Examining Trends in Birth Location and Birth Attendance Among Women in the Amarakaeri Communal Reserve

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Melissa Watt

Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Despite global improvements in maternal mortality since 2000, preventable maternal deaths are still an issue for many populations. According to available research, indigenous peoples are one of these populations. Indigenous populations, especially those in Latin America, often do not utilize allopathic delivery services due to traditional cultural beliefs regarding the nature of birth and poor perceptions or experiences with allopathic health care workers and clinics. The primary objective of this study was to conduct a preliminary analysis on birth location and birth attendance trends across time of Amazonian Indigenous women compared to women of Andean Highland decent. This analysis used survey data from the Hunt Oil Baseline Cohort Study in the Amarakaeri Communal Reserve, located in Amazonian Peru. Bivariate analysis and GEE logistic regression were used to examine birth location and birth attendance across time. The odds of Amazonian Indigenous women giving birth in a health structure compared to birth home in 2010-2015 (0.81) are much higher than they were in the pre-2000s (0.59), but homebirths remained the most popular option when disaggregated. Similarly, the odds of Amazonian Indigenous women giving birth with a skilled birth attendant compared to a relative in 2010-2015 (1.11) are much higher than in the pre-2000s (0.59) and remain the most utilized birth attendants among these women. Despite

increases in utilization over time, disparities still exist in utilization between Andean Highland and Amazonian Indigenous women. From the study analyses, it is concluded that women of Amazonian Indigenous decent are increasingly utilizing skilled birth attendants and allopathic health structures for labor and delivery, but lingering disparities in 2010-2015 data indicate that barriers to utilization may remain. Further qualitative research is needed to ascertain the reasons why Amazonian Indigenous women still prefer giving birth at home, and additional modeling is necessary to determine the effects of potential influencing variables, such as urban status, proximity to health structures, mother's education levels, and family income.

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1. Introduction

Improvements in maternal, child, and reproductive health have been an emphasized and championed cause among the global health and public health communities. Three of the eight Millennium Development Goals (MDGs) set by the United Nations called for improvement in women's rights, child mortality rates, and maternal health services between 2000 and 2015, and are reemphasized in the first two targets of Sustainable Development Goal (SDG) #3, which aim for improvements in maternal & child mortality [1, 2]. Indeed, the available data indicates that the progress made since the inception of the MDGs has been substantial – global maternal mortality ratios dropped 44% from 1990 to 2015, including a 52% drop in Latin America and a 73% drop in Peru [3]. Child mortality rates have seen similar improvements, with a reduction of 56% and 68% globally and in Latin America, respectively [4].

Success in maternal mortality reduction can be achieved via various types of initiatives, and often depend on a country or region's health system structures and sociocultural context, as displayed in the World Health Organization's (WHO) Ending Preventable Maternal Mortality (EPMM) objectives [5]. Published as the MDGs expired in 2015, the EPMM objectives serve to steer global maternal mortality initiatives during the era of the SDGs based on countries that saw great success in maternal mortality

reduction. Some countries have improved their maternal mortality ratios by addressing these aims in unique ways – for example, in Southeast Asia alone, Vietnam improved access to care by tailoring reproductive health services specifically for adolescents, Bangladesh improved service coverage by expanding reproductive, maternal, and child health (RMCH) services in private clinics, and Indonesia invested in RMCH service expansion at the village level while also empowering and training midwives [6-8]. Each of these initiatives has been championed for their creativity and impact on maternal mortality reduction and adaptability to local contexts.

However, throughout the evolution and implementation of maternal health care strategies in recent years, the WHO has consistently maintained that one of the most important factors in preventing maternal deaths is the utilization of skilled birth attendants at the time of birth by pregnant women [9]. Complications during labor and delivery are often unpredictable and can rapidly escalate and become fatal for mother and/or newborn [10]. Three-quarters of global maternal deaths can be attributed to hemorrhage, postpartum infections, hypertension, delivery complications, and unsafe abortion [11] – complications that occur just before, during, or within 48 hours after delivery [12]. These trends in maternal mortality indicate just how dangerous the process of labor and delivery can be when issues arise, and reinforce the importance of

care by a trained attendant at the time of delivery. This emphasis is corroborated in the first listed objective in the EPMM – ensuring that women have access to equitable, high quality care.

