Global Distribution of Unintended Pregnancies and Contraceptive Usage

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This uses MS Word as output format. [See here](https://quarto.org/docs/output-formats/ms-word.html) for more information.

## 0.1 Project Part 1

# 1. Data Source

The data source for this project is the Guttmacher Institute, which is a well-known research organization focusing on improving sexual and reproductive health around the world. The data used here is from their Adding It Up project. The goals of this project include estimating the need for, impact of, and costs associated with providing sexual and reproductive health services. Low and middle income countries are the target audience for this research, specifically women of reproductive age (15-49). Some of the variables included in this dataset are modern contraceptive use, unintended pregnancies, unplanned births, and abortions averted. Observations are drawn from nationally representative surveys, including Demographic and Health Surveys, UNICCEF Multiple Indicator Cluster Surveys, US Centers for Disease Control Reproductive Health Surveys, Performance Monitoring for Action Surveys, and others. The UN Population Division is the source of population projections for women in this age group, and estimates of unintended pregnancies are from the Guttmacher Institute, WHO, and other authors, which have been adjusted to 2019.

# 2. Load and describe the data

library(here)  
AIUdata <- read\_csv(here("data", "raw-data", "AIU All Women Dataset.csv"))

Rows: 132 Columns: 399  
── Column specification ────────────────────────────────────────────────────────  
Delimiter: ","  
chr (4): country, data\_source\_year, region, subregion  
dbl (395): iso\_numeric, wra, pct\_currentlymarried, pct\_formerlymarried, pct\_...  
  
ℹ Use `spec()` to retrieve the full column specification for this data.  
ℹ Specify the column types or set `show\_col\_types = FALSE` to quiet this message.

dim(AIUdata)

[1] 132 399

str(AIUdata)

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 .. curr\_cp\_costs = col\_double(),  
 .. curr\_costs\_cp\_percap = col\_double(),  
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 .. curr\_prnc\_costs\_newborn = col\_double(),  
 .. curr\_prnc\_costs\_pmtct = col\_double(),  
 .. curr\_abortion\_pac\_costs = col\_double(),  
 .. curr\_abortion\_pac\_costs\_percap = col\_double(),  
 .. curr\_abortion\_costs\_direct = col\_double(),  
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 .. curr\_costs\_sti\_percap = col\_double(),  
 .. curr\_sti\_costs\_direct = col\_double(),  
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 .. curr\_sti\_noprc = col\_double(),  
 .. curr\_sti\_noprc\_direct = col\_double(),  
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 .. curr\_sti\_costs\_wra = col\_double(),  
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 .. all\_sti\_costs\_wra = col\_double(),  
 .. all\_pid\_notrt\_chlgon = col\_double()  
 .. )  
 - attr(\*, "problems")=<externalptr>

There are 132 observations, one row for each low- to middle- income country, of the 399 variable included in the Adding It Up All Women Dataset. Some examples of numeric variables included are percentages of pregnancy outcomes, rates of safe and unsafe abortions, percentage of various contraceptive usages, percentages of care received for various pregnancy complications, and costs for many variables including abortions and STIs. There are three important character variables that can be used to group the numeric variables: country name, region, and sub region.

# 3. Summarize the data

table(AIUdata$region)

Africa Asia   
 53 36   
 Europe Latin America & the Caribbean   
 11 24   
 Oceania   
 8

table(AIUdata$subregion)

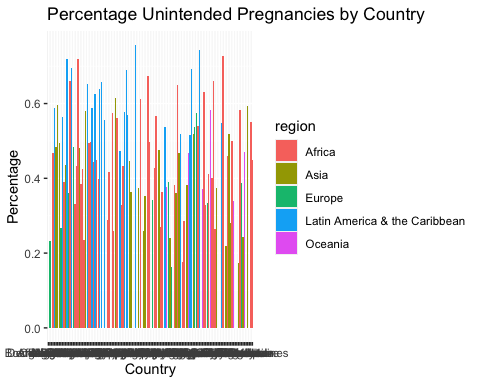
Caribbean Central America Central Asia Eastern Africa Eastern Asia   
 7 7 5 17 3   
 Eastern Europe Middle Africa Northern Africa Oceania South America   
 6 9 6 8 10   
 Southeast Asia Southern Africa Southern Asia Southern Europe Western Africa   
 9 5 9 5 16   
 Western Asia   
 10

summary(AIUdata$pct\_upreg)

Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
 0.1633 0.3704 0.4701 0.4679 0.5753 0.7565 24

ggplot(AIUdata, aes(x = country, y = pct\_upreg, fill = region)) +  
 geom\_col(position = "dodge") +  
 labs(title = "Percentage Unintended Pregnancies by Country",  
 x = "Country",  
 y = "Percentage")

Warning: Removed 24 rows containing missing values (`geom\_col()`).



The dataset includes 53 African countries, 36 Asian countries, 11 European Countries, 24 Latin American/Caribbean countries, and 8 Oceanic countries.There are 16 subregions that provide better detail about each country’s location. The average percentage of unintended pregnancies at the country level is 46.79%. with a maximum of 75.65%. This variable has 24 missing values, which will need to be cleaned. A simple visualization shows that African and Latin American/Carribean countries have the highest percentages of unintended pregnancies.

# 4. Research Questions

1. Is there a significant difference in the percentage of unplanned pregnancies between contraceptive methods among all countries? Does this difference vary by region? The main outcome variables will be total percentage of unintended pregnancies per birth control method (pct\_upreg\_larcster, pct\_upreg\_sarc, pct\_upreg\_trad). The control variable will be total percentage of unintended pregnancies among women not using birth control (pct\_upreg\_none) The predictor variables will include the total number of people women using each type of birth control standardized by population size, which will be utilized to create a factor variable showing low, medium, and high usage for each method per country. Covariates will include the number of women using each of these methods across four different age groups: 15-19, 20-24, 25-34, and 35-49. -Number of women 15-19 using long-acting reversible methods larc\_1519 -Number of women 15-19 using short-acting methods sarc\_1519 -Number of women 15-19 using traditional methods tradmethods\_1519 -Number of women 15-19 using no method nomethod\_1519 -Number of women 20-24 using long-acting reversible methods larc\_2024 -Number of women 20-24 using short-acting methods sarc\_2024 -Number of women 20-24 using traditional methods tradmethods\_2024 -Number of women 20-24 using no method nomethod\_2024 -Number of women 25-34 using long-acting reversible methods larc\_2534 -Number of women 25-34 using short-acting methods sarc\_2534 -Number of women 25-34 using traditional methods tradmethods\_2534 -Number of women 25-34 using no method nomethod\_2534 -Number of women 35-49 using long-acting reversible method larc\_3549 -Number of women 35-49 using short-acting method sarc\_3549 -Number of women 35-49 using all traditional methods tradmethods\_3549 -Number of women 35-49 using no method nomethod\_3549

We will be looking for patterns in contraceptive methods and higher unintended pregnancies across age groups to investigate the effectiveness of each method. We hope to find relationships between subregions, rates of unintended pregnancies, and contraceptive methods to determine possible interventions that will increase the effectiveness of contraceptive methods.

# 5. How to analyze

All of the variables used in this analysis are numeric, so we can build linear regression models to analyze how each method of contraception affects the percentage of unintended pregnancies. We can group countries together based on the subregion variable to compare how these relationships vary across the world as shown in the crude visualization above. There are other interesting variables that can be used for grouping for analysis such as wealth, urban/rural location, and marriage status.

# 6. Summary/Abstract

*Write a summary of your project.*

# 7. Introduction

## 7.1 General Background Information

*Provide enough background on your topic that others can understand the why and how of your analysis*

We will be looking for patterns in contraceptive methods and higher unintended pregnancies across age groups (20-24) and (35-49) to investigate the effectiveness of each contraceptive method.Financial, social, religious, and cultural factors are current challenges against efforts towards reducing unintended pregnancies. According to a cross-sectional survey done in 2017, contraceptive use was prevalent among women who had attained higher education, were in stable partnerships, and identified with the dominant ethnic group. Additionally, factors like previous pregnancies and immigration status did not appear to influence contraceptive use in this study. The table provided above under Summarize the data shows that African and Latin American/Caribbean countries have the highest percentages of unintended pregnancies. This could be due to the current legal status of contraception within Latin American countries. Free emergency contraception access exists, but regulations differ. Chile, Colombia, and Ecuador legally recognize access, while Nicaragua and Bolivia rely on Ministerial protocols. Argentina and Brazil lack legal recognition, but offer protocols and guides. Mexico requires provision to victims of sexual and domestic violence (Hevia, 2012).

## 7.2 Description of data and data source

*Describe what the data is, what it contains, where it is from, etc. Eventually this might be part of a methods section.*

This data originates from the Guttmacher Institute’s Adding It Up project. The data contains numeric variables: percentages of pregnancy outcomes, rates of safe and unsafe abortions, percentage of various contraceptive usages, percentages of care received for various pregnancy complications, and costs for many variables including abortions and STIs. There are only three character variables that can be used to group the numeric variables: country name, region, and sub region. So far we have dvided the observations into “low”, “medium”, and “high” category of birth control usage.

## 7.3 Questions/Hypotheses to be addressed

*State the research questions you plan to answer with this analysis.*

1. Is there a significant difference in the percentage of unplanned pregnancies between three contraceptive methods among all countries compared to no usage?
2. How does marriage status affect percentage of usage across three different types of birth control per region? (back-up question)

To cite other work (important everywhere, but likely happens first in introduction), make sure your references are in the bibtex file specified in the YAML header above (here dataanalysis\_template\_references.bib) and have the right bibtex key. Then you can include like this: Examples of reproducible research projects can for instance be found in (McKay, Ebell, Billings, et al., 2020; McKay, Ebell, Dale, Shen, & Handel, 2020).

# 8. Methods

*Describe your methods. That should describe the data, the cleaning processes, and the analysis approaches. You might want to provide a shorter description here and all the details in the supplement.*

## 8.1 Schematic of workflow

Sometimes you might want to show a schematic diagram/figure that was not created with code (if you can do it with code, do it). is an example of some - completely random/unrelated - schematic that was generated with Biorender. We store those figures in the assets folder.

