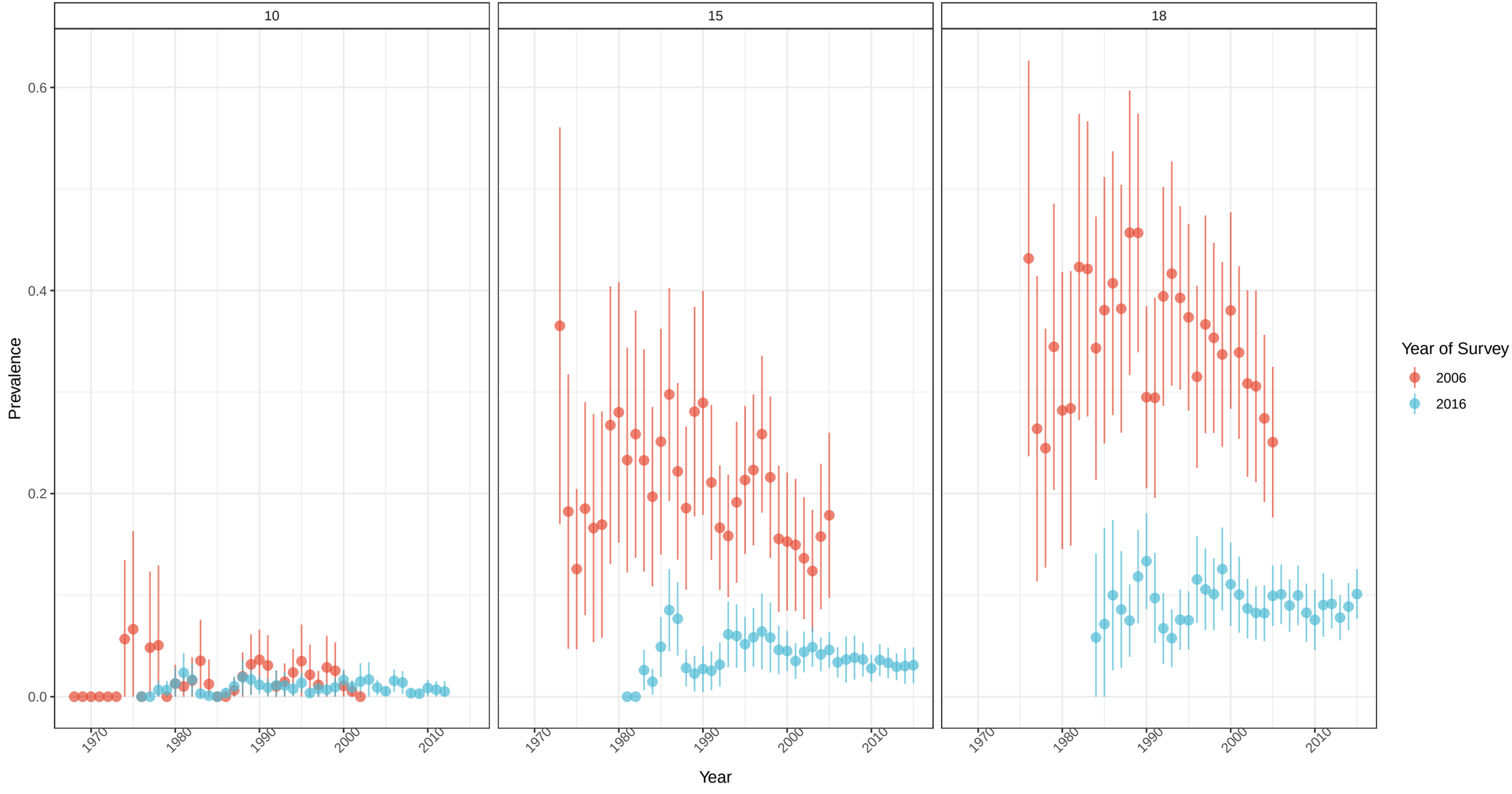
Figure S3 − Prevalence Estimates by Time and Geography

United Republic of Tanzania: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds

Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

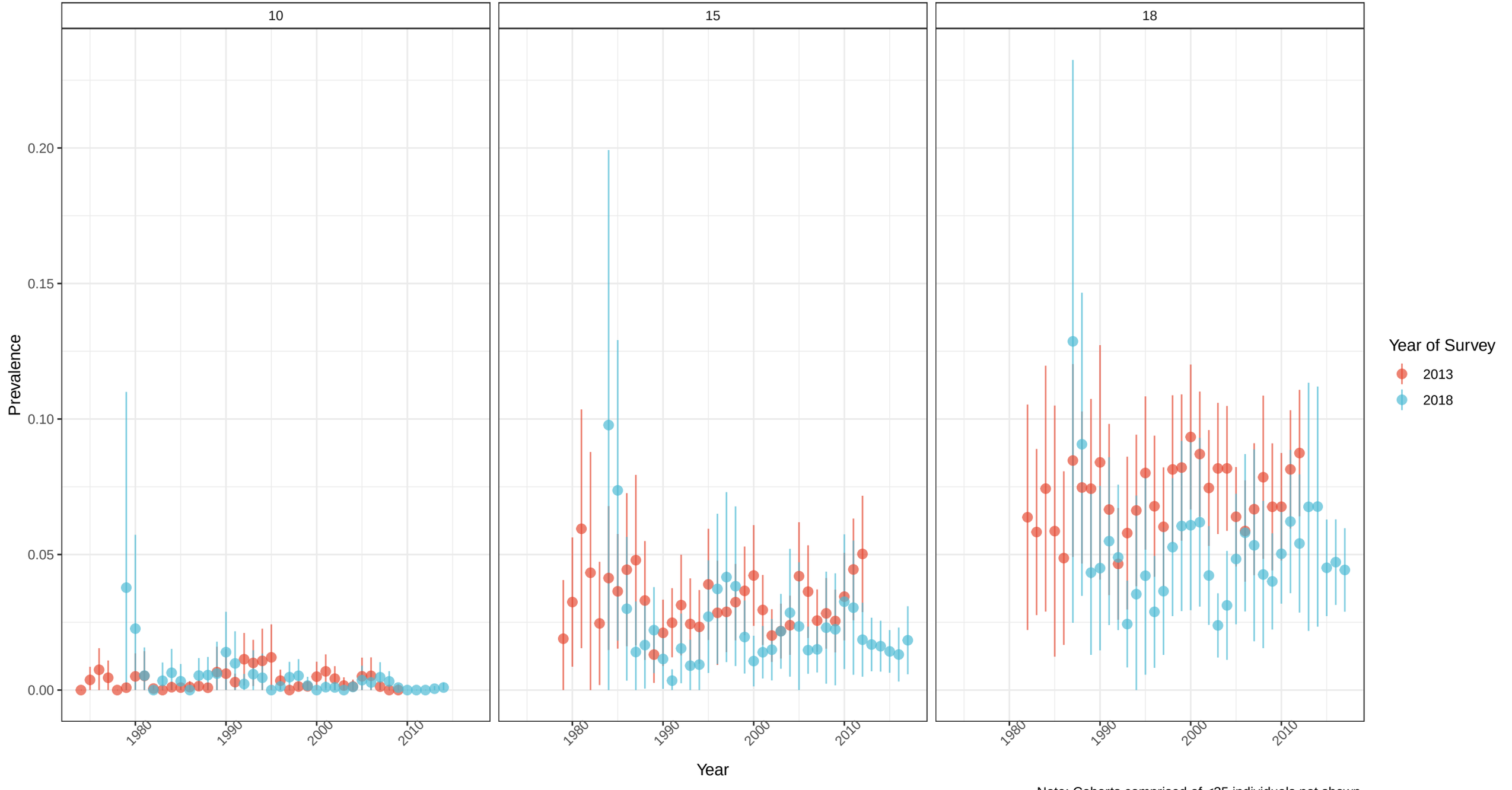
Uganda: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

