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Teen mothers and the use of antenatal care services in Georgia 2017 – 2019: A cross-sectional study

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Abbreviations

ANC – Antenatal Care

CI – Confidence Interval

DAG – Directed Acyclic Graph

GBR – Georgian Birth Registry

HDI – Human Development Index

MMR – Maternal Mortality Ratio

NCDC – Georgian National Centre for Disease Control

OR – Odds Ratio

REC/REK – Regional Committee for Medical and Health Research Ethics

UNFPA – United Nations Population Fund

WHO – World Health Organization

Abstract

Background

Teenage mothers are a particularly vulnerable population with a high risk of adverse health outcomes such as premature births and asphyxia compared to non-teen mothers. With timely and proper utilization of antenatal care (ANC) services, many of the signs associated with these risks can be detected early and the effects can be negated all together. The Caucasus region historically has high rates of teenage pregnancies compared to Europe and other parts of Asia. The republic of Georgia is no exception.

Objective

The objective of this study is to determine 1) the spatial distribution of teenage mothers in Georgia, and 2) to discover the association between teenage mothers and the utilization of adequate ANC services.

Methods

This study uses a cross-sectional approach and included all women who gave birth in Georgia from 2017-2019. Data was collected from the Georgian Birth Registry and the number of women included in the study was 148 133. Percentages of teen mothers were compared across regions. The association between teen mothers and adequate antenatal care was assessed using a logistic regression analysis.

Results

Teenage mothers comprised 6.2% of mothers in Georgia in 2017-2019. The spatial distribution showed that percentages of teenage mothers were highest in Kvemo Kartli (13.3%) and lowest in Tbilisi (2.9%). Teenage mothers had 15% increased odds (OR 1.15 95% CI 1.10 – 1.21) of receiving adequate antenatal care compared to non-teens.

Conclusion

The main finding of this study is that teenage mothers had 15% higher odds of receiving adequate ANC compared to non-teens in Georgia. A possible explanation for this finding is that most teenage pregnancies in Georgia occur within marriage. There were large variances in the percentage of teenage mothers across the different regions of Georgia. This study identified populations which could potentially benefit from public health interventions and provided insight into the utilization of ANC services in Georgia.

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1 Introduction

When a teenage girl becomes pregnant there are many aspects of her life that are immediately affected. The girls` health, education, and earning potential are among the most impacted. Teenage pregnancies have a higher risk of adverse health effects than their non-teenage counterparts. About 70,000 teenage mothers die annually in the developing world from causes related to pregnancy and childbirth [1]. Pregnant teenagers are a particularly vulnerable population where there is a high potential to increase quality of life. By utilizing timely and qualified antenatal care services (ANC) , several adverse health effects surrounding pregnancy can be mitigated or anticipated such as premature births, foetal growth restriction, anaemia, and gestational hypertension [2]. Therefore, determining the utilization of ANC services among teens is imperative to implement effective public health interventions.

1.1 Terminology

Teenage mothers are defined as women who are 19 years or younger when they give birth. It is common to divide teenage mothers into “young teenagers”, who are less than 15 years of age and “teenagers”, who are 15-19 years. This is because there is a considerable difference between a 12 year old girl and a young women of 19 [3]. When comparing teenage mothers between countries, the teenage birth rates, teenage pregnancy rates and the percentage of mothers who are teens among the entire population are common reporting statistics[3]. The teenage birth rates and pregnancy rates are usually reported as per 1000 women.

In this study, adequate ANC was defined as a minimum of four ANC visits before February 1st, 2018 and a minimum of eight visits after February 1st, 2018. The benchmarks

were determined by the number of governmentally funded ANC visits at the time of delivery. The definition of adequate ANC changed in February 2018 because the number of ANC visits in Georgia funded by the state increased from four visits to eight visits in order to be concurrent with the recommendation from the World Health Organization (WHO) [4].

The classification of developed and developing countries is important to consider when comparing statistics. The Human Development Index (HDI) is a common tool used to classify developing and developed countries [5]. The HDI is a scale of 0 to 1, where 0 is not developed and 1 is developed. The benchmark for a developing country to be considered developed on the HDI is commonly considered to be 0.700. The HDI of Georgia in 2018 was 0.692, which is below the benchmark for developed countries [5], thus when comparing statistics between developing and developed countries, Georgia is considered developing.

1.2 Teenage pregnancies

Teenage pregnancies disproportionally occur in developing countries. It is estimated about 95% of teen pregnancies occur in developing nations [6]. About 19% of women in developing countries become pregnant before the age of 18, and girls under 15 account for 27% of all teen births every year [6]. The United Nations Population Fund (UNFPA) conducted a study in 2011 to determine the scope of teenage pregnancies in Eastern Europe and Central Asia. Sub regions in the study population included Eastern Europe, the Caucasus, Central Asia, Turkey, and Russia. In 2013, the Caucasus region (Georgia, Armenia, and Azerbaijan) had the highest teenage birth rate (37.3 per 1000 women) compared to the other regions [7]. The teenage birthrate in Georgia was 41 per 1000 women, which was the highest in the Caucasus.

The populations at the greatest risk of teen pregnancies are women with limited education and low socio-economic status. These conditions are more common in rural settings of developing countries. A study that analyzed teen birth rates from 79 countries globally

found that the teenage birth rate of girls with no education was 154 per 1000, girls with only primary education was 119 per 1000, and girls with secondary or higher education was 56 per 1000 [8]. The same trend can be seen across the socio-economic spectrum where girls from the poorest families have the highest rates of teenage pregnancy [8]. In rural communities within the 79 countries studied, teenage birth rates were 103 per 1000, which was about 54% higher than their urban counterparts [8].

Patterns of teen pregnancies in developing countries are present in developed countries as well; women in low income, rural households, who have less education, and belong to ethnic minorities or marginalized sub-populations, are more likely to become pregnant before the age of 18 [8]. Similarities in the trends of teen pregnancies deviate between developed and developing countries in married and single women. In developing countries, most teen pregnancies occur within marriages, while in developed countries, they increasingly occur outside of marriage [8]. Sex before marriage in developing countries is often highly stigmatized because of religious and cultural traditions, while in developed countries sex before marriage is becoming increasingly less stigmatized [9]. This is a possible explanation for the difference in teenage pregnancy trends in developed and developing countries.

Contraceptives are a crucial tool for women who wish to increase their autonomy in a patriarchal society and control their reproductive health. Contraceptive use is often presented by the percentage of those who use traditional methods of contraceptives and modern methods of contraceptives. Traditional methods of contraceptives include the withdrawal method (78% effective) and the calendar method (76% effective) while modern methods of contraceptives include the male condom (82% effective), and hormonal contraceptives (99% effective) [10]. If used correctly, modern methods of contraception are more effective than traditional methods. Worldwide, it is estimated that 44% of all women aged 15-49 use modern methods of contraception, while 4% used traditional methods of contraception in

2019 [11]. By comparison, the use of modern and traditional methods of contraceptives in 2010 among all Georgian women was 32% and 21% respectively which has been steadily increasing since 1999 [12]. Knowledge of the proper use of modern contraceptives is quite low in Georgia and there is large need to for sexual education and contraceptive counseling [12] especially among teens. There is a severe stigmatization of teenagers who seek or use contraceptives at a young age in Georgia resulting in a cultural barrier to providing preventative reproductive care to teenagers [12]. The benefit of contraceptives in Georgia is largely limited to preventing unwanted pregnancies within marriage [12].