## 8.2 Data aquisition

*As applicable, explain where and how you got the data. If you directly import the data from an online source, you can combine this section with the next.*

## 8.3 Data import and cleaning

*Write code that reads in the file and cleans it so it’s ready for analysis. Since this will be fairly long code for most datasets, it might be a good idea to have it in one or several R scripts. If that is the case, explain here briefly what kind of cleaning/processing you do, and provide more details and well documented code somewhere (e.g. as supplement in a paper). All materials, including files that contain code, should be commented well so everyone can follow along.*

## 8.4 Statistical analysis

*Explain anything related to your statistical analyses.*

# 9. Results

## 9.1 Exploratory/Descriptive analysis (Project Part 2)

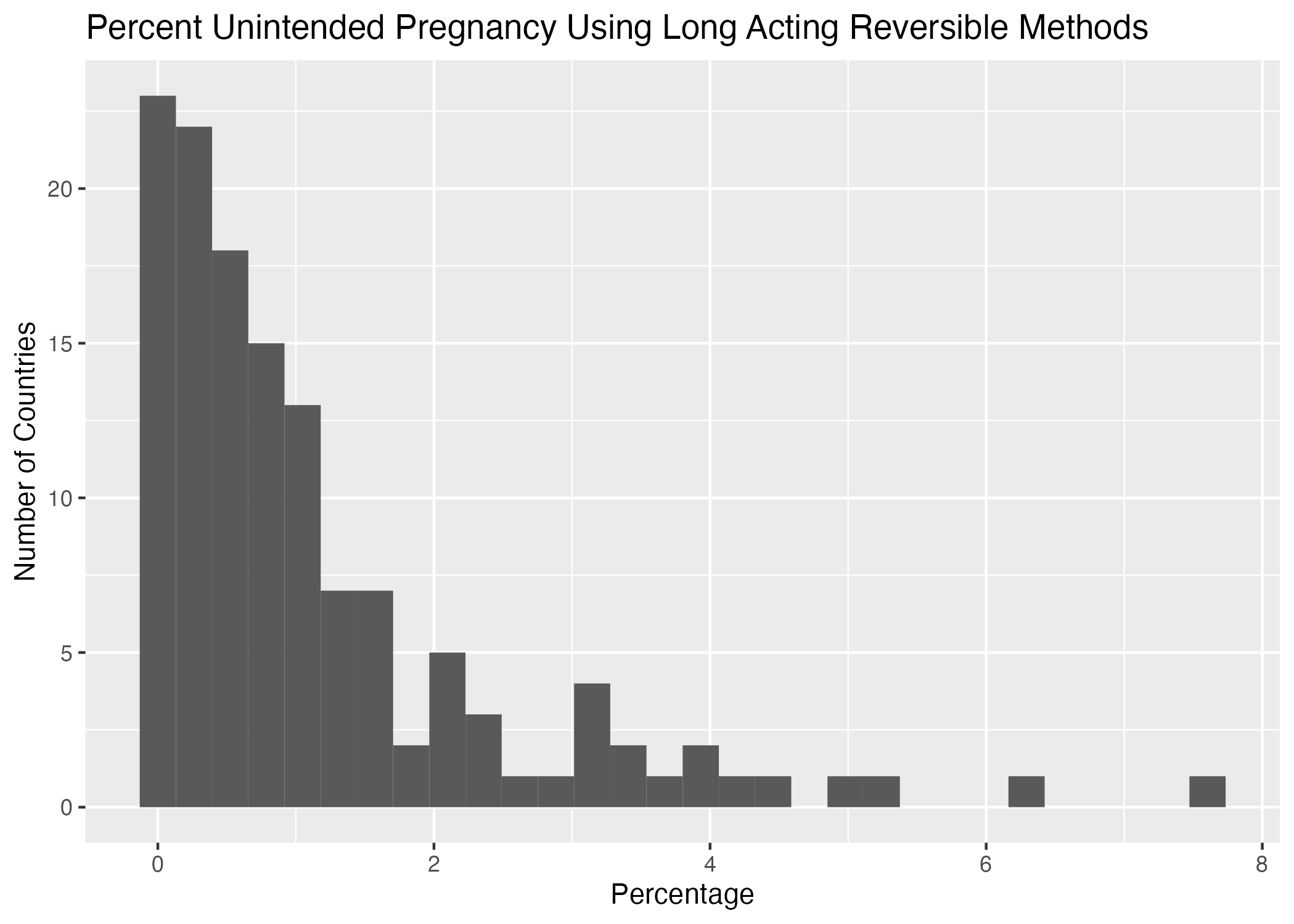
The first priority when cleaning the data was analyzing missing values, and our findings can be seen [Table 1](#tbl-summarytable). We found that the pct\_upreg variable containing the percentage of unintended pregnancies is unreliable due to missing data that could not be explained. We decided to use the variables with percentage of unintended pregnancies related to each birth control method as our outcome variables because they are complete and were found directly based on the AIU protocol information. We printed the summary table here because it was useful in determining missingness and creating a new factor variable for the usage of each birth control method at the factor level later in the processing sequence.

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| Table 1: Summary table of numeric variables   | skim\_type | skim\_variable | n\_missing | complete\_rate | character.min | character.max | character.empty | character.n\_unique | character.whitespace | factor.ordered | factor.n\_unique | factor.top\_counts | numeric.mean | numeric.sd | numeric.p0 | numeric.p25 | numeric.p50 | numeric.p75 | numeric.p100 | numeric.hist | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | character | country | 0 | 1.0000000 | 4 | 32 | 0 | 132 | 0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | | character | subregion | 0 | 1.0000000 | 7 | 15 | 0 | 16 | 0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | | factor | region | 0 | 1.0000000 | NA | NA | NA | NA | NA | FALSE | 5 | Afr: 53, Asi: 36, Lat: 24, Eur: 11 | NA | NA | NA | NA | NA | NA | NA | NA | | factor | larcster\_usage | 0 | 1.0000000 | NA | NA | NA | NA | NA | FALSE | 3 | Med: 79, Low: 33, Hig: 20 | NA | NA | NA | NA | NA | NA | NA | NA | | factor | sarc\_usage | 0 | 1.0000000 | NA | NA | NA | NA | NA | FALSE | 3 | Med: 66, Hig: 33, Low: 33 | NA | NA | NA | NA | NA | NA | NA | NA | | factor | trad\_usage | 0 | 1.0000000 | NA | NA | NA | NA | NA | FALSE | 3 | Med: 66, Hig: 33, Low: 33 | NA | NA | NA | NA | NA | NA | NA | NA | | factor | none\_usage | 0 | 1.0000000 | NA | NA | NA | NA | NA | FALSE | 3 | Med: 66, Hig: 33, Low: 33 | NA | NA | NA | NA | NA | NA | NA | NA | | numeric | wra | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.242699e+04 | 4.376124e+04 | 25.5030000 | 745.8216564 | 2748.0664850 | 8613.2582500 | 3.533569e+05 | ▇▁▁▁▁ | | numeric | pct\_upreg | 24 | 0.8181818 | NA | NA | NA | NA | NA | NA | NA | NA | 4.678779e-01 | 1.427748e-01 | 0.1632998 | 0.3703958 | 0.4700902 | 0.5753019 | 7.564701e-01 | ▃▇▇▇▃ | | numeric | pct\_upreg\_larcster | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.156700e+00 | 1.356247e+00 | 0.0128692 | 0.2355402 | 0.7105178 | 1.4625074 | 7.616232e+00 | ▇▁▁▁▁ | | numeric | pct\_upreg\_sarc | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.582183e+01 | 1.084294e+01 | 2.1441521 | 7.6515339 | 12.3349491 | 22.8814566 | 4.766020e+01 | ▇▅▂▂▁ | | numeric | pct\_upreg\_trad | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.079317e+01 | 9.725091e+00 | 0.5519164 | 3.4076718 | 6.9575185 | 14.8161055 | 4.119182e+01 | ▇▃▂▁▁ | | numeric | pct\_upreg\_nouse | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 7.222831e+01 | 1.552603e+01 | 34.6493357 | 60.4638691 | 75.3752449 | 84.7383516 | 9.654246e+01 | ▂▅▆▇▇ | | numeric | larc\_1519 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.407059e+01 | 4.498734e+01 | 0.0000000 | 0.1113384 | 1.4697677 | 8.3967371 | 3.775064e+02 | ▇▁▁▁▁ | | numeric | ster\_1519 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.025001e+00 | 6.882524e+00 | 0.0000000 | 0.0000000 | 0.0020571 | 0.1024225 | 7.775330e+01 | ▇▁▁▁▁ | | numeric | sarc\_1519 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.226480e+02 | 3.649535e+02 | 0.0278823 | 2.9717419 | 29.0438879 | 89.6284302 | 3.803077e+03 | ▇▁▁▁▁ | | numeric | tradmethods\_1519 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.577868e+01 | 5.106852e+01 | 0.0000000 | 0.6135273 | 2.7260638 | 12.0517047 | 5.027744e+02 | ▇▁▁▁▁ | | numeric | nomethod\_1519 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 8.964546e+01 | 2.020529e+02 | 0.1297914 | 3.5322040 | 20.9274500 | 88.7315414 | 1.901195e+03 | ▇▁▁▁▁ | | numeric | larc\_2024 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 8.778236e+01 | 3.588239e+02 | 0.0000000 | 1.4154023 | 12.4396204 | 41.0000874 | 3.773921e+03 | ▇▁▁▁▁ | | numeric | ster\_2024 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 5.364719e+01 | 3.740276e+02 | 0.0000000 | 0.0000109 | 0.1721045 | 2.2235096 | 3.455633e+03 | ▇▁▁▁▁ | | numeric | sarc\_2024 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 4.198713e+02 | 1.353423e+03 | 0.1902078 | 16.2297545 | 89.9685125 | 316.7151306 | 1.344921e+04 | ▇▁▁▁▁ | | numeric | tradmethods\_2024 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 6.415122e+01 | 2.322300e+02 | 0.0000000 | 2.0328821 | 9.6545894 | 37.1921438 | 2.167788e+03 | ▇▁▁▁▁ | | numeric | nomethod\_2024 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 2.271312e+02 | 7.857574e+02 | 0.4303841 | 15.0060768 | 62.2025652 | 160.7291268 | 8.050780e+03 | ▇▁▁▁▁ | | numeric | larc\_2534 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 4.476434e+02 | 2.851579e+03 | 0.0000000 | 4.2724241 | 54.9849468 | 161.5925744 | 3.257327e+04 | ▇▁▁▁▁ | | numeric | ster\_2534 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 5.109694e+02 | 3.412677e+03 | 0.0000000 | 0.9464894 | 4.2325035 | 39.8833392 | 3.420214e+04 | ▇▁▁▁▁ | | numeric | sarc\_2534 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 9.939626e+02 | 3.142770e+03 | 0.8615842 | 54.5557513 | 191.1774047 | 616.4785976 | 3.036216e+04 | ▇▁▁▁▁ | | numeric | tradmethods\_2534 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.941059e+02 | 6.629754e+02 | 0.1015477 | 4.7369120 | 32.9842600 | 114.7048909 | 6.826595e+03 | ▇▁▁▁▁ | | numeric | nomethod\_2534 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 4.407532e+02 | 1.438758e+03 | 0.8963190 | 37.2000765 | 115.1800937 | 339.2502288 | 1.507830e+04 | ▇▁▁▁▁ | | numeric | larc\_3549 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 6.488136e+02 | 4.778938e+03 | 0.0387575 | 5.3537013 | 47.4176100 | 177.1081038 | 5.478257e+04 | ▇▁▁▁▁ | | numeric | ster\_3549 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.095300e+03 | 6.488281e+03 | 0.0064028 | 4.2442303 | 22.1867931 | 205.2715035 | 6.603597e+04 | ▇▁▁▁▁ | | numeric | sarc\_3549 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 9.438814e+02 | 3.926525e+03 | 0.4242947 | 35.2800808 | 145.5362069 | 507.5624883 | 4.247417e+04 | ▇▁▁▁▁ | | numeric | tradmethods\_3549 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 2.565321e+02 | 7.444454e+02 | 0.2558316 | 5.0259124 | 44.4789229 | 147.6353266 | 7.058509e+03 | ▇▁▁▁▁ | | numeric | nomethod\_3549 | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 3.630434e+02 | 9.023915e+02 | 0.8716472 | 26.9470757 | 113.3720025 | 278.8326536 | 6.985929e+03 | ▇▁▁▁▁ | | numeric | pct\_preg | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.000000e+02 | 0.000000e+00 | 100.0000000 | 100.0000000 | 100.0000000 | 100.0000000 | 1.000000e+02 | ▁▇▂▁▁ | | numeric | total\_larcster | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 2.859251e+03 | 1.585080e+04 | 1.7030785 | 23.9486455 | 220.3272545 | 859.6164638 | 1.473820e+05 | ▇▁▁▁▁ | | numeric | total\_sarc | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 2.480363e+03 | 8.494272e+03 | 1.5039690 | 114.3311259 | 474.2729083 | 1554.7608775 | 8.668515e+04 | ▇▁▁▁▁ | | numeric | total\_trad | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 5.305678e+02 | 1.668597e+03 | 0.3909577 | 15.0500000 | 91.8253116 | 332.4750000 | 1.655567e+04 | ▇▁▁▁▁ | | numeric | total\_none | 0 | 1.0000000 | NA | NA | NA | NA | NA | NA | NA | NA | 1.120573e+03 | 3.233809e+03 | 2.8000000 | 80.0750000 | 337.7500000 | 875.2750000 | 3.201620e+04 | ▇▁▁▁▁ | |