While recent data and successful case studies across cultures point to an improving environment for RMCH services in communities around the globe, the WHO EPMM objectives exist to make the world aware that there are still too many maternal mortalities and morbidities stemming from preventable causes in many populations. One such population left behind by maternal health initiatives are indigenous populations. Indigenous populations in countries around the world have been consistently on the wrong end of health and development disparities in the past few centuries – trends that continue to this day due to a conglomerate of factors, such as systemic poverty, lower education levels compared to non-indigenous populations, challenges in creating culturally appropriate services, and living in remote, geographically challenging areas [13]. This ecology of sociocultural and demographic factors coincides with high maternal mortality ratios compared to country-respective benchmark populations and can be seen in indigenous groups around the world – from the Aboriginal and Torres Strait Islanders of Australia and the high plateaus of Tibet, to the other side of the ocean across Central and South America [13].

The RMCH disparities among Latin American indigenous populations are striking. Recent analyses show that the indigenous maternal mortality ratio (MMR) in Colombia is more than 3.5 times that of its benchmark population; in Panama, the indigenous MMR is greater than 6 times that of the benchmark population [13]. Worse, this alarming disparity is often obfuscated by global burden of disease data when aggregated. For example, skilled birth attendant utilization is reported to be approximately 97% and 94% in Colombia and Panama, respectively, while deaths from maternal disorders are reported to be 0.76 and 1.26 per 100,00 people in these countries [14]. One likely cause of this phenomenon is an all-too-often exclusion of indigenous groups from research studies based on Spanish language proficiency [15], which ultimately results in a lack of representation of the marginalized indigenous populations in critical health data and metrics.

Data available regarding maternal health among Latin American indigenous communities may not reflect respective national trends for many reasons outside of data exclusion and obfuscation. It is apparent that indigenous women in Latin America are far less likely to give birth in the presence of skilled birth attendants in health institutions when compared to non-indigenous women [10] – the WHO's emphasized and championed method for improving maternal mortality ratios. This trend among

indigenous women occurs because indigenous people often do not, or cannot, access these services for a variety of reasons. To start, Latin American indigenous populations usually reside in poor rural areas, which usually have little to no access to reproductive services [16]. While geographic isolation and difficulties in travel due to terrain are some of the chief hurdles in indigenous people's access to care, improved access to roads and transportation has not been found to increase utilization of prenatal or delivery care services [17, 18], which illustrates the complexities of allopathic care seeking by indigenous groups in Latin America. Even when indigenous mothers can access health services and choose to utilize them, they can be subjected to poor treatment, abuse, or stigmatization by allopathic health care workers [19]. Often, this malpractice can be attributed to the lack of interpretation efforts by clinic staff and to the rejection of indigenous birthing preferences and beliefs, which may lead to further avoidance of allopathic care services by indigenous mothers and/or poor quality of care given by clinic staff, and thus higher maternal mortality ratios [15, 19, 20].

These concerns are no different in Peru, where indigenous ethnicities make up 47% of the total population nationwide [21]. Existing peer-reviewed data regarding Peruvian indigenous groups is scant [22]; however, what is available paints a portrait of stark disparity. Recent published data show that Peruvian Amazonian indigenous

populations are half as likely as Peruvians that speak Spanish as their first language to complete year twelve of education – correlating with an astronomical 81% poverty rate for the Amazonian Indigenous, compared to 29% in the Spanish-speaking benchmark population [13]. In the northern Amazonian state of Loreto, over half of indigenous people surveyed at a mobile clinic reported that they could not access medical attention when needed, citing both financial and geographic challenges [22]. This contrasts to substantial improvements in health care access nationwide, once again hiding these indigenous disparities from view in prominent datasets and publications [23]. These barriers are all too common for many indigenous communities and are especially concerning when considering maternal and child health and the processes of labor and delivery. The inability to access, or decision not to access, appropriate allopathic care and skilled birth attendance when needed means mothers with complications before, during, or following labor are unable to attain the attention they need to successfully navigate these dangerous health events. These access barriers, exacerbated by perceived inappropriate and poor quality of care by Peruvian indigenous mothers, ultimately result in disparate maternal mortality ratios [20, 24] and high infant mortality ratios, which have been estimated to be as high as 1 in 10 live births among Machiguenga communities [21].