The low contraceptive use in Georgia is linked to a high abortion rate. Historically, abortions on request was the main method of birth control in the Soviet Union and remained so in many countries formerly part of the Soviet Union, including Georgia after the dissolution in 1991 [13]. The high reliance on abortions and low use of contraceptives has recently started to shift in Georgia. As contraceptive use increases, abortion rates decrease [13]. Therefore, the Georgian government welcomed assistance from the UNFPA to increase accessibility and quality of reproductive health services, including antenatal care (ANC) services, reproductive health counselling, and contraceptive distribution [14].

1.3 Factors linked to teen pregnancies

One of the major factors leading to teen pregnancies in developing countries is teenage marriage, synonymously known as child marriage. Child marriage is defined as the marriage of a girl before the age of 18. About 90% of teenage pregnancies in the developing world are within marriage [8]. In child marriages, the girl is usually expected to have a baby shortly after she is married. Child marriages are often perpetuated from generation to generation because of parental influence and/or cultural traditions. Child marriages disproportionally affect females. About 16% of girls in developing countries are married before the age of 18,

compared to only 3% of boys [8]. The child marriage rate in Georgia was 17% in 2014, which was slightly higher than the average of all developing countries [8].

The parents in child marriage arrangements often believe by arranging a marriage for their daughter it guarantees a better future for their child. Other reasons for child marriages could be the intention to build or strengthen alliances between two families, pay off debts, settle disputes, or to receive a dowry [8, 15]. Child marriages can also be a safeguard for premarital sex in places where premarital sex is highly stigmatized, such as Georgia. The act of marriage also transfers the duty of protection from sexual harassment from the family to the husband [8].

Child marriage rates are correlated to level of education. Females with higher education can see the value in their education, thus refraining from marrying off their children so they can attend school [8]. Child marriages are perpetuated when the education level of the mother is low. In this circumstance, the family may see marriage as an alternative to education because they fear education would make their child unsuitable for responsibilities as a wife and mother [8]. The result of this thought process is often the reason for limited choices and opportunities for girls involved in child marriages, especially those who drop out of school because of teenage pregnancies [8].

A study looking at child marriage rates among the minority populations (mainly Azerbaijanis and Armenians) in the Kvemo Kartli region of Georgia showed that 32% of married women reported to be married before the age of 18. Five percent were married between 13-14 years and 16% married between 15 to 16 years [16]. In the same study, 74% of women who participated in the study, agreed that the most important thing for a woman in life is to get married and have children [16]. Notably, in Georgia, the child marriage rate of

ethnic minorities is expected to be much higher than the national rate of 17% but the true numbers are unknown [17].

The Georgian government has committed to stricter marriage laws protecting teenage girls. The law in Georgia restricts marriages before 18 years of age, but girls can be married at 16 with a court's approval. In the first half of 2015, courts approved marriages of 265 girls between 16 and 18 years [16]. Since it is believed most teenage pregnancies in Georgia occur within marriage, it is suspected marriages involving girls under the legal age are often performed illegally by the church or mosque, then later officially registered by the state after the girl turns 18 [17]. This allows many girls to circumvent the underage marriage law.

1.4 Potential morbidities during teenage pregnancy

Health risks and complications during pregnancy disproportionally affect teenage mothers. Complications of pregnancy and childbirth are the leading cause of death for females aged 18-19 globally [18]. Factors which directly impact the rate of death, illness and disability among teenagers during pregnancy are physical immaturity, complications from unsafe abortions, and lack of access to routine and emergency health services [8].

Physical immaturity increases the risk of prolonged obstructed labor which can result in obstetric fistulas particularly, if an emergency caesarean section is not possible [8]. Studies conducted in Ethiopia, Malawi, Niger, and Nigeria concluded that one in three women with obstetric fistula reported developing it as a teenager [19-24]. Obstetric fistulas cause a woman to be incontinent, effectively debilitating her to a normal life. Girls giving birth before the age of 15 have twice the risk of obstetric fistulas compared to older women, including older teenagers [6]. The condition disproportionally affects teenage girls living in the lower social economic bracket [8].

Most health risks are elevated in teen pregnancies. Some risk factors seem to be concentrated within certain developmental stages. For instance, girls who become pregnant within two years of their first menstruation are at the highest risk of maternal health problems compared to those who become pregnant after two years of their first menstruation. These health problems include a higher risk of eclampsia, puerperal endometritis, and systemic infections [18]. At this stage of development, the pelvis and birth canal are still growing, which could partially explain why these maternal health outcomes are more common in early teen pregnancies.

Teenage pregnancies are also associated with an increase in several adverse perinatal birth outcomes. Among children born to teen mothers, there is an increased risk of low birth weight, preterm delivery, and malformations. In a large cohort study conducted in the United States, neonatal deaths were 32% more likely among infants born to teenage mothers compared to mothers aged 20-24 [25].

A sub-Saharan, Latin American, and South Asian study concluded teenage mothers aged 15 – 19 had higher risks of adverse maternal outcomes [26]; the risk of preterm birth increased by 23% [26], and the risk of low birth weight increased by 18% when compared to mothers over 20 years old. Infants of mothers ages 15-19 had an 18% increased risk of neonatal mortality within 28 days of birth and the risk of perinatal mortality among teen mothers increased by 13% [26]. Specifically, in the Latin American and Sub-Saharan populations, teen mothers had a 14% increased risk of hypertension and a 10% increased risk of obstructed labour compared to mothers over 20 years old [26]. Some variations can be found across different populations. For example, the risk of adverse neonatal outcomes for teen pregnancies was much lower in the south Asian population compared to the sub-Saharan and Latin American populations [26] . It is evident there is an association of adverse maternal

health outcomes of varying degrees of risk among teenage mothers across all populations but, an association, nonetheless.

1.5 The importance of adequate antenatal care

ANC is a service used to identify conditions in pregnancy with the aim of decreasing the risk of adverse maternal and neonatal health outcomes. The utilization of ANC services is linked to improved maternal and neonatal outcomes [27, 28]. Between 30% -50% of maternal deaths globally are due to hypertensive disorders (mainly pre-eclampsia and eclampsia) and antepartum hemorrhage, which are adverse health outcomes directly related to inadequate care during pregnancy [29]. Since teen mothers are at higher risks of these adverse health outcomes compared to mothers over 20 years [25, 26, 30], it is important to determine if they are receiving adequate antenatal care.