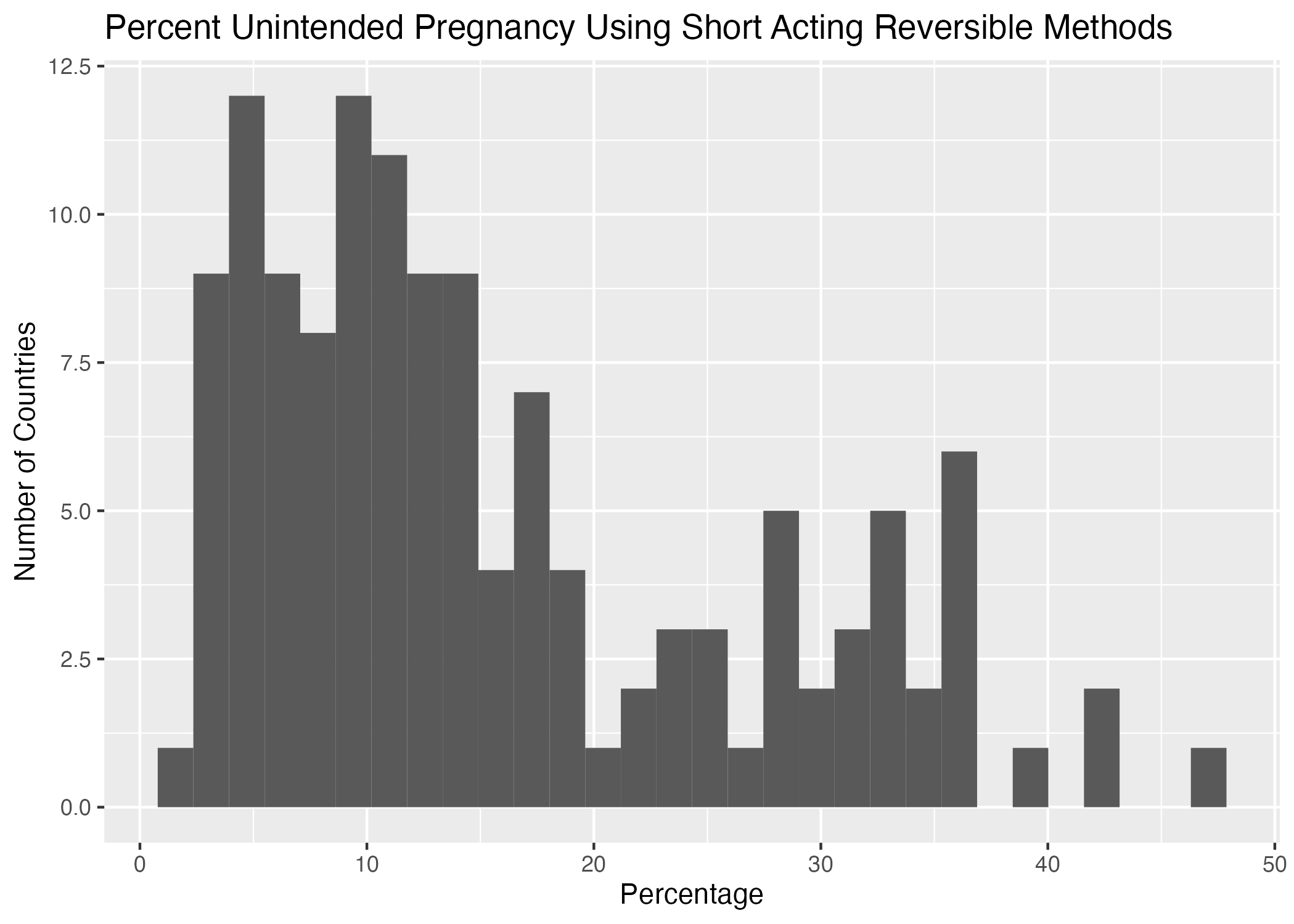
We explored the distribution of the countries by five categorical variables: region, larcster\_usage, sarc\_usage, trad\_usage, and none\_usage which is displayed in [Table 2](#tbl-summarytable2). We found that most countries are located in Africa followed by Asia and Latin America/the Caribbean. Only 20 countries have high usage of long acting reversible and sterilization methods compared to 33 countries with high usage of short acting reversible and traditional methods. It is interesting that the distributions for short acting reversible method, traditional method, and no method usages are the same.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 2: Summary table for categorical variables   | **Characteristic** | **N = 132** | | --- | --- | | region | NA | | Africa | 53 | | Asia | 36 | | Europe | 11 | | Latin America & the Caribbean | 24 | | Oceania | 8 | | larcster\_usage | NA | | High | 20 | | Low | 33 | | Medium | 79 | | sarc\_usage | NA | | High | 33 | | Low | 33 | | Medium | 66 | | trad\_usage | NA | | High | 33 | | Low | 33 | | Medium | 66 | | none\_usage | NA | | High | 33 | | Low | 33 | | Medium | 66 | |

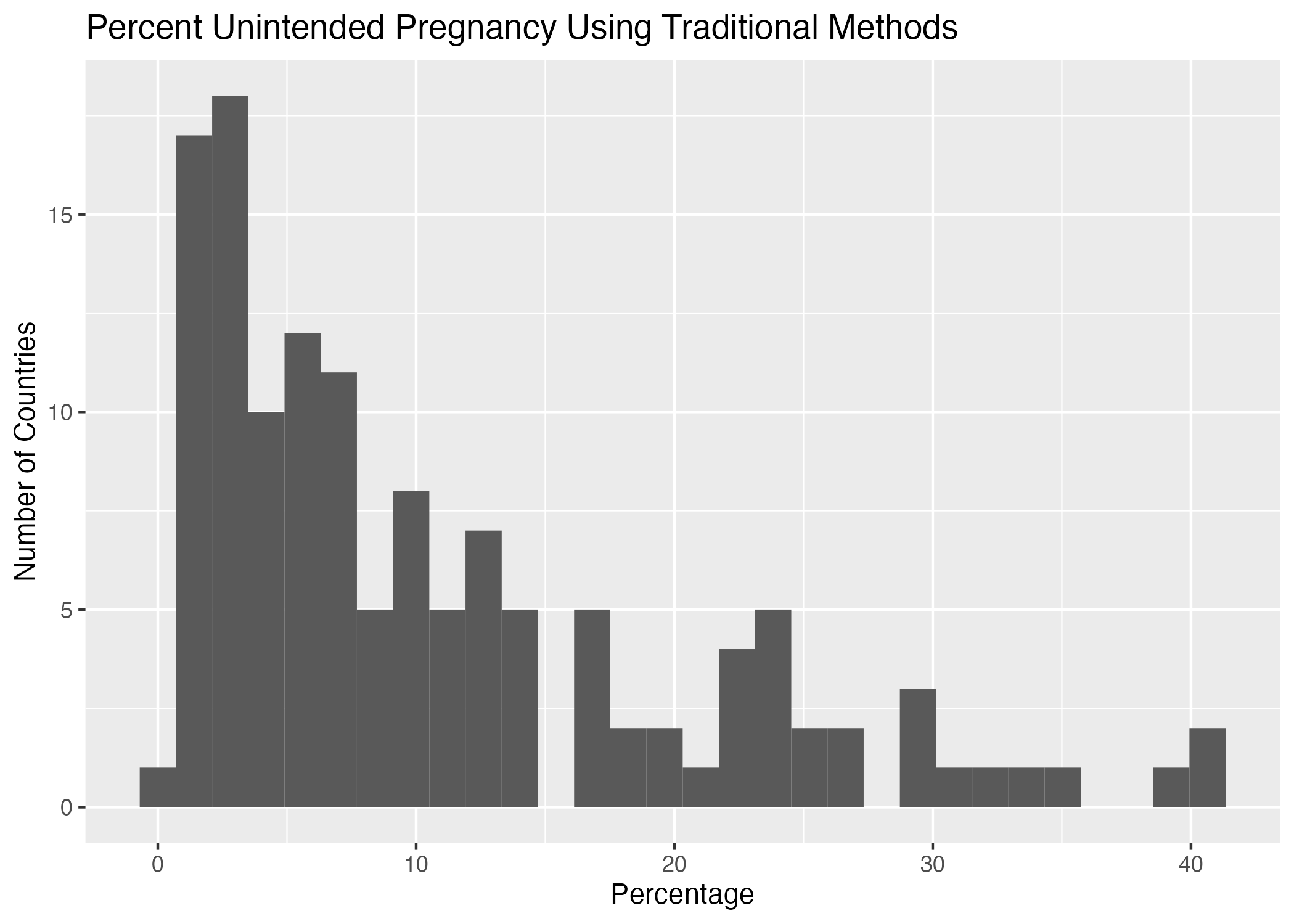
We created a multitude of exploratory plots to understand our data better. The histograms of percent of unintended pregnancies related to each method of birth control showed discrepancies in skewness which can be seen (**exploratory-result?**). The pct\_upreg\_larcster and pct\_upreg\_trad variables are highly skewed right, which shows that more countries experience lower rates of unintended pregnancies when using these methods. The pct\_upreg\_sarc histogram is not as skewed. It shows that the percentage of unintended pregnancies among those using short acting reversible methods varies more between countries compared to long acting reversible methods. The histogram for pct\_upreg\_none shows that more countries report a higher percentage of unintended pregnancies among women who do not use any contraception, but it varies widely by country.