The morsels of data available on maternal mortality among indigenous populations Peru is lacking, but what exists paints a grim portrait. Not much is known regarding the maternal health of those populations in Madre de Dios – there was no data available in 2012 regarding maternal mortality [33]. However, it has been estimated that the maternal mortality ratio in the state of Madre de Dios was approximately 290 women per 100,000 live births in the year 2000, compared to 52 women per 100,000 live births in the Lima region and 173 women per 100,000 live births nationally [25]. A search of journals in PubMed and Scopus returned zero results in English for articles pertaining to delivery service use in the state of Madre de Dios, which shares a border with Brazil and Bolivia and is home to a variety of Amazonian ethnic groups. From this, it is apparent that there is a dearth in knowledge in the maternal health status and delivery service utilization of the people in this region of the Amazon.

The goal of this study was to perform a preliminary comparative analysis on delivery service utilization by ethnic group among women in the protected area of the Amarakaeri Communal Reserve (ACR) within Madre de Dios. To achieve this goal, the study tested for the differences in two outcomes - birth location and birth attendance - comparing the Andean Highlands population and the Amazonian Indigenous over time using bivariate analyses and logistic regression estimated with generalized estimating

equations (GEE). The study examined these outcomes because they are some of the most important ways to reduce preventable maternal deaths. The results of this study will aid in future research on health service utilization and can inform health policy decision making in order to improve and tailor culturally appropriate health services for women in this region, with a long-term goal of improving delivery service utilization of all women and reducing preventable maternal death.

2. Methods

2.1 Study Overview

Much of the information in this chapter was initially provided in an unpublished, private report for Hunt Oil Company for its baseline study in the ACR, composed by the principal investigator (Dr. William Pan) and research team members in both the United States and Peru. This cohort study's primary objective was to assess the baseline health of populations in the ACR, which is a hotbed of natural resource extraction activities. Methods relating to the primary research objective of the baseline study are also available in a paper published in the *American Journal of Tropical Medicine and Hygiene* by Weinhouse et al [26]. The author at this time acknowledges the Hunt Oil Study research teams of past who were integral in designing, collecting, writing, and distributing the baseline study and its information.

2.2 Setting

Much of Peru's various indigenous peoples live in the towering Andes mountain range, and to the east, where the Amazon rainforest sprawls across the border with Brazil. Tucked between the immense Manu National Park and the Bolivian border is the Amarakaeri Communal Reserve (ACR) within the state of Madre de Dios. The ACR is home to a variety of indigenous groups, including communities that are populated by Machiguenga, Yine, and Harakbut natives indigenous to the Amazon rainforest. Additionally, the reserve is home to both rural and larger urban communities populated by migrants from the Andes, often with enough resources and development to serve as labor and resource hubs for nearby remote communities. Increasingly, these are areas where local peoples from surrounding communities commute to, migrate to, and work. This mixing of backgrounds and ideas via migration and differing availability of health care resources in certain communities may lead to changes in health care seeking behavior as cultures intermingle and as health care service availability changes from community to community [27]. Additionally, landscape changes could be a factor in influencing migration and exchange in cultures and knowledge. The initiation in 2006 of paving of the Interoceanic Highway though Madre de Dios brings promise of improved methods of transportation and connectivity for residents but increases land use demand

alongside existing artisanal gold mining, deforestation, and selective logging activities in the region [28].

2.3 Participants

23 communities were identified a priori by Hunt Oil Company as impacted by resource extraction activities. Identified communities were enrolled in the study conditional on community leadership approval of the study protocol, principal investigator, and research team. Households within selected communities were eligible for the study if they had at least one woman of child-bearing age (ages 15-49, "WCBA") living in the household and had lived in the ACR for at least three months. Households that did not have a WCBA were eligible only if nine consecutive households with WCBA had been enrolled. The Hunt Baseline Study collected data on over 4,000 individuals from 1,126 households across 23 communities in the ACR – in which there were 859 WCBA with an assigned ethnicity that had given birth to at least one child. Details regarding participants included in the analysis can be viewed in section 2.6.

2.4 Procedures

Every household with a WCBA in Rural and Native Communities (fewer than 75 households) were surveyed, while households with WCBA in Urban communities (greater than 75 households) were surveyed by random sampling. Selected households

were approached by a study team consisting of an interviewer and nurse. If the household met the eligibility criteria, the head of household and spouse (if applicable and present) were invited to participate in the study. After providing informed consent, a household survey was administered, gathering demographic and health data on all members of the household. Individual surveys were administered separately to the WCBA and her male partner (or male head of household).