The WHO recommends eight ANC visits during a low-risk pregnancy and the frequency of visits should increase with each trimester. Before 2016, the WHO recommendation of ANC visits was four (Georgia didn't adopt this recommendation until 2018) [31]. This change in recommendation was based on a review of 4 randomized control trials which included over 50 000 women. The results indicated women who attended eight ANC visits had slightly lower rates of perinatal mortality, preterm births and, were more satisfied with their ANC thus, the recommendation was increased [31]. There is some skepticism as to whether eight ANC visits are necessary for all women, as it could deplete limited medical resources and tax already strained health systems especially in developing countries [31].

The quality of ANC services is associated with the maternal mortality ratio (MMR) [32]. The MMR in Georgia is one of the highest of all former Soviet countries at 31 deaths per 100,000 live births in 2014 [32]. The MMR in Armenia was 19 per 100,000 and 15 per 100,000 in Azerbaijan. Compared to the MMR average of the WHO European region (4 per

100,000), the Georgian MMR rate is six times higher [32]. The high MMR ratios in Georgia indicate a weak maternal health care system. That being said, utilization of ANC services in Georgia is quite high with only 15% of women who did not receive 4 ANC visits in 2010 [33].

This brings the quality of ANC services in Georgia into question. In Georgia, the absolute majority of ANC check-ups are performed by gynecologists because checkups by midwives are prohibited. Furthermore, there is no strategy for continuity of care between visits thus, a woman can meet with any gynecologist on duty rather than the same one each visit foregoing possible benefits of continuity care. The mother can choose freely as to which ANC clinic she attends but, there are extreme variances in the quality of ANC throughout the country [33]. This gives the responsibility of seeking and evaluating ANC clinics to the mothers rather than trained health care professionals. ANC services in the rural communities is limited in many clinics. If a woman has a complication requiring an incubator for example, many rural communities simply cannot provide care and require the women to travel long distances for the required care [33]. Other concerns affecting the quality of ANC in Georgia is the limited medical staff and services, high costs (82% of mothers who delayed reproductive health services did so due to high costs, [33]), lack of information on available health services, lack of skilled reproductive health professionals, and conflictions of cultural traditions/personal values [33, 34]. To increase utilization of ANC services and decrease the MMR, Georgia introduced universal healthcare in 2013, making the recommended number of ANC visits free of charge but the quality and accessibility of care remains a concern.

1.6 Objective of the Study

In order to develop targeted, research-based public health policies and initiatives to improve the reproductive health of women in Georgia, it is important to identify specific

populations that are at higher risk of receiving inadequate ANC. There are numerous quantitative studies looking at data and trends of reproductive health in Georgia [12, 14], and other studies which analyze the reproductive health systems in Georgia from a macro-perspective (e.g. distribution of health facilities and medical staff) [35], the ethnic inequalities in ANC usage within Georgia [16] and barriers which stop women from seeking ANC using a qualitative approach [33]. There is a gap in the research dealing with the utilization of ANC services among teenagers compared to non-teenagers. Teenagers are a vulnerable population at high risk of adverse maternal and neonatal outcomes. Therefore, providing adequate ANC to this population is imperative. The aim of this study is to determine 1) the spatial distribution of teenage mothers in Georgia, and 2) to assess the association between teenage mothers and the provision of adequate ANC services.

2 Material and Methods

2.1 Study Setting

Georgia is a republic in the Caucasus region with a population of 3,7 million [36], located between Armenia, Azerbaijan and Turkey in the south, and Russia in the North. It is estimated that 47% of the population live in rural communities and the remaining 53% live in urban areas. About one third of the population lives in the capital city of Tbilisi [37] and 86% of the population are ethnically Georgian. Other ethnic groups living in Georgia include the Azerbaijanis and Armenians, which comprise 9% and 4% of the population respectively. Russians, Ossetians, Yazidis, Greeks, Kists and Ukrainians comprise about the remaining 2% of the ethnic population [38].

2.2 Study Material

The study used data from the Georgian Birth Registry (GBR). The GBR is a national medical birth registry, where information on pregnant women and their newborns are entered digitally. Pregnant women are monitored through an electronic module starting from their first antenatal visit until childbirth. The GBR was launched on January 1st 2016 [39] and registration became mandatory by law on May 1st 2016. Today, the GBR is used by all clinics providing antenatal, labour and delivery services, or postnatal care in Georgia. Data is entered into electronic forms after every consultation at the responsibility of the doctors. Data is recorded on over 470 variables which span topics of maternal, medical and pregnancy history, maternal and paternal characteristics, current pregnancy, the delivery, and newborn statistics [40]. In 2019 the GBR covered 99.8% of all births in Georgia. Health care providers are incentivized to enter complete information for each woman by a governmental reimbursement program. Quality control of the GBR is overseen by full time employees at the registry office of the Georgian National Center for Disease Control (NCDC) [39]. There are built-in measures in the registry for several variables which detect outliers or values which are biologically implausible to ensure quality data.

2.3 Study Population

The study population included all 152 798 women in the GBR who gave birth in Georgia to a single fetus from January 1st, 2017 to December 31st 2019.

Exclusions consisted of multiple births since they are considered to be high risk pregnancies resulting in higher mortality and morbidity than their singleton counterparts [41]. Twins are often detected early in the pregnancy by ultrasound. Since twins have a different number of recommended ANC visits compared to singletons, they were excluded from the study. Women who were below the age of 15 when they gave birth were also excluded from

the study. This age group had very few cases and could therefore potentially be identified based on other characteristics. In addition, the cut-off at 15 years is consistent with other studies that deal with teen pregnancies [28, 42-44]. Women who gave birth abroad were also excluded. These are women who were required to register their baby in the GBR to be able to apply for Georgian citizenship. There is no ANC data for these women thus, they were excluded from the study.

2.4 Definition of variables

Adequate ANC: A minimum of four ANC visits before February 1st, 2018 and eight visits after February 1st, 2018. See section 1.1 for an elaboration.

Age: Defined as the age of the mother at the time of delivery. Teens were considered mothers in the 15-19 age group.

Ethnicity: The ethnic group in which the mother identified.

Region of residence: The region in Georgia where the mother's reported to be living.

Urban/Rural: assigned to the mother based on their residing location.

Education: based on the highest level of education completed by the mother

Parity: The number of times the mother has given birth to a fetus with gestational age of 22 weeks or greater.

Morbidity during pregnancy: The mother was considered to have a morbidity during pregnancy if she had any ICD-10 code registered in the ANC-module at any visit.

2.5 Data Management

The exposure variable (teenagers) was entered as a binomial variable which was coded 1 = teenager, 0 = not-teenager.

Adequate ANC was entered as a binomial variable coded 1 = adequate ANC 0 = not adequate ANC.

Maternal education was entered as a categorical variable coded 1 = women who completed a primary education, 2 = women who completed a secondary education, and 3 = women who completed a higher education.

Parity was entered as a categorical variable coded 1= para 1, 2= para 2, 3 = para 3 and above. After three children, the number of cases decreased sharply. Therefore, to maintain a reasonable number of cases in each group the category of 3+ deliveries was created. Parity only includes the birth in question, therefore nulliparous was not an option.