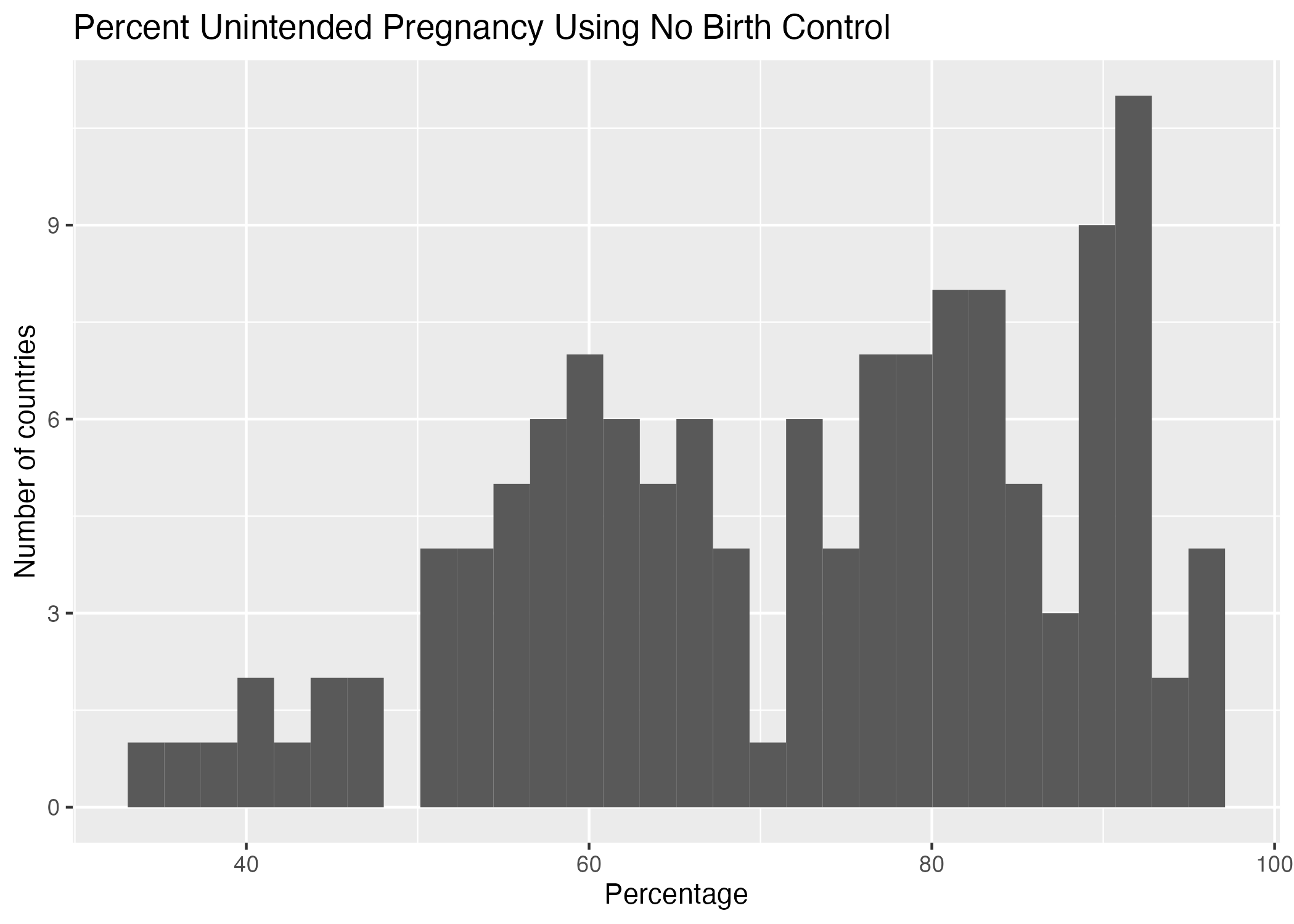
Histograms of Percentage of Unintended Pregnancy Use by Birth Control Method