Ethnicity data of the ACR population was not initially collected in the Hunt Baseline Study. The study author provided a table of ethnic groups found in the region of Madre de Dios to an anthropologist from the Peruvian Ministry of Culture assigned to the ACR, who maintains both an intimate knowledge of the region and relationships with its residents. The anthropologist examined the household roster from the baseline study and assigned likely ethnicities to each individual based on his knowledge of each family, their paternal and maternal last names, and their community of residence. A Peruvian research team visited communities and households unknown to the anthropologist to fill in missing ethnic data. All ethnic data were merged to form a single database of individuals and their ethnic background, which was subsequently combined with the existing Hunt Baseline files.

Additional data collected during baseline enrollment included anthropometry and biological samples to test for methyl mercury exposure, tuberculosis, and anemia, among other conditions. These data and their associated survey questions are not relevant to this analysis and henceforth excluded.

Approval for this study was obtained February 23, 2015 (IRB Code 63056) through the Universidad Peruana Cayetano-Heredia *Comité Institucional de Ética para Humanos* (UPCH-CIE) in Lima, Peru. In addition, the study team met with the presidents and other leaders of each partner community prior to study enrollment to review the study protocol, processes, objectives, and obtain permission to conduct the study in their communities.

2.5 Measures

2.5.1 Ethnicity

Individuals enrolled in the baseline study were assigned to one of the following ethnic group categories: Harakbut, Wachiperi, Machigenga, Quechua, Yine, Other Indigenous, Andean Highlands, Non-Native Amazon, Other, Missing, or Mixed (more than one ethnic group). Ethnicity was grouped into two broad categories for the study analyses: Andean Highland and Amazon Indigenous (including Harakbut, Wachiperi, Machigenga, and Yine groups).

2.5.2 Birth Location and Birth Attendance

In a structured survey separate from the household demographic and health surveys, WCBA in enrolled households were interviewed separately from other family members and asked questions regarding migration history, reproductive health history, HIV/AIDS knowledge, and opinions related to Hunt Study objectives. Within a section pertaining to reproductive health history, WCBA were asked to provide information on each of the children to whom they had given birth. Among the information requested was the facility in which the child was born and who was the attendant during the delivery. These outcomes were requested in the following manner within a series of questions about children born to WCBA. In Spanish - "Ahora me gustaría preguntarle sobre cada uno de los partos sin importar si el niño ahora, empezando por el primer parto que tuvo. Pregunta 15: Lugar de Nacimiento; Pregunta 16: Quien atendió el parto?" In English – "Now I would like to ask you about each of the birth you have had, regardless of whether the child is currently alive, starting with the first birth you have had. Question 15: Place of birth; Question 16: Who attended the delivery?"

No translation from Spanish to local indigenous language (i.e., Quechua) was necessary among study participants. Birth location responses were categorized as: Public Hospital, Ministry of Health Post, Private Hospital or Clinic, In My House, or Other.

Birth attendant responses were categorized as: Nobody, Doctor, Nurse, Midwife, Relative, or Other. These two variables were examined as the outcomes of this study.

2.4.3 Birth Year

Among the information requested about the birth of each woman's child was the year in which each child was born. Birth years of children of enrolled WCBA are categorized as being born pre-2000 or within the following intervals: 2000-2004, 2005-2009, and 2010-2015. This allows for the analysis to examine trends in birth location and birth attendance over time.

2.5.4 Income

Household income was assessed as a part of the household survey. Families were asked if they made 600 soles or more per month (Y/N) as the first question in a series of questions to determine income group categories. Those who reported making less than 600 soles per month were subsequently asked if they made 300 soles per month (Y/N). Those who reported making more than 600 soles per month were subsequently asked if they made 1000 soles per month (Y/N).

2.5.5 Mother's Education

A question regarding the highest attained level of education of each member of the household was included in the household survey. Study participants responded

with the number of their highest completed grade in school. The range of the responses varied from 0 to 14. WCBA who had given birth to at least one child were stratified into the following levels: None/Some Primary, Complete Primary/Some Secondary, and Complete Secondary or higher. “Some Primary” and “Some Secondary” indicate that the WCBA’s highest completed year of education fell between the start and end of primary or secondary school, while “Complete Primary” and “Complete Secondary” categorization indicates that the WCBA’s highest completed year of education was either grade six (primary) or twelve (secondary), which are the terminal years for their respective levels of education in Peru.

2.5.6 Urban/Rural Status

The 23 participating communities in the ACR were classified as Urban, Rural, or Native in the Hunt Baseline Study. For sampling purposes, communities with greater than 75 households were classified as Urban in the Hunt Study, while communities with less than 75 households were classified as Rural. In the Peruvian census, the cutoff for Urban/Rural status was 100 households, but there was no change in categorization of any community when the Urban/Rural cutoff was placed at 75 households.