Maternal morbidity was included as a binomial variable coded 1 = “had a morbidity”, 0 = “did not have a morbidity”. The percentage of morbidity for every year in the study period was compared and were similar across all three years; 2017: 32%, 2018: 33%, 2019: 33%. The variable of morbidity during pregnancy is an opt-in recording method in the GBR. Thus, those who had no ICD-10 recorded were assumed to have no morbidities during pregnancy.

Ethnicity was included as a categorical variable coded 1 = other, 2 = Armenia, 3 = Azerbaijani, 4 = Georgian.

2.6 Directed acyclic graph

A directed acyclic graph (DAG) was used to decide which variables to include in the analysis. The DAG is a visual representation of covariates and their interactions with the

exposure and outcome variables via causal pathways. The webpage www.dagitty.net was used to build the model and provide the graphical/visual presentation (Figure 2). The DAG displays potential mediators and confounders involved in this study. Confounders are variables that directly affect both the exposure and the outcome. This is represented in the DAG as two direct causal pathways originating at the potential confounders, with one arrow pointing towards the exposure and the other towards the outcome. In contrast, a mediator lies on the path between the exposure and outcome. This means, there is an indirect association between the exposure and the outcome via the mediator. This association is represented in the DAG as an arrow originating at the exposure and passing through the mediator before reaching the exposure variable.

When drawing the DAG, we assumed a causal effect of teen mothers on receiving adequate ANC [45-50] represented by a direct arrow from teen mothers to adequate ANC. The confounders in this study (i.e. ethnicity, education, urban/rural) were identified based on the assumptions that they influence both the exposure and outcome variables as discovered in previous studies. When determining confounders, the following assumptions were made; 1) rates of teenage mothers and their utilization of ANC services differ across ethnic groups [49, 51-56] because of a variety of factors which are rooted in differences of behavioral and cultural tendencies. 2) Educated women have the beans to better understand both, the importance of receiving adequate ANC during their pregnancy [46, 48, 49, 54, 55, 57, 58], and the risks associated with teen motherhood [59]; hence the influence of education on utilization of ANC and rates of teen pregnancies. 3) Teen pregnancy rates have been discovered to be higher in rural communities [60] and the access to ANC is decreased in rural communities when compared to urban environments, thus effecting the utilization of ANC in rural/urban communities [47, 49, 51, 55, 56, 61].

When determining mediators (parity and morbidities during pregnancy), we assumed a causal pathway from the exposure to the mediator and from the mediator to the outcome. In doing so, we made the following assumptions: 1) naturally, teen mothers have had fewer numbers of pregnancies than older mothers. 2) Parity influences utilization of ANC because those with a higher parity either had a good, neutral, or poor perception regarding their previous ANC experience, thus influencing utilization of future ANC services [45, 46, 51, 52, 58, 59]. 3) Being a teen mother is associated with increased adverse health outcomes and morbidities during pregnancy such as premature births, foetal growth restriction, obstetric fistulas, anaemia, and gestational hypertension [2, 6, 8, 18, 26] and 4) women with a morbidity during pregnancy are more likely to utilize ANC services [45, 46, 51, 52, 58].

The unobserved variables (employment status, marital status, and husband's education) are thought to influence the exposure and outcome. Women who are employed utilize ANC services more than the unemployed due in part to financial barriers [47, 53, 61, 62]. Teen marriage rates are associated with teen pregnancy rates [8], and married women are more likely to utilize ANC services compared to unmarried women [46, 52, 53]. Husbands education is a potential explanatory variable of utilization of ANC services [42, 63, 64] especially in patriarchal societies, where husbands refusal of ANC services was one of the major reasons of decreased utilization of ANC among women [65] .

2.7 Statistical Analysis

All analyses were performed using the IBM SPSS version 26.0 statistical software. The crosstabs function was used to determine descriptive statistics. Statistical analysis was performed by logistic regression. First, a univariate analysis was run for each variable against the binomial outcome variable (adequate ANC: yes/no). In the multivariate analysis, all variables identified as confounders, according to the DAG, were entered together with the

main exposure (teens, urban/rural, ethnicity, and education). The mediators (parity and morbidities during pregnancy) were not adjusted for in the logistic regression as conditioning on mediators would block the relationship between the exposure (teen mothers) and the outcome (adequate ANC), thus introducing bias [66]. The variables husbands' education, employment status, and marital status could not be entered in the model due to insufficient data, even though they were identified as possible confounders. All results are displayed as odds ratio (OR) with 95% confidence intervals (CI) and a significance level of <0.05.

The ethnicity variable had 19% missing values which is a significant portion of the study sample. Therefore, a sensitivity analysis was performed. The odds ratio of the main exposure was compared when ethnicity was taken out of the analysis and when the missing cases were included as a separate group, but this did not change the OR of the main exposure by more than 5%. Thus, the number of missing cases is not thought to significantly influence the results.

2.8 Methodological Limitations

The main limitation of a DAG is that it relies upon the subject knowledge of the researcher. Thus, there is a possibility that the DAG is incorrect. This possibility is reduced as the covariates involved resemble other similar studies [45-55, 62]. Extensive research was conducted to ensure that the interactions of the covariates are depicted accurately. The DAG is also unable to quantify the strength of a confounder or mediator as is possible in other research methods by comparing changes in covariate coefficients in various statistical models [67]. A limitation in the data was the number of unobserved variables (marital status, husbands' education, employment status), which could potentially impact the results.

2.9 Ethical Considerations

The GBR dataset is anonymized and the possibility of personal identification is removed. The Regional Committee for Medical and Health Research Ethics (REC) of Northern Norway concluded that there was no need to obtain permission from REC to use the data (2017/404/REK Nord). Mothers in GBR below 15 years is a particularly vulnerable group and the sample size was small. It was therefore decided to exclude them altogether from the study due to the possibility of identification based on other characteristics.

3 Results

3.1 Demographic characteristics

The number of women eligible for the study was 148 133 after 4 665 women were excluded (Figure 1).

The demographic characteristics of the study sample are provided in Table 1. Women aged 15–19 comprised 6% of the study sample. The largest age group in the sample were women aged 25 – 29 years old (32%). Most of the women in the study were ethnically Georgian, 69% and 19% did not report their ethnicity in the birth registry. The other major ethnic groups in the sample were Azerbaijanis and Armenians which comprised 7% and 3% respectively. All other ethnic groups comprised 2% of the study sample. When missing cases in ethnicity are excluded, the proportion of the study sample is: 86% Georgian, 9% Azerbaijani, 4% Armenian, and 2% Other (the extra 1% is due to rounding).

Georgia consists of 12 regions, the largest proportion of mothers in the study resided in the capital Tbilisi, with 34%. The regions of Mtskheta-Mtianeti, Guria, Abkhazia, and Racha-Lechkhumi/Kvemo Svaneti had the smallest number of births, each contributing less than 2%

of the study sample. All other regions each made up 4% to 8% (n = 5 591 to 11 250) of the study sample. Most of the women included in the study lived in an urban environment (71%), while the remaining 29% lived in a rural environment.