Histograms of Percentage of Unintended Pregnancy Use by Birth Control Method

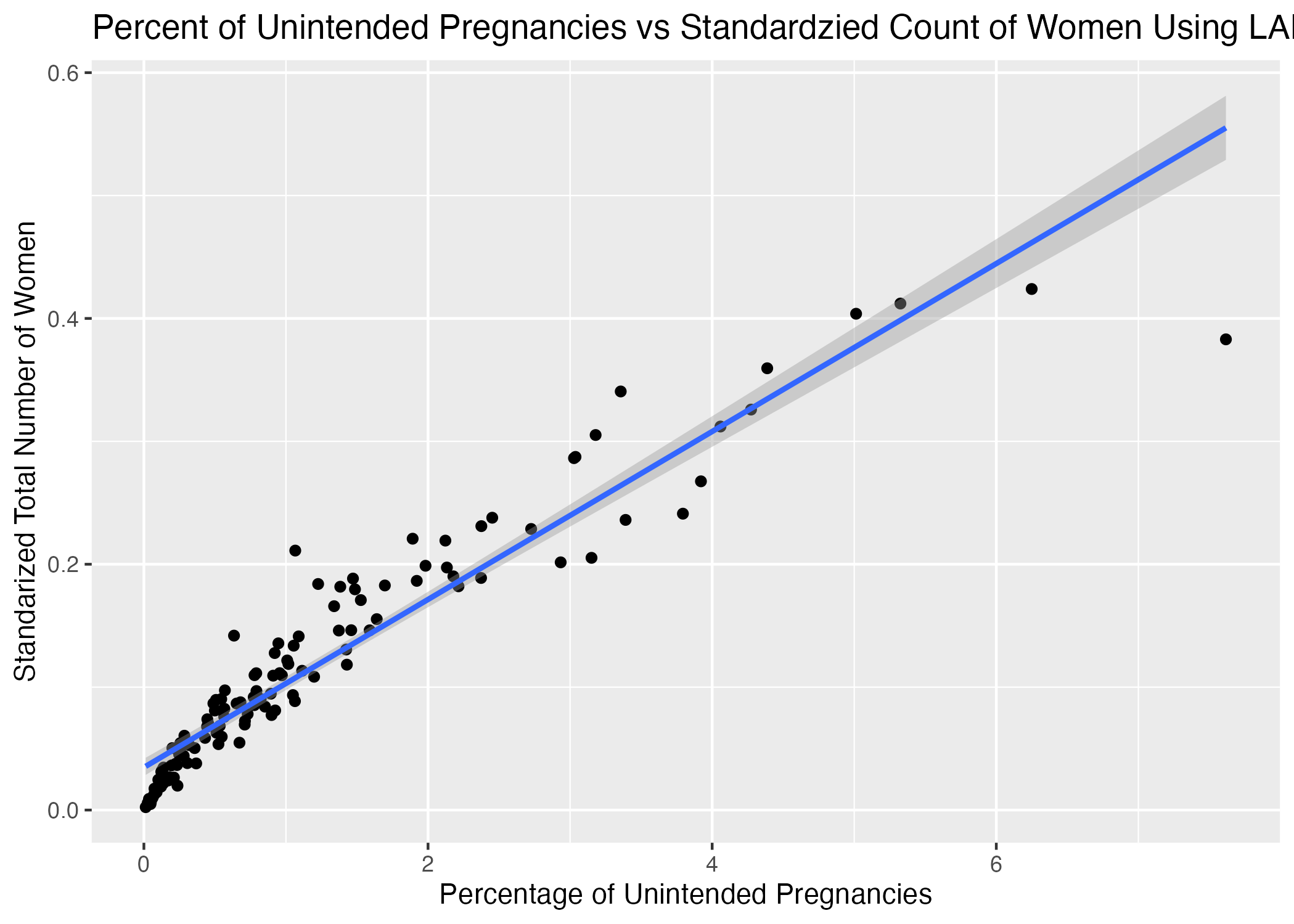


Histograms of Percentage of Unintended Pregnancy Use by Birth Control Method

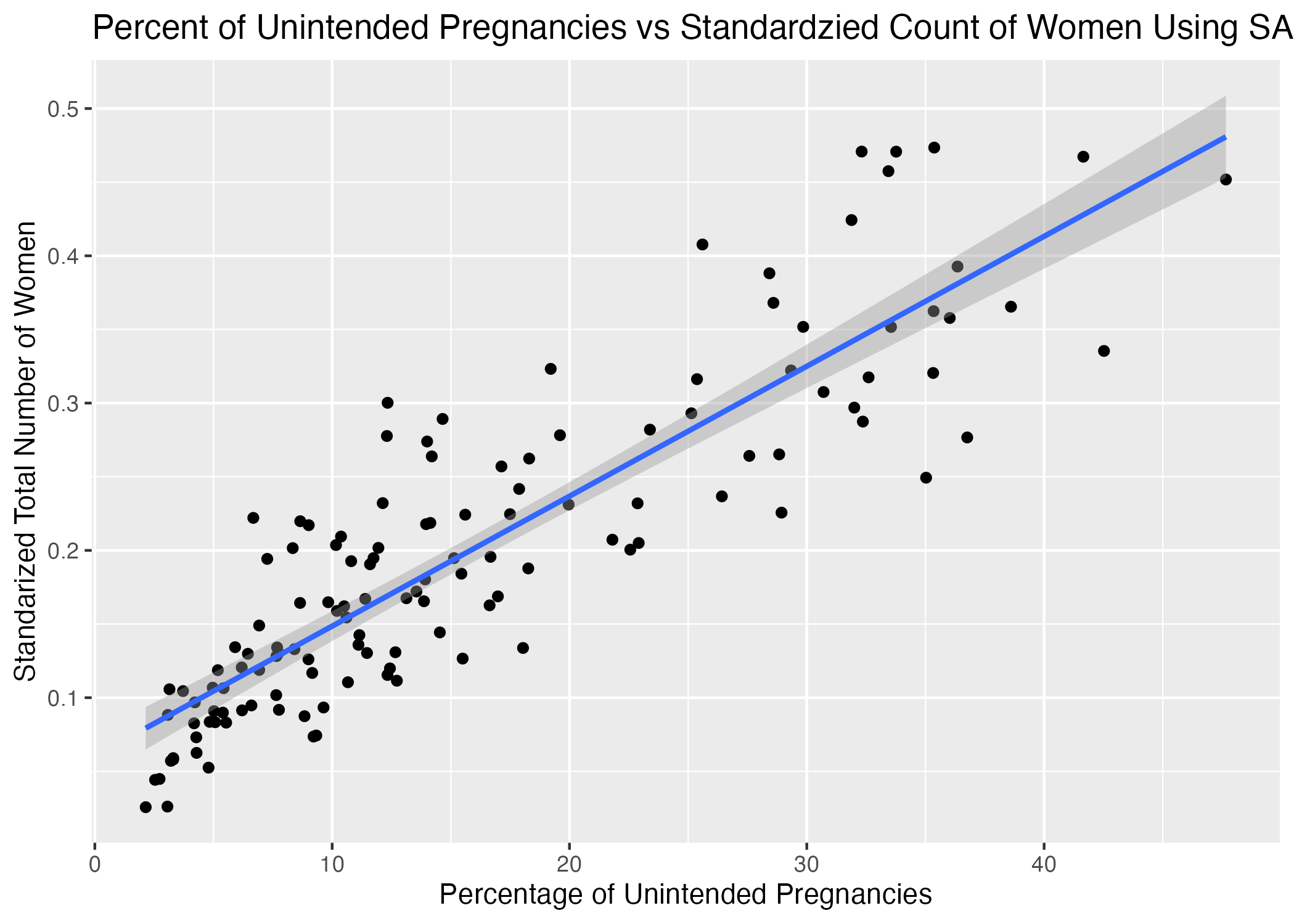


Histograms of Percentage of Unintended Pregnancy Use by Birth Control Method

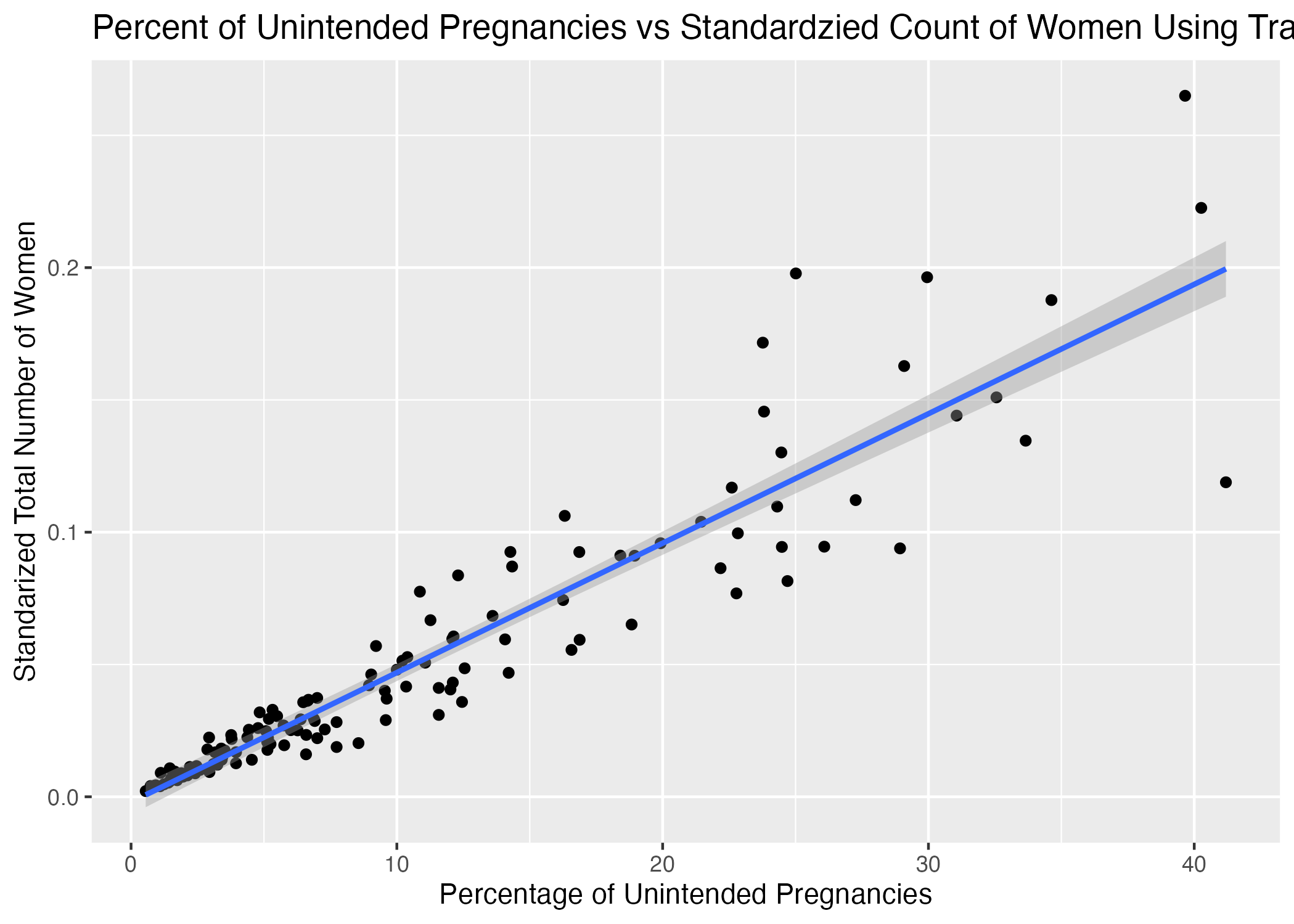
The next set of variables we explored were the total counts of women using each birth control method. There were two large outliers that prevented the graphs from being useful. After exploring the outliers, we standardized using the population size of reproductive aged women (15-49 years). There is a positive association between the percentage of unintended pregnancies and the total number of women using that method of birth control for all three methods and those not using any method, which is to be expected. There is more variation among those using SARMs and traditional methods compared to those using long-acting reversible methods. Additionally, the lowest percentage in this category is around 35%, which is much higher than the percentages associated with the three birth control methods. These figures can be seen (**exploratory-result2?**).



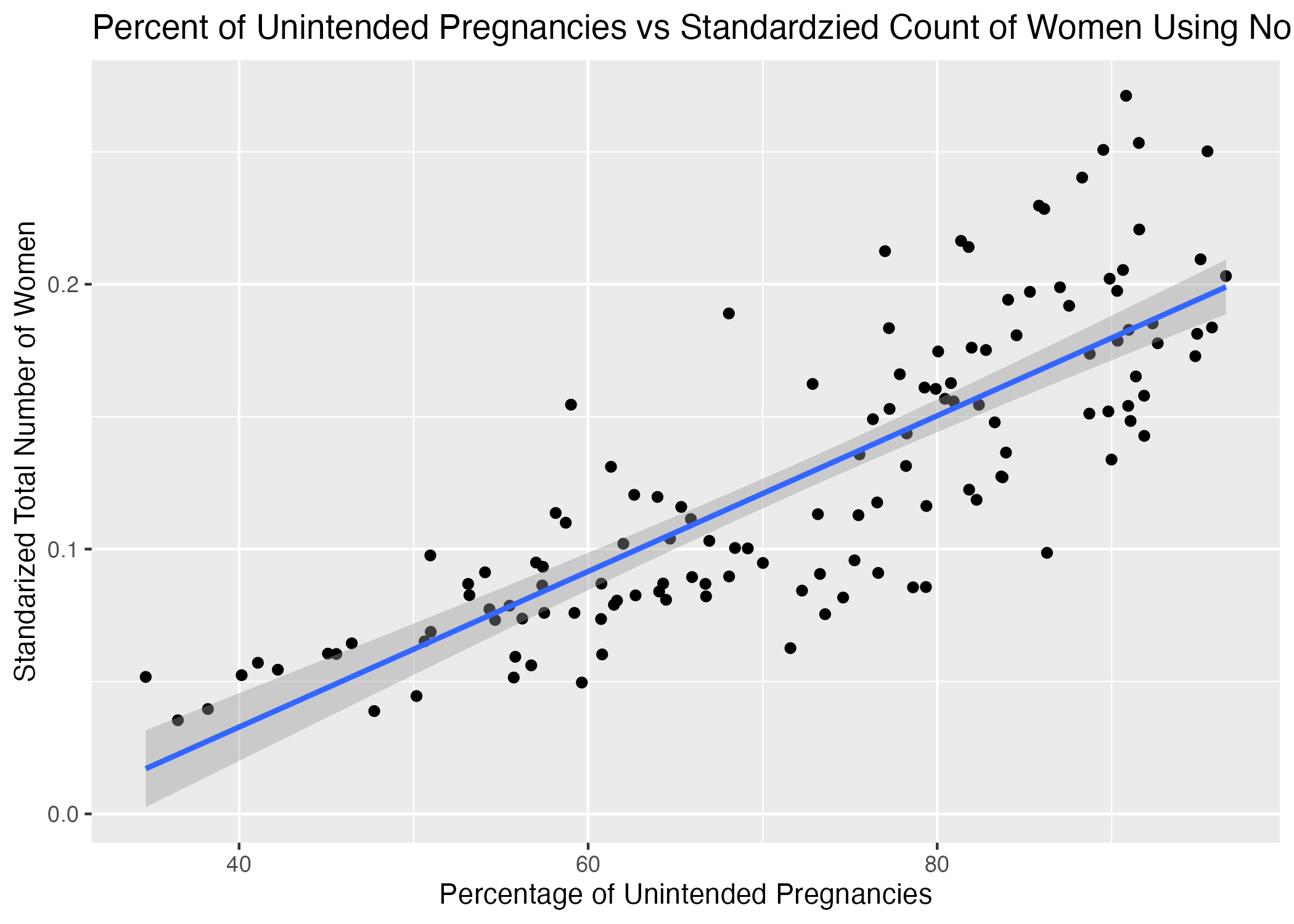
Relationship between Percentage of Unintended Pregnancies and Standardized Population Totals



Relationship between Percentage of Unintended Pregnancies and Standardized Population Totals

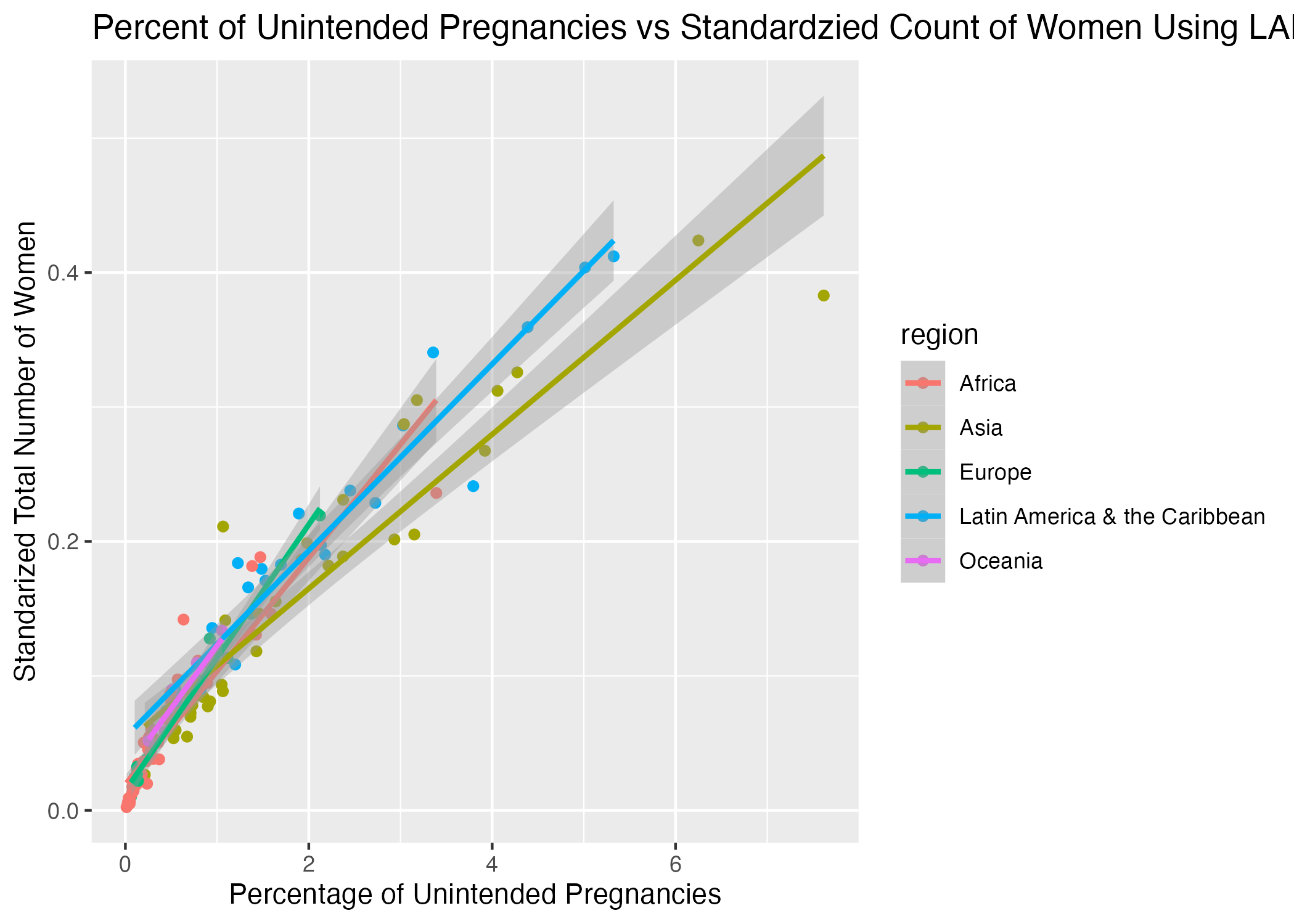


Relationship between Percentage of Unintended Pregnancies and Standardized Population Totals