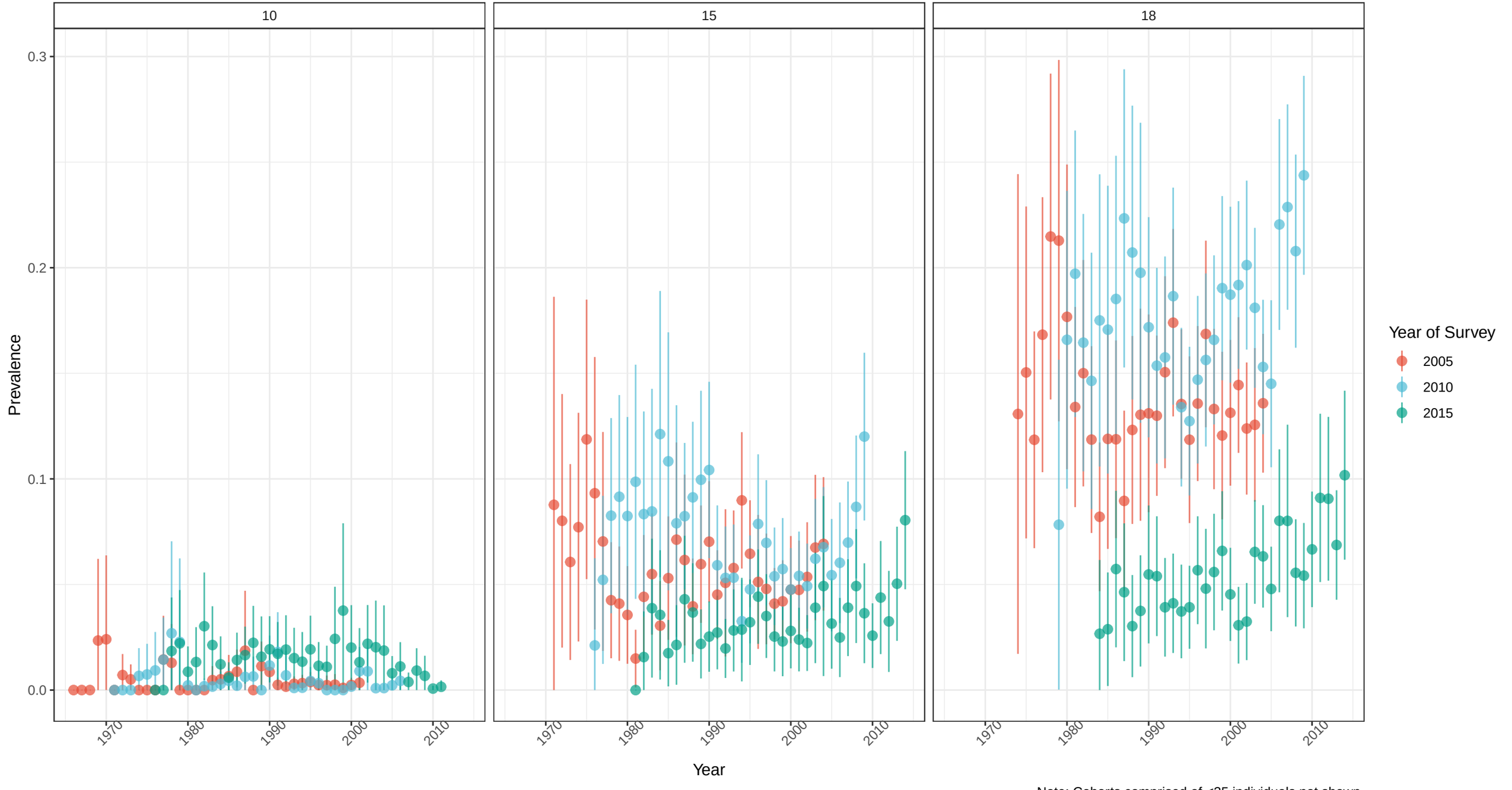
Zambia: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S3 − Prevalence Estimates by Time and Geography

Zimbabwe: lifetime prevalence of sexual violence among 10−, 15−, and 18−year−olds



Note: Cohorts comprised of <25 individuals not shown.

Figure S4. Estimates from DHS cohort analysis in comparison to VACS estimates from same country and year.