Furthermore, 45% of the women had completed secondary school while 8% had only completed primary school. In the study, 11% did not report their education status.

It was the woman's first delivery for 39% of the study sample. For 37% of the sample, it was their 2nd delivery and the remaining 25% had at least two other pregnancies at the time of recording. In the study population, 32% reported having any morbidity during their pregnancy

3.2 Antenatal care descriptive frequencies

Table 1 also shows the percentage of women in the study who received adequate ANC versus inadequate ANC in Georgia from 2017-2019. Of the entire sample, 48% received adequate ANC. Of the women aged 15–19, 46% received adequate ANC and 23% had less than 4 ANC visits. In the other age groups, between 18% and 21% had less than 4 ANC visits. About 45% of women who gave birth when they were 35 or older received adequate ANC.

Notable populations with a negative deviation of 5% or more in adequate ANC coverage relative to the entire sample included the Azerbaijanis, with 37%, and the ethnic group categorized as 'other' which had 24% who received adequate ANC. The regions with low adequate ANC coverage relative to the entire sample included Abkhazia (31%), Samegrelo/Zemo Svaneti (34%), Mtskheta-Mtianeti (40%), Racha-Lechkhumi/Kvemo Svaneti (41%), and Kakheti (42%). The regions with a positive deviation of 5% or more in receiving adequate ANC coverage included Imereti (54%), and Shida Kartli (59%).

There was no difference in the percentage of women who received adequate ANC in rural (48%) and urban (48%) areas.

The percentage of women who only completed primary school and received adequate ANC was 38%. Among women who completed a higher education, 53% of them received adequate ANC. Furthermore, 54% of women in their first pregnancy received adequate ANC, while 40% of women in their third or additional pregnancy received adequate ANC.

3.3 Percent of teen mothers by region

The percent of teenage mothers in Georgia by region in 2017 – 2019 is displayed in Figure 3. The results of this study indicate regions with a notably higher percentage of teen mothers relative to the national percentage (6.2%). These regions include: Kvemo Kartli (13.3%) and Kakheti (10.6%). Regions with notably low percentages of teen mothers include: Tbilisi (2.9%), and Racha-Lechkhumi/Kvemo Svaneti (3.4%)

3.4 Logistic Regression

The univariate analysis was significant for teens, ethnicity and education, but not for women who either lived in rural or urban settings.

The multivariate analysis resulted in significant associations between the outcome and the following exposures: teenage mothers, ethnicity, and education. Teenage mothers had 15% increased odds (OR 1.15, 95% CI 1.10 – 1.21) to receive adequate ANC compared to their non-teenage counterparts. Georgians had the highest odds of receiving adequate ANC. Compared to Georgians, Armenians had a 15% (OR 0.85, 95% CI 0.79 – 0.90) decreased odds of receiving adequate ANC, Azerbaijanis had a 23% (OR 0.77, 95% CI 0.73 – 0.81) decreased odds , and the ‘other’ ethnic groups had 62% decreased odds (OR 0.38, 95% CI 0.34 – 0.42) of receiving adequate ANC

Women with a secondary level education had 28% (OR 0.72, 95% CI 0.70 – 0.74) decreased odds of receiving adequate ANC compared to women who held a higher educational level. Women who only had a primary school level education had 49% (OR 0.51, 95% CI 0.48 – 0.54) decreased odds of receiving adequate ANC compared to women with a higher education.

4 Discussion

4.1 Findings of the study

The main findings of this study were that teenage mothers had 15% increased odds of receiving adequate antenatal care compared to non-teenage mothers. The spatial distribution of teenage mothers is disproportionally higher in the region of Kvemo Kartli, and the Kakheti region with 13.3% and 10.6% respectively, while Tbilisi and Racha-Lechkhumi/Kvemo Svaneti have very low percentages of teenage mothers with 2.9% and 3.4% respectively.

4.1.1 Percentage of teenage mothers in Georgia

The percentage of all live births to mothers aged 15-19 in the sample was 6.2% which is a large decrease from a study in 2013 that found 11% of all mothers were teenagers [7]. Historically, the Caucasus region has had high rates of teenage pregnancies (37.3 per 1000 women in 2013) compared to teenage pregnancy rates in Western Europe, Eastern Europe and Central Asian populations. By comparison, in 2012 the teenage birth rate in Switzerland was 4 per 1000 women, and in the Netherlands it was 5 per 1000 women [68, 69]. It should be noted, there are large variances in the percentage of teenage mothers across regions in Georgia (i.e. 13.3% in Kvemo Kartli and 2.9% in Tbilisi).

According to the most recent Georgian reproductive health survey conducted in 2010, fertility rates among ethnic minorities are much higher in the 15-24 age group compared to all other age groups, particularly among Azerbaijanis [12]. As indicated in section 1.3, child marriages among ethnic minorities are suspected to be considerably higher than the already high national percentage of 17%. The reproductive health survey indicates only 5% of Georgian women partake in premarital sexual intercourse [12]. The close proximity of the Kvemo Kartli region to Azerbaijan suggests the cultural tendency surrounding early marriages of the Azerbaijani population in Kvemo Kartli is a contributing factor to the higher percentages of teenage mothers in this region.

The Georgian reproductive health survey of 2010 also found that across urban areas in Georgia, women reported initiating sexual activity and childbearing 2 years later than women residing in rural areas [12]. Specifically, women living in Tbilisi reported sexual activity and childbearing even later. This is likely due to the high cost of living, greater presence of educational opportunities, and competitive job market of which, all are present in urban environments in Georgia, and more-so in Tbilisi [12].

However, the region of Racha-Lechkhumi/Kvemo Svaneti is a rural mountainous region with a low percentage of teenage mothers (3.4%) second only to Tbilisi. Women in this region also reported initiation of sexual activity and childbearing much later than the national average [12]. The explanation for this is likely because of very different reason than urban residents. The number of individuals of a low reproductive age in this region are much lower than other regions, according to the Georgian census conducted in 2010. This insinuates many young people are leaving the region, likely to pursue higher education and employment opportunities elsewhere, all of which are scarce in the small region of Racha-Lechkhumi/Kvemo Svaneti [12]. The emigration from the region among people of reproductive age is likely a factor contributing to the low percentage of teenage pregnancies.

Previous studies conducted in the United States have identified an inverse relationship between increased contraceptive use and a decrease in the percentage of teenage pregnancies [70, 71]. There is limited reliable data on contraceptive use in Georgia among women 15-19 years old because it is a highly stigmatized topic. It is known, the use and knowledge of modern contraceptives throughout Georgia has increased steadily since 1999 [12]. The increase in contraceptive use is a plausible explanation of the overall decrease in teenage pregnancies in Georgia. However, the causation of the decrease in teenage pregnancies in Georgia is likely different. This is because most teenage pregnancies occur within marriage and have the intent of becoming pregnant [12]. Ultimately, the causal pathways between contraceptive use and the reduced percentage of teenage pregnancies is unknown in Georgia and should be studied further to determine why the percentage of teenage mothers is decreasing in Georgia and discover possible public health interventions.