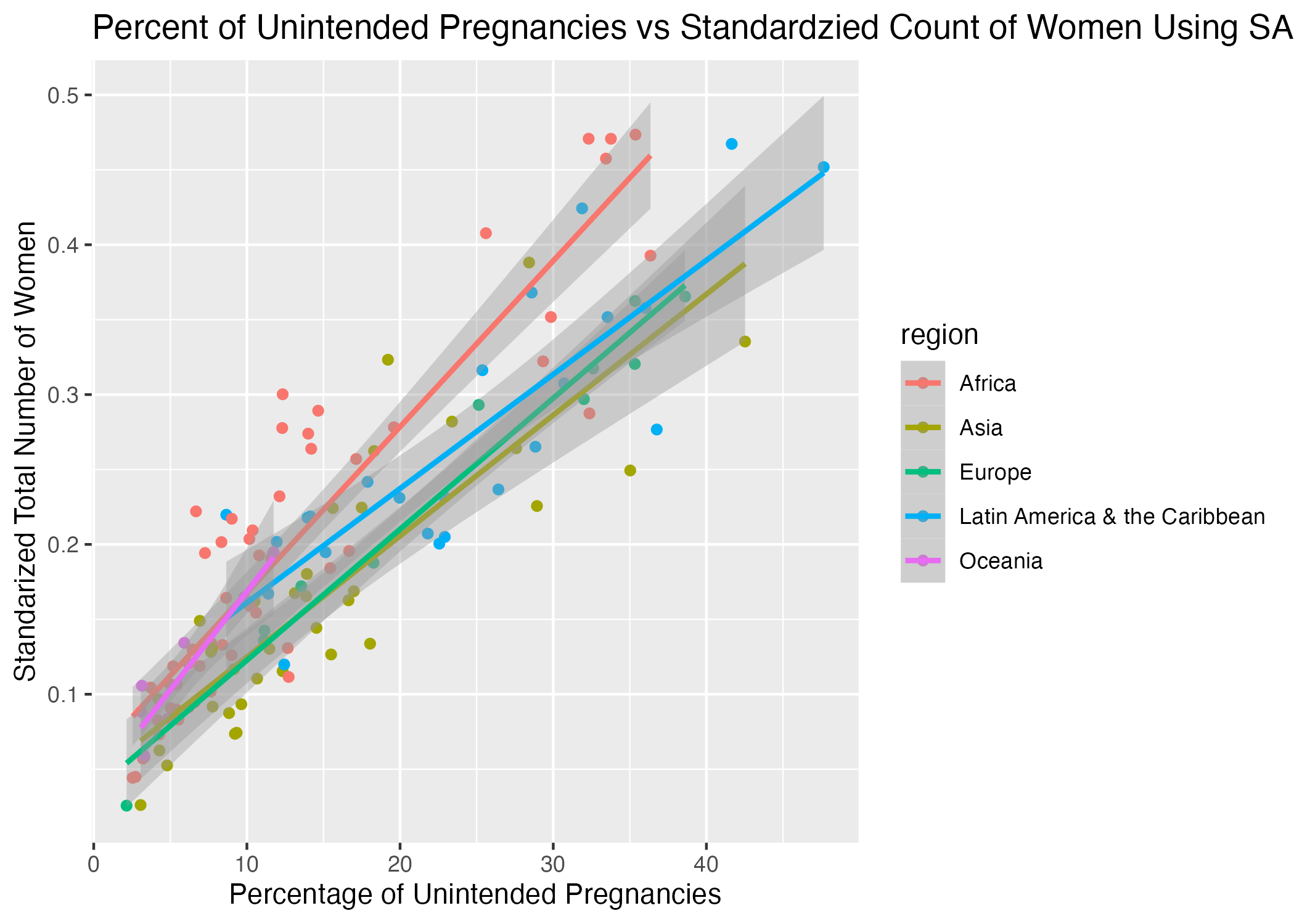


Relationship between Percentage of Unintended Pregnancies and Standardized Population Totals

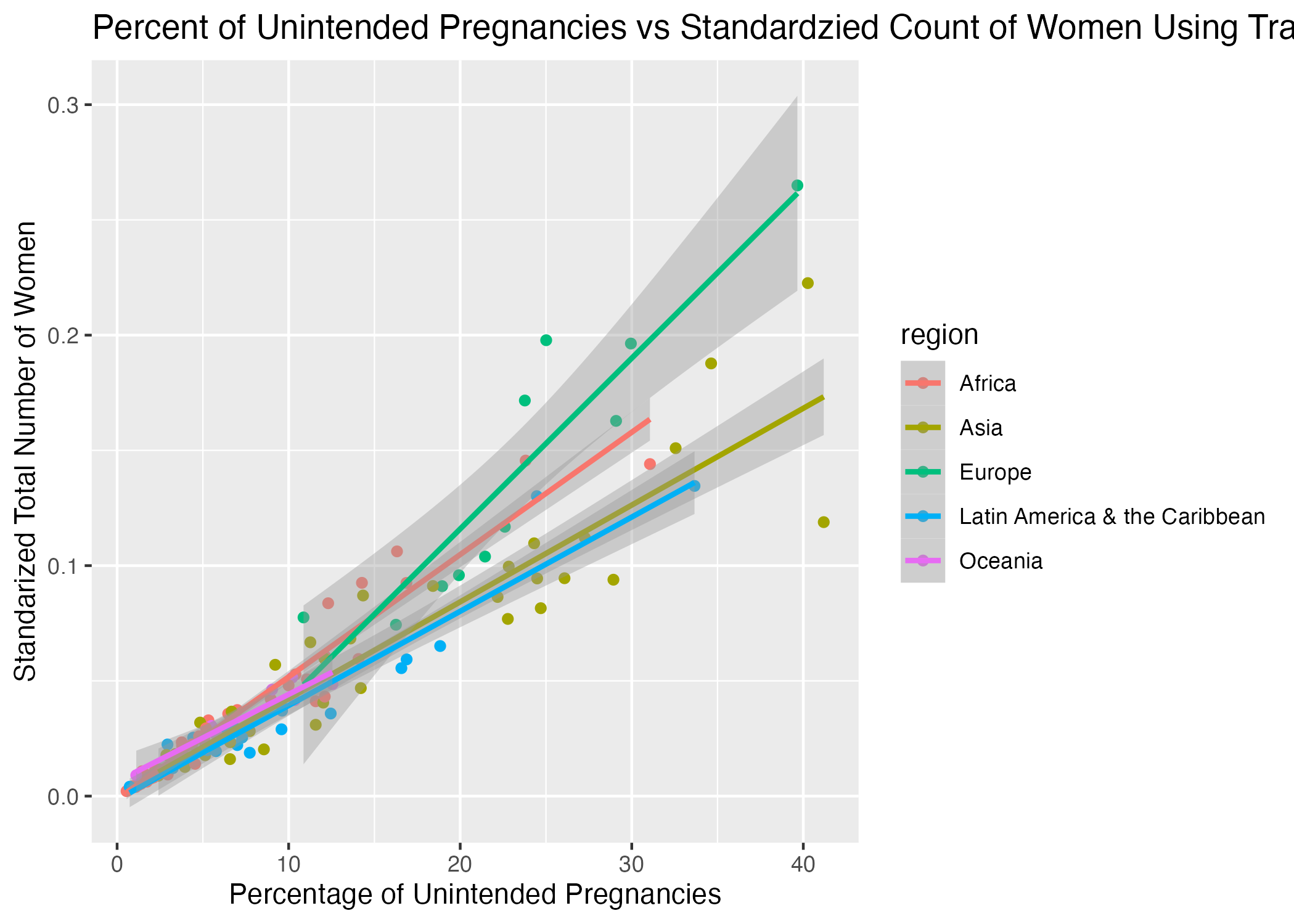
We stratified these four graphs by region to examine how the relationships differ across each of the 6 regions which is shown in (**exploratory-result3?**) . The long acting reversible and sterilization methods graph is a little difficult to decipher, but Asia has the highest percentages of unintended pregnancies, followed by Latin America/the Caribbean and Africa. The graph for short acting reversible methods shows clearer differences between regions, and Latin America/the Caribbean leads in the percentage of unintended pregnancies in this category, but Africa shows the sharpest increase in percentage of unintended pregnancies as the total population increases.Among women using traditional birth control methods, Europe has the sharpest increase in unintended pregnancies as population increases, but Asia has the highest percentage of unintended pregnancies in this category. The graph for women not using any birth control methods shows that Oceania has the highest percentage of unintended pregnancies.