A community was classified as Native if most of its population consists of persons of any Amazonian Indigenous decent. These communities have been defined as

Native by the Peruvian government. In the Hunt study, all of the Native communities enrolled have less than 75 households, also fulfilling the definition for Rural.

2.6 Analysis

Analyses were conducted using Stata 15.1 (College Station, TX) and/or Microsoft Excel Version 1802 (Redmond, WA). In the Hunt Baseline Study, 859 WCBA of all ethnicities reported birth locations, attendance, and birth year for a first-born child. Those WCBA in the dataset who had no reported birth location, birth attendant, or birth year for a first-born child were dropped, as were WCBA who were not categorized as Andean Highland or Amazonian Indigenous. 199 WCBA were excluded on these criteria, 173 of them due to missing ethnicity assignments. This left 660 WCBA between the Andean Highland (n=547) and Amazonian Indigenous (n=113) ethnic groups. Data regarding birth location, birth attendance, and birth year is available to 1,566 children born to these women.

Bivariate chi-squared and Fisher's Exact tests were completed at significance level of 0.05 to compare urban status, education levels, and income between Andean Highland and Amazonian Indigenous WCBA for participant characteristics. Chi-squared and Exact tests were also preformed to compare crude differences in birth location and birth attendance of children born to Andean Highland and Amazonian

Indigenous WCBA. Generalized estimating equations (GEE) were used to fit logistic regression models to examine and compare trends in health structure, birth location, and skilled birth attendance among Andean Highland and Amazonian Indigenous WCBA across the periods of pre-2000s, 2000-2004, 2005-2009, and 2010-2015. GEE was used to adjust for correlation of birthing responses within mother (i.e., correlation of birth decisions by mothers with more than one child). The regression model was specified as follows:

$$\text{logit}(\text{outcome}) = \beta_0 + \beta_1(\text{indig}) + \beta_2(2000\text{-}04) + \beta_3(2005\text{-}09) + \beta_4(2010\text{-}15) + \beta_5(\text{indig}*2000\text{-}04) + \beta_6(\text{indig}*2005\text{-}09) + \beta_7(\text{indig}*2010\text{-}15)$$

where "outcome" represents either birth location (health structure vs. at home as the reference) or birth attendance (SBA vs. family relative as the reference) and "indig" represents Amazonian Indigenous groups. The referent time period was the pre-2000s with the referent group being Andean Highland women (β_0). β_1(indig) represents Amazonian Indigenous Women in the pre-2000s. The time periods (2000-2004, 2005-2009, and 2010-2015) represent overall trends in utilization in each of these time periods in relation to the pre-2000s, while the interaction terms (indig*2000-04, indig*2005-09,

indig*2010-15) represent Amazonian Indigenous women in each of these time periods in relation to the referent groups.

Marginal odds ratios were estimated by exponentiating each of the following terms or combination of terms. β_0 represents Andean Highland women in the pre-2000s. $\beta_0+\beta_1$(indig) represents Amazonian Indigenous women in the pre-2000s. $\beta_0+\beta_2$(2000-2004) represents Andean Highland women in 2000-20004. $\beta_0+\beta_1$(indig)+β_2(2000-2004)+β_5(indig*2000-04) represents Amazonian Indigenous women in 2000-2004. $\beta_0+\beta_3$(2005-2009) represents Andean Highland women in 2005-2005. $\beta_0+\beta_1$(indig)+β_3(2005-2009)+β_6(indig*2005-2009) represents Amazonian Indigenous women in 2005-2009. $\beta_0+\beta_4$(2010-2015) represents Andean Highland women in 2010-2015. $\beta_0+\beta_1$(indig)+β_4(2010-2015)+β_7(indig*2010-2015) represents Amazonian Indigenous women in 2010-2015. 95% confidence intervals for each marginal odds ratio estimate were calculated using the following formula:

$$\mathbf{B} \text{ +/- } 1.96*\text{sqrt}(\text{Var}(\mathbf{B}))$$

where **B** represents the linear combination used to calculate the odds for each cell in Table 5. For example, **B** for birth in a health structure among Andean Highlands between 2000-2004 is:

$$\mathbf{B} = \beta_0 + \beta_2(2000\text{-}04)$$

The estimated variance for this odds ratio estimate is computed as a combination of terms from the GEE logistic regression model. For example, the variance for the above scenario would be:

$$Var(\beta_0 + \beta_2(2000\text{-}04)) = Var(\beta_0)+Var(\beta_2)+cov(\beta_0, \beta_2);$$