4.1.2 Adequate ANC coverage

This study found that 48.2% of the study population received adequate ANC. This is much lower than the percentage of women who received adequate ANC (at least 4 visits) in 2015 (88.3%) [72] because the recommended number of visits increased from four to eight in February 2018. In fact, the number of women who received at least four ANC visits in this study sample was 81.5% which is comparable to the percentages in 2015. A qualitative study could be beneficial to determine why many Georgian women attended at least four ANC visits, but did not take advantage of all eight governmentally funded ANC visits. Possible explanations could include limited ANC resources, time constraints, long travel distances or a lag in adoption of policy.

4.1.3 Logistic Regression

This study found that teenage women had 15% increased odds of receiving adequate ANC compared to non-teenagers, which is consistent with a study conducted in India by Fulpagare et.al. [73]. However, other studies have found that teens have decreased odds of receiving ANC compared to their non-teen counterparts [42, 53]. A possible explanation in the difference in findings could be the normality of teen pregnancies in Georgia and their occurrence within marriage. This allows pregnant teens to seek ANC services with the support and promotion of family members. While age at pregnancy was found to be strongly associated with the utilization of ANC in the majority of studies, it has also been found to have no association [74, 75]. The inconsistency in findings for the association of teens on receiving adequate ANC services suggests there are numerous determinants of ANC utilization among teens which differ among various populations. Therefore, the findings of this study may not be generalized for populations outside of Georgia.

Another factor which is likely influencing the utilization of ANC among teens is parity. Several studies have found an inverse relationship between parity and utilization of ANC services; typically as parity increases, utilization decreases [48, 53, 56, 62, 76]. It is probable to assume that since teen mothers are more likely to be primiparous, they are more likely to adhere to the ANC recommendations. This study intentionally did not include parity in the statistical analysis because it was considered a mediator as explained in section 2.6. If parity was included, a bias would be introduced in the results by shifting part of the association between the main outcome (adequate ANC) and exposure (teen mothers), to the mediator (parity). There is a suspected significant association between parity and receiving adequate ANC which should be studied further.

When looking at the difference in utilization of ANC in women who live in rural and urban settings, there was no significant association in this study. This finding is inconsistent with most of the previous literature which states women in urban areas used more ANC than rural areas [48, 77, 78]. In fact, the utilization of ANC among Georgians in rural and urban environments is the same. This is surprising considering there are many barriers to accessing ANC in rural communities in Georgia which are not applicable in urban areas [33]. For example, all participants in a qualitative study in Georgia commonly cited travel distances, cost of travel, and availability of public transportation routes as barriers to accessing ANC in rural communities while there were no distance related problems accessing ANC cited among participants living in urban environments of Tbilisi and Batumi [33]. It appears, by receiving the same amount of care as their urban counterparts, Georgians in rural communities are better able to overcome locational barriers compared to other countries. The exact reason for this is unknown and could be studied further to potentially determine possible solutions applicable in other countries which would increase utilization of ANC in rural communities.

In concurrence with previous studies, ethnicity is a significant determinant of receiving adequate ANC [49, 51, 52, 54, 79, 80]. Typically, ethnic minorities or marginalized populations, have decreased odds of receiving adequate ANC. This study suggests it is also the case in Georgia; Georgians had higher odds of receiving adequate ANC compared to all other ethnic groups. A qualitative study conducted by *UN Women* in the Kvemo Kartli region of Georgia revealed the main reason ethnic minorities attend less ANC visits was due to lack of knowledge of governmentally funded services available to them [16]. The language barrier played a large role in restricting the flow of information to these groups where 63% of the women included in the study did not speak Georgian [16]. The television was the main source of information for 90% of the women in the same study population [16]. Therefore, specific language accommodations to ethnic minorities which utilize television programs could be

considered when implementing public health interventions concerning ANC services, in order to increase accessibility and utilization of ANC across all ethnicities in Georgia.

Our findings revealed there was a significant association between education and those who received adequate ANC among the Georgian population. As education increased, the utilization of ANC increased as well. These results are consistent with most other studies, including a systematic review, which showed education to be the best predictor for the number of ANC visits in 16 different studies [59]. Women who are educated are more likely to understand the benefits of utilizing ANC services [57]. The association of education and utilization of ANC can also be explained because women who are educated typically have a higher socio-economic status which likely increases their understanding of, and access to, information regarding ANC services available to them [81].

4.2 Strengths and weaknesses of the study

This study was designed to look at the association between being a teenage mother and receiving adequate ANC in Georgia. The main strength of this study is the comprehensiveness of the study sample. The study included 99.8% of all births in Georgia. Thus, the descriptive results represent the entirety of the Georgian population. Furthermore, the main exposure and outcome variables are ones that are reliable with no missing cases reported. This means it is highly likely the descriptive frequencies of teen mothers in Georgia and the percentage of women who receive adequate ANC is correct and represents the Georgian population.

A weakness in the statistical analysis was the high number of missing cases for some of the variables. Among the cases included in the study, 28% were missing. The variable of ethnicity had 19% missing cases. Therefore, there was a large percentage of the eligible cases not included in the statistical analysis. There is a possibility of under reporting bias among

ethnicities, but this is unlikely because the study population still accurately resembled the Georgian population. According to the most recent census data of the Georgia population, conducted in 2014, ethnic Georgians comprised 87% of the population, while Azeris and Armenians comprised 6% and 4%[38] respectively. The proportion of each ethnic group included in the study sample was 86% Georgian, 9% Azerbaijani, and 4% Armenian. Since the proportion of ethnicities in the study sample are comparable to the Georgian census data, it suggests the missing cases are random and should not affect the results of the study.

This study was designed to produce quantitative results and cannot determine qualitative results past speculation. For example, the percentage of ANC coverage in the Georgian population is very reliable in this study, but the quality of care cannot be determined. Also, the reasons for mothers utilizing or not utilizing ANC services cannot be determined by this study. This information is important to consider when developing public health policies or interventions regarding utilization of ANC services and should be studied further.

In addition to the confounders identified in the section 2.6, there are possible hidden confounders which could affect the results. For example, women who hide their pregnancies likely have different odds of receiving adequate ANC than non-hidden pregnancies. This data is not known; thus, it is impossible to determine the effect of hidden confounders on the findings of this study. In order to determine the prevalence of hidden pregnancies in the data set, a qualitative study is required which is a topic for further research. Other topics of future research could be focused on determinants of utilizing ANC services in Georgia, and all irregularities in the findings of this study.