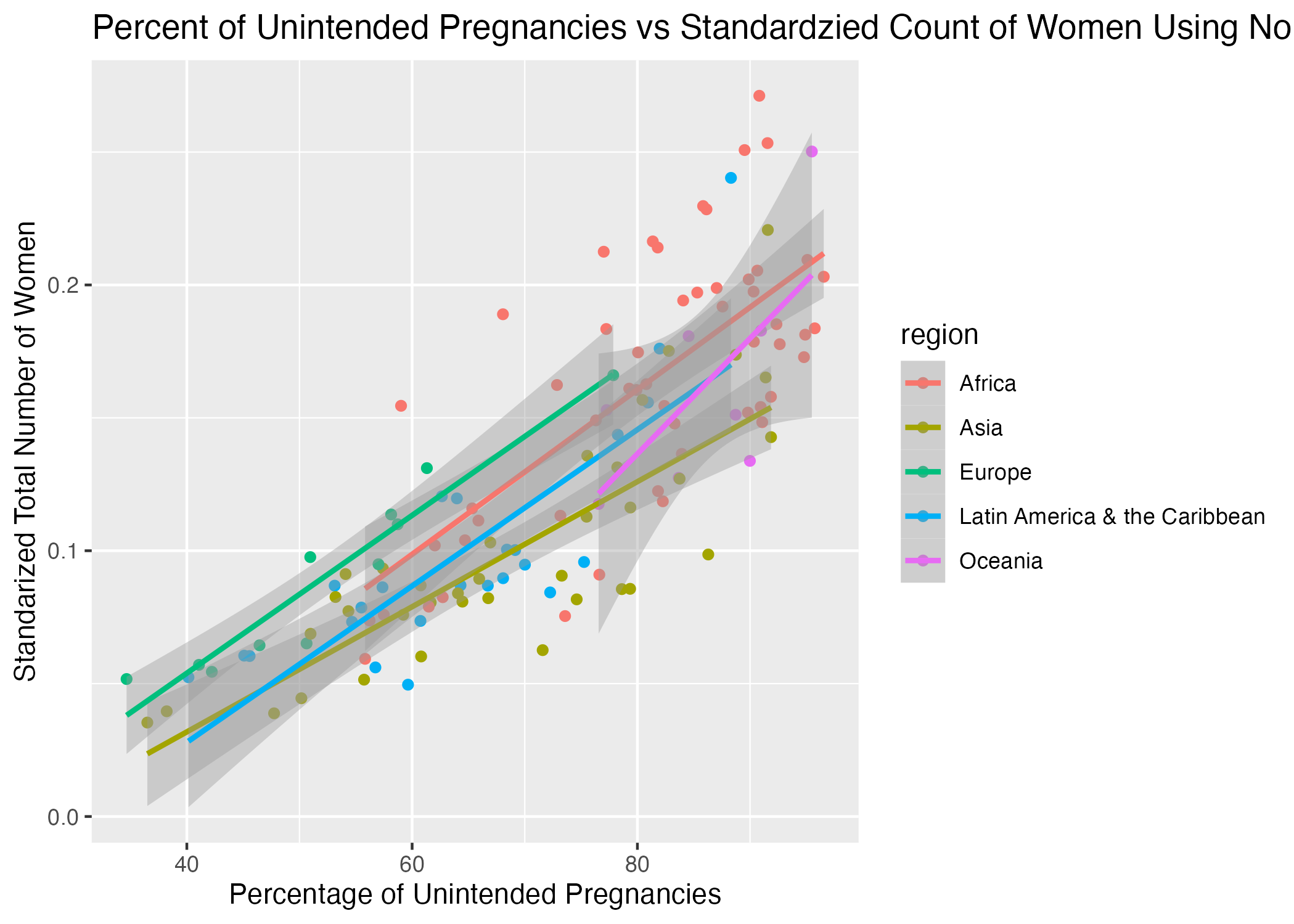
Percentage of Unintended Pregnancies Stratified by Region