5 Conclusion

The most important findings in this study is that there was a large variance in percentage of teenage mothers across the different regions of Georgia, and teenage mothers had higher odds of receiving adequate ANC compared to non-teenage mothers. The percentage of mothers in Georgia whom were teenagers in 2017-2019 was 6.2%. The highest proportion of teen mothers was in the Kvemo Kartli region (13.3%) and the lowest in Tbilisi (2.9%). The percentage of teenage births in Georgia are comparable to other countries in the Caucuses but, considerably higher than western European countries. The suspected reasons teenagers have an increased odds of receiving adequate ANC are because teenage mothers are more likely to be primiparous and become pregnant within marriage, so they receive support from family members to utilize ANC services.

The results also indicate receiving adequate ANC is strongly dependent on education and the ethnicity of the mother. Georgians had the highest odds of receiving adequate ANC compared to ethnic minorities (Armenians, Azerbaijanis, and 'other') due in part, because of the language barrier among ethnic minorities which restricted flow of information to these populations [16]. This is important to consider when determining public health interventions to increase utilization of ANC services at a national level.

Figures and Tables

Table 1 – The percentage of women who received adequate ANC among different demographic groups in Georgia from 2017 – 2019.

Demographic variables	Women who received adequate ANC (%)	Women who received inadequate ANC (%)	Sample size n (%)
Sample size n (%)	**71 331 (48.2%)**	**76 802 (51.8%)**	**148 133 (100)**
Age			
15-19	46	54	9 413 (6)
20-24	49	52	37 589 (25)
25-29	50	50	47 940 (32)
30-34	48	52	32 935 (22)
35+	45	55	20 256 (14)
Ethnicity			
Armenian	45	55	4 330 (3)
Azerbaijani	37	63	10 715 (7)
Georgian	51	49	102 139 (69)
Other	24	76	2 248 (2)
Missing			28 701 (19)
Region of residence			
Abkhazia	31	69	1 102 (1)
Adjara	51	49	17 211 (12)
Guria	52	48	3 144 (2)
Imereti	54	46	17 880 (12)
Kakheti	42	58	11 250 (8)
Kvemo Kartli	45	55	18 187 (12)
Mtskheta-Mtianeti	40	60	2 791 (2)
Racha-Lechkhumi/Kvemo Svaneti	41	59	730 (0)
Samegrelo/Zemo Svaneti	34	66	10 213 (7)
Samtskhe-Javakheti	46	54	5 591 (4)
Shida Kartli	59	41	9 367 (6)
Tbilisi	50	50	50 667 (34)
Missing			187 (0)
Urban/Rural			
Urban	48	52	105 391 (71)
Rural	48	52	42 622 (29)
Missing			120 (0)
Education level			
Higher	53	47	53 183 (36)

Secondary	49	52	66 798 (45)
Primary	38	63	12 278 (8)
Missing			15 874 (11)
Parity			
1	54	46	57 066 (39)
2	48	52	54 698 (37)
3+	40	60	36 244 (25)
Missing			125 (0)
Morbidity during pregnancy			
yes	50	51	47 891 (32)
no	48	53	100 242 (68)

Table 2 – Univariate and multivariate results

The odds ratios (OR) are presented with 95% confidence intervals (CI) of maternal demographic variables for receiving adequate ANC in the Georgian Birth Registry, 2017 – 2019 (n = 106 079)

Maternal Demographic Variables		Univariate Analysis (95% CI) Adequate Antenatal Care	P - Value	Multivariate Analysis (95% CI) Adequate Antenatal Care	P - Value
Women ≥ 20 years		Reference		Reference	
Women < 20 years		0.91 (0.87 – 0.94)	< 0.001	1.15 (1.10 – 1.21)	< 0.001
Rural		Reference		Reference	
Urban		1.02 (1.00 - 1.04)	0.106	1.03 (1.00 – 1.05)	0.072
Ethnicity	Georgian	Reference		Reference	
	Armenian	0.77 (0.74 – 0.84)	< 0.001	0.85 (0.79 – 0.90)	< 0.001
	Azerbaijani	0.57 (0.55 – 0.59)	< 0.001	0.77 (0.73 – 0.81)	< 0.001
	Other	0.31 (0.28 – 0.34)	< 0.001	0.38 (0.34 – 0.42)	< 0.001
Education	Higher	Reference		Reference	
	Secondary	0.80 (0.79 – 0.82)	< 0.001	0.72 (0.70 – 0.74)	< 0.001
	Primary	0.53 (0.51 – 0.55)	< 0.001	0.51 (0.48 – 0.54)	< 0.001