Percentage of Unintended Pregnancies Stratified by Region

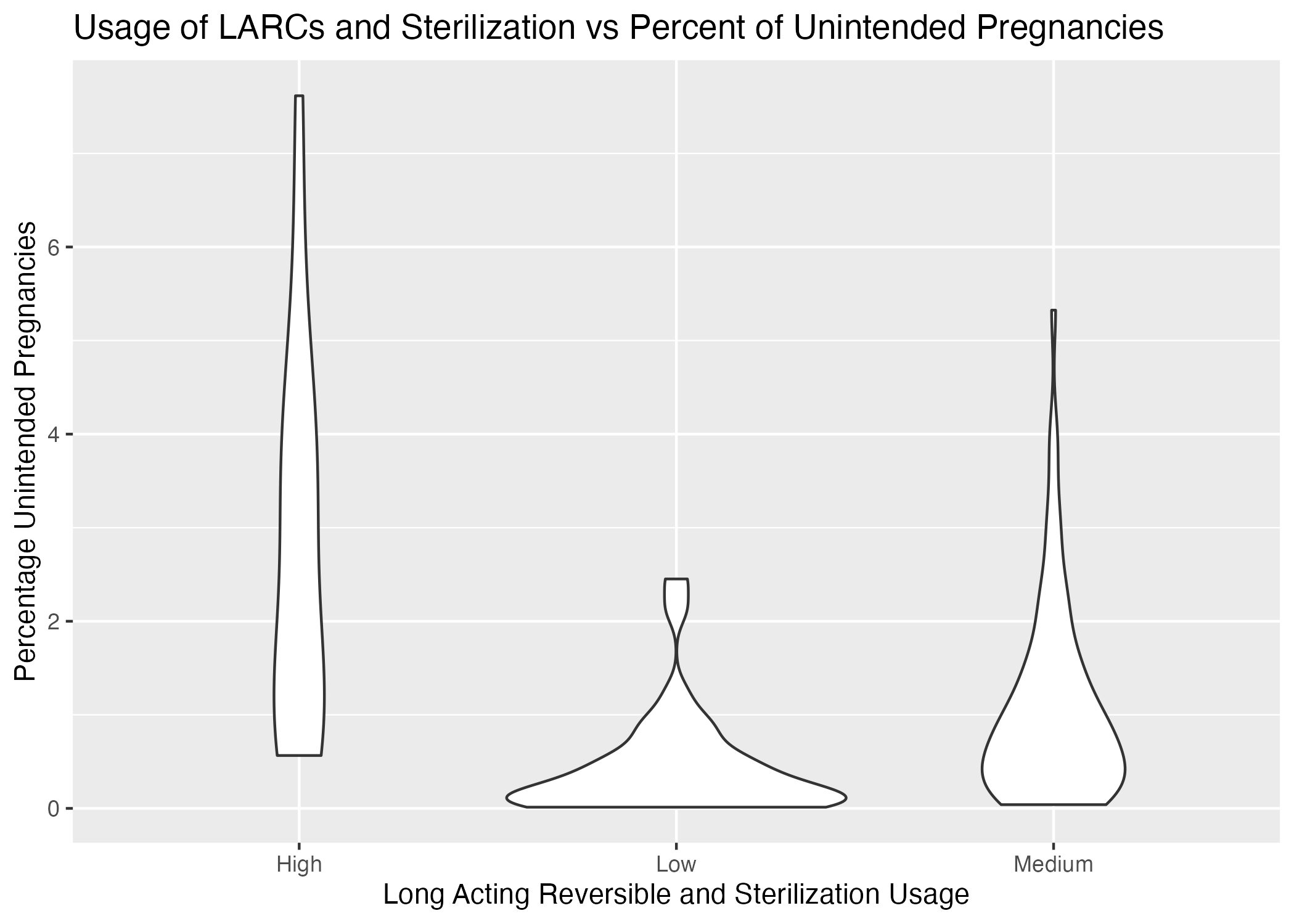


Percentage of Unintended Pregnancies Stratified by Region

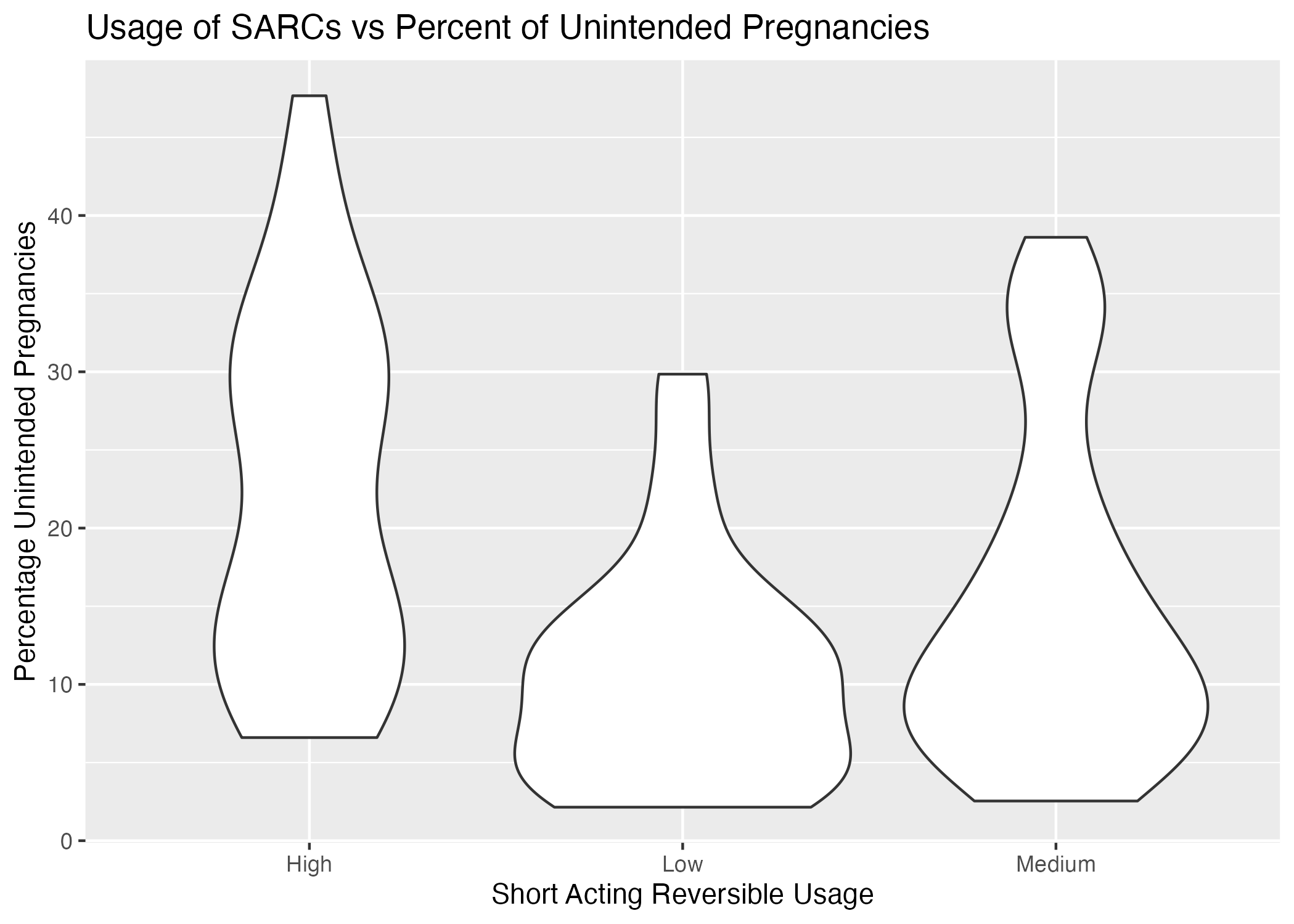


Percentage of Unintended Pregnancies Stratified by Region

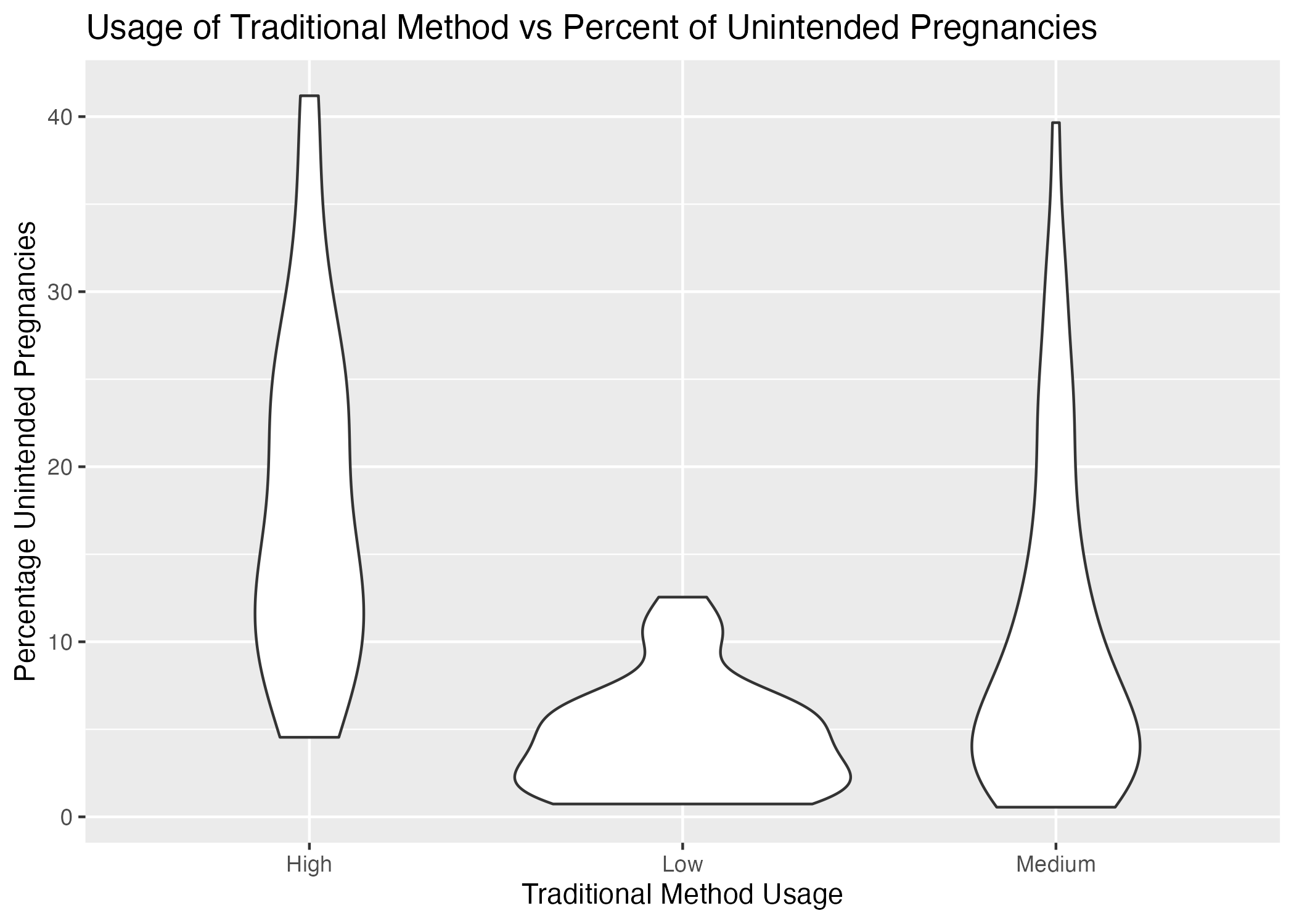
The last set of plots we created to explore the data are violin plots using the categorical usage variables for each birth control method as shown in (**exploratory-result4?**). The first violin plot shows that the distribution of percentage of unintended pregnancies varies a lot among usage levels of long acting reversible and sterilization methods. High usage countries have a consistent percentage of unintended pregnancies, but countries with a medium usage level tend to have lower percentages of unintended pregnancies. It appears that the distribution of short acting reversible method usage is skewed towards lower percentages of unintended pregnancies across all usage levels, suggesting that more countries have lower percentage of unintended pregnancies among women using this method. Among women using traditional birth control methods, the distribution of percentage of unintended pregnancies is similar among medium and high usage countries, but low usage countries are skewed towards lower percentage of unintended pregnancies. While the distribution of percentage of unintended pregnancies is similar across the three usage levels for women not using any birth control method, the high usage countries appear to have a bottleneck in percentage of unintended pregnancies. The high and low usage countries appear to be skewed towards higher levels of unintended pregnancies, but the medium usage countries appear to have lower percentage of unintended pregnancies.



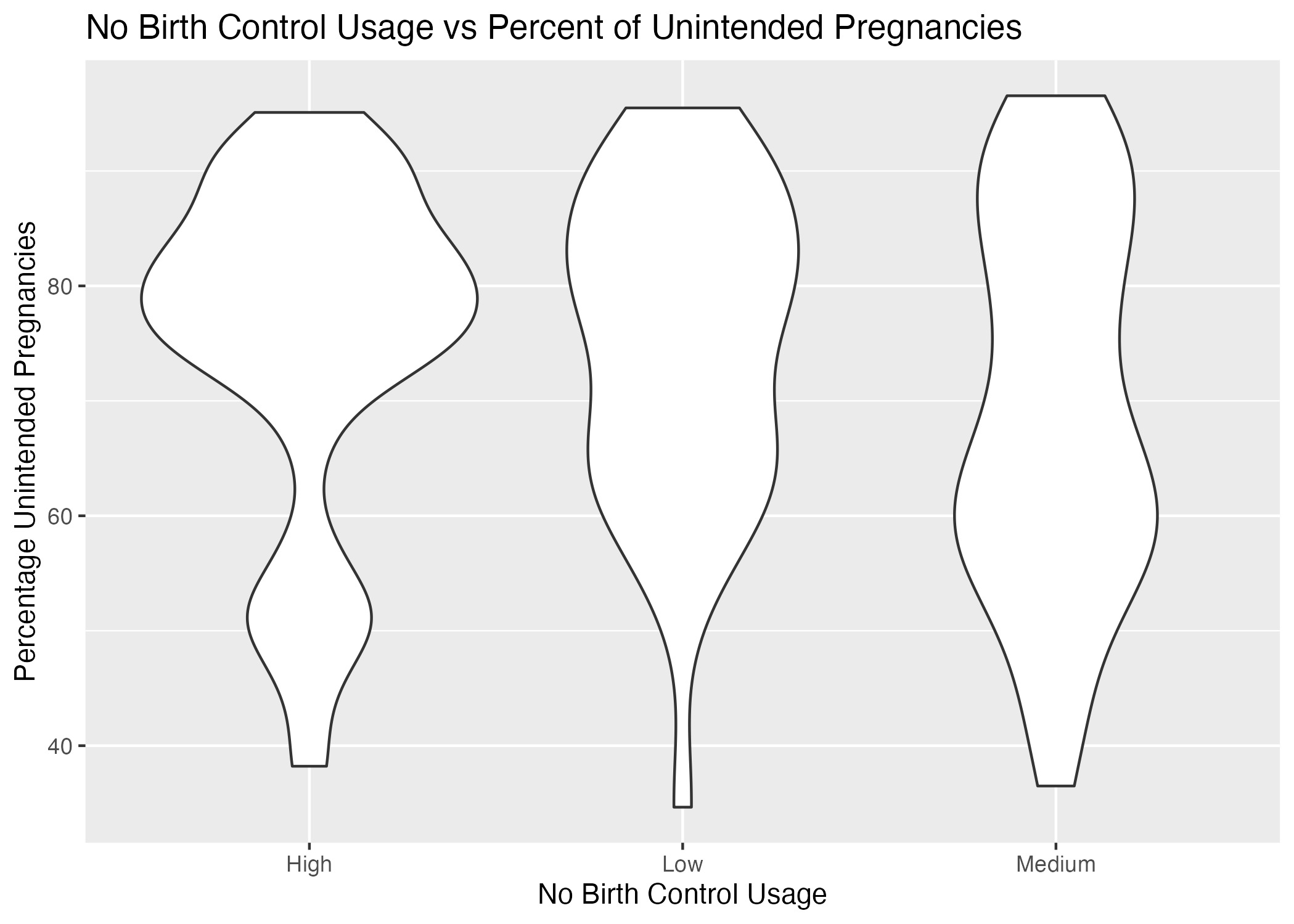
Violin Plots with Birth Control Usage Levels



Violin Plots with Birth Control Usage Levels



Violin Plots with Birth Control Usage Levels



Violin Plots with Birth Control Usage Levels

## 9.2 Basic statistical analysis

*To get some further insight into your data, if reasonable you could compute simple statistics (e.g. simple models with 1 predictor) to look for associations between your outcome(s) and each individual predictor variable. Though note that unless you pre-specified the outcome and main exposure, any “p<0.05 means statistical significance” interpretation is not valid.*

shows a scatterplot figure produced by one of the R scripts.

## 9.3 Full analysis

*Use one or several suitable statistical/machine learning methods to analyze your data and to produce meaningful figures, tables, etc. This might again be code that is best placed in one or several separate R scripts that need to be well documented. You want the code to produce figures and data ready for display as tables, and save those. Then you load them here.*

Example [Table 3](#tbl-resulttable2) shows a summary of a linear model fit.

|  |
| --- |
| Table 3: Linear model fit table. |

# 10. Discussion

## 10.1 Summary and Interpretation

*Summarize what you did, what you found and what it means.*

## 10.2 Strengths and Limitations

*Discuss what you perceive as strengths and limitations of your analysis.*

## 10.3 Conclusions

*What are the main take-home messages?*

*Include citations in your Rmd file using bibtex, the list of references will automatically be placed at the end*

This paper (Leek & Peng, 2015) discusses types of analyses.

These papers (McKay, Ebell, Billings, et al., 2020; McKay, Ebell, Dale, et al., 2020) are good examples of papers published using a fully reproducible setup similar to the one shown in this template.

Note that this cited reference will show up at the end of the document, the reference formatting is determined by the CSL file specified in the YAML header. Many more style files for almost any journal [are available](https://www.zotero.org/styles). You also specify the location of your bibtex reference file in the YAML. You can call your reference file anything you like, I just used the generic word references.bib but giving it a more descriptive name is probably better.

# 11. References

* https://pubmed.ncbi.nlm.nih.gov/32981858/
* https://www.sciencedirect.com/science/article/pii/S001078241730478X
* https://www.sciencedirect.com/science/article/abs/pii/S0020729211005406 #legal status article
* https://www.guttmacher.org/report/adding-it-up-investing-in-sexual-reproductive-health-2019-methodology (Guttmacher source)
* https://pubmed.ncbi.nlm.nih.gov/35332057/ (original source of data)

Leek, J. T., & Peng, R. D. (2015). Statistics. What is the question? *Science (New York, N.Y.)*, *347*(6228), 1314–1315. <https://doi.org/10.1126/science.aaa6146>

McKay, B., Ebell, M., Billings, W. Z., Dale, A. P., Shen, Y., & Handel, A. (2020). Associations Between Relative Viral Load at Diagnosis and Influenza A Symptoms and Recovery. *Open Forum Infectious Diseases*, *7*(11), ofaa494. <https://doi.org/10.1093/ofid/ofaa494>

McKay, B., Ebell, M., Dale, A. P., Shen, Y., & Handel, A. (2020). Virulence-mediated infectiousness and activity trade-offs and their impact on transmission potential of influenza patients. *Proceedings. Biological Sciences*, *287*(1927), 20200496. <https://doi.org/10.1098/rspb.2020.0496>