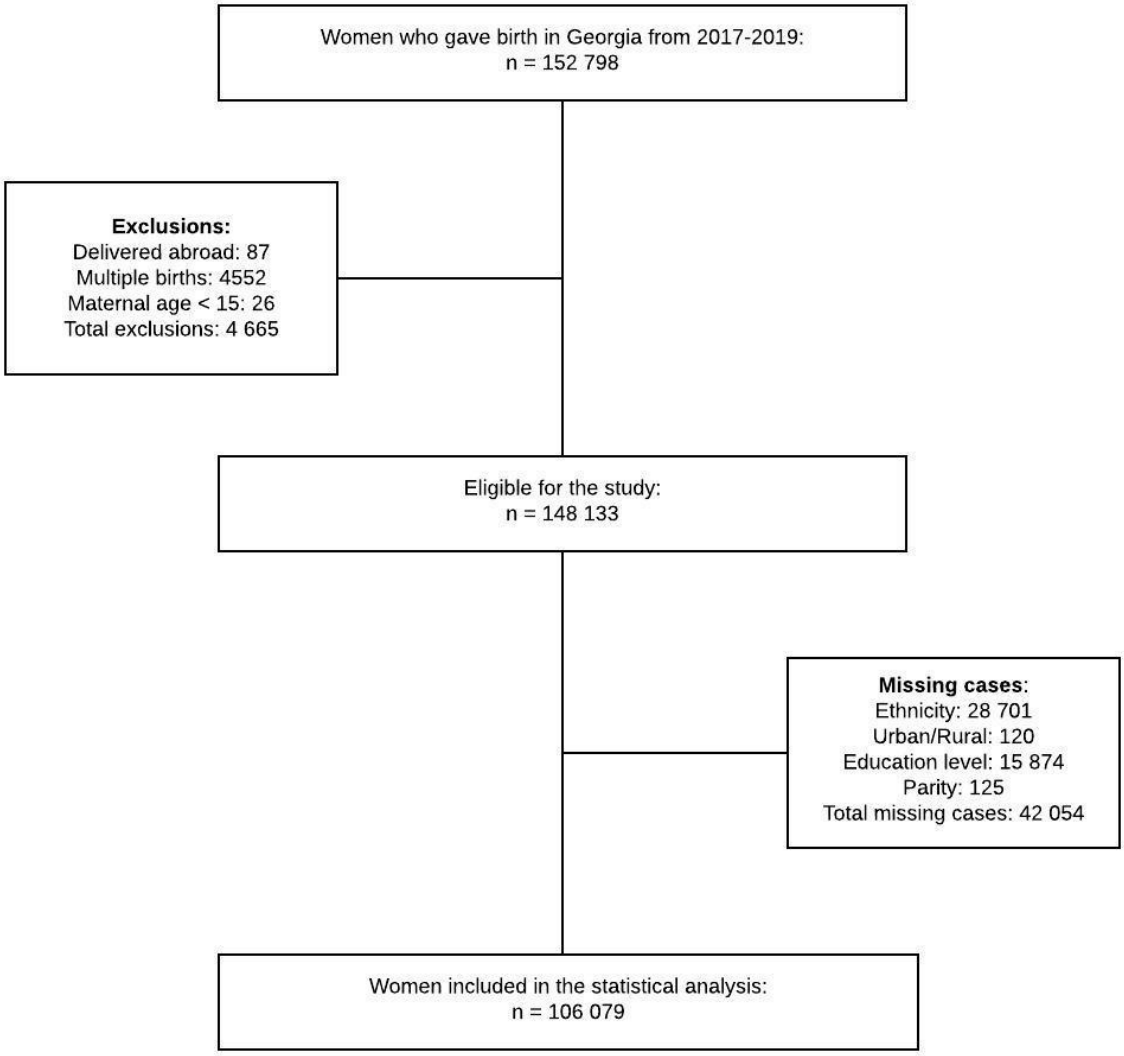

Figure 1 - Flow chart of the study sample

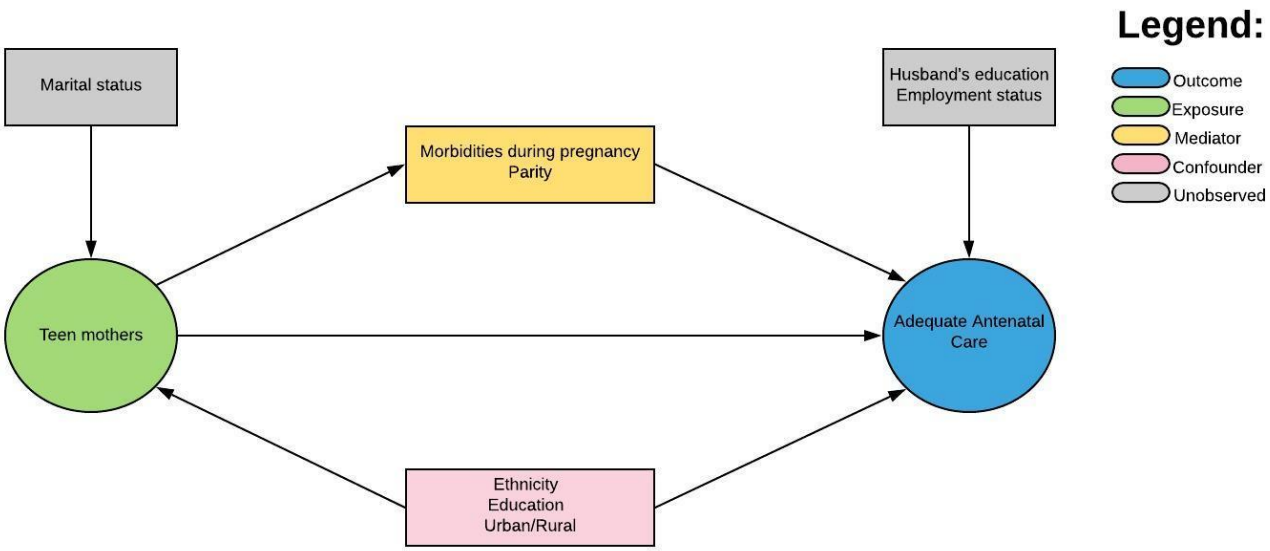

Figure 2 - Directed Acyclic Graph (DAG)

Figure 2 presents the associations between the exposure (teen mothers), outcome (adequate ANC), potential mediators (morbidities during pregnancy, parity), potential confounders (ethnicity, education, urban/rural), and unobserved variables (marital status, husbands' education, employment status)

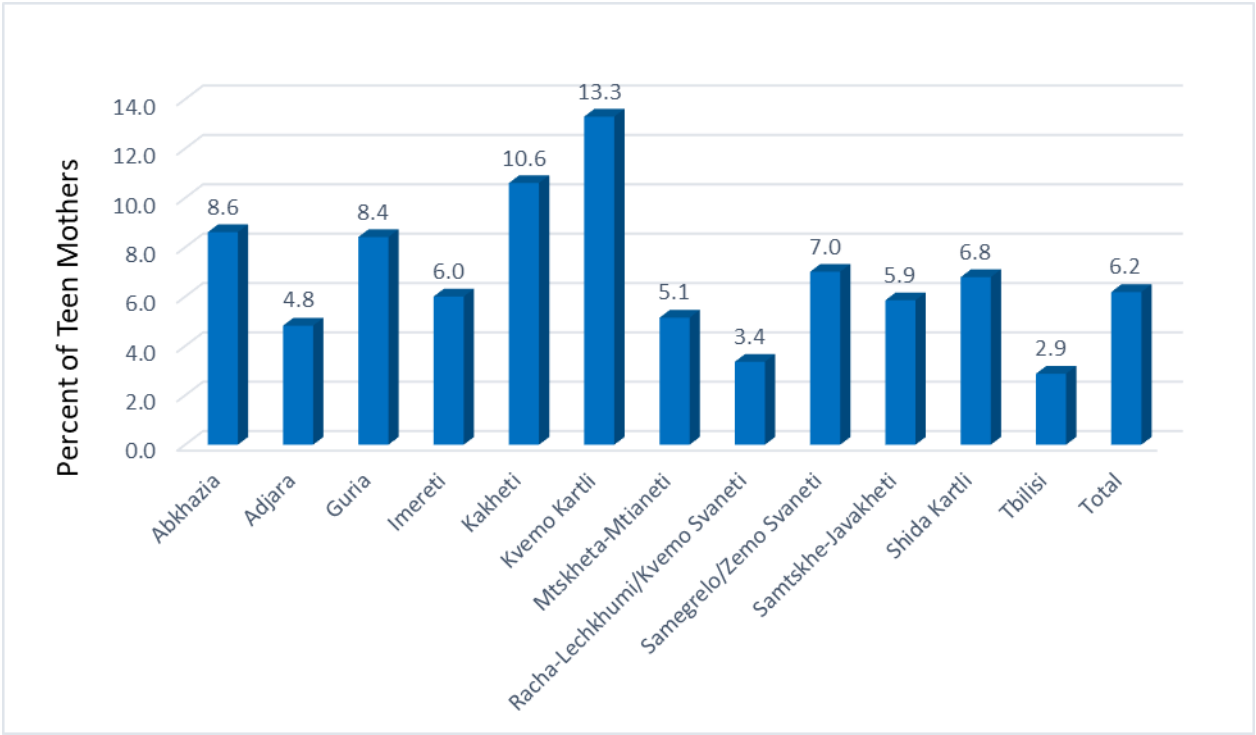

Figure 3 – Percent of mothers who are teens in Georgia by region from 2017 – 2019.

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