And the 95% confidence interval would be:

$$\beta_0 + \beta_2(2000\text{-}04) +/- 1.96*sqrt(Var(\beta_0 + \beta_2(2000\text{-}04)))$$

3. Results

3.1 Comparing Andean Highland and Amazonian Indigenous Women

Table 1 compares urban status, education, and family income of Andean Highland and Amazonian Indigenous women with at least one child. According to the presented Fisher's exact and chi-squared bivariate analyses, there are statistically significant differences between Andean Highland and Amazon Indigenous women at the 0.05 level. Very few Amazonian Indigenous mothers live outside of native communities (11), while only 26 Andean Highland mothers live in native communities. Andean Highland and Amazonian Indigenous women also have significantly different education levels. Table 1 indicates that a greater percentage of Amazonian Indigenous women have completed some secondary school than Andean Highland women, but this is likely because a greater percentage of Highland women go on to complete secondary

school (20.26%) than indigenous women (9.82%). A glaring discrepancy exists between the ethnic groups among these demographic variables regarding family income. 82.19% of Andean Highland women are part of families that reported earning more than 600 soles per month, while only half of Amazonian Indigenous women reported being part of families earning more than 600 soles per month. While the differences between the groups at the 300 soles income level are not statistically significant at the 0.05 level, a greater percentage of Amazonian Indigenous women are a part of families earning less than 300 soles per month than Andean Highland women. Families that reported making more than 600 soles were then asked if they made more than 1000 soles a month. 73.14% of Andean Highland women are a part of families that reported making more than 1000 soles a month, compared to just 43.64% of Amazonian Indigenous women. This difference was significant at the 0.05% significance level, indicating income disparities between Andean Highland and Amazonian Indigenous families. Additionally, Amazonian Indigenous women on average have more children (3.1) than Andean Highland women (2.2).

Table 1: Comparing Urban Status, Education, and Family Income Among Andean Highland and Amazonian Indigenous Women With At Least One Child.

	Ethnic Group, n (%)		
	Andean Highlands	Amazon Indigenous	
Urban Status			
Rural	115 (21.02%)	6 (5.31%)	
Urban	406 (74.22%)	5 (4.45%)	
Native	26 (4.75%)	102 (90.27%)	
Total	547	113	*Fischer's Exact = <0.001*
WCBA Education			
None/Some Primary	85 (15.65%)	21 (18.75%)	
Complete Primary/Some Secondary	348 (64.09%)	80 (71.43%)	
Complete Secondary or Higher	110 (20.26%)	11 (9.82%)	
Total	543	112	*Pearson Chi-Squared (2) = 6.79 P = 0.034*
Family Income			
Less than 600 soles	96 (17.81%)	54 (50.00%)	
More than 600 soles	443 (82.19%)	54 (50.00%)	
Total	539	108	*Pearson Chi-Squared (1) = 52.35 P = <0.001*
Less than 300 Soles	31 (32.39%)	24 (44.44%)	
More than 300 Soles	65 (67.71%)	30 (55.56%)	
Total	96	54	*Pearson Chi-Squared (1) = 2.20 P = 0.138*
Less than 1000 Soles	119 (26.86%)	31 (56.36%)	
More than 1000 Soles	324 (73.14%)	24 (43.64%)	
Total	443	54	*Pearson Chi-Squared (1) = 20.23 P = <0.001*

3.2 Trends in Birth Location and Birth Attendance

Table 2 compares the birth locations and birth attendance of children born to Andean Highland and Amazonian Indigenous women, regardless of birth year. Chi-squared testing resulted in a p value of less than 0.001 in both outcome variables, indicating statistically significant differences at the 0.05 level of birth locations and birth attendants used between women of Andean Highland and Amazonian Indigenous decent. By far, most Amazonian Indigenous children were born at home (57.39%), compared to 15.07% of Andean Highland children. Ministry of Health posts were the second most common birth location for both Amazonian Indigenous (24.15%) and Andean Highland (36.16%) children. Public hospitals were the most common birth location for children of Andean Highland decent (41.43%) compared to just 8.52% of Amazonian Indigenous children. Utilization of birth attendants follows similar trends; an overwhelming majority (53.98%) of Amazonian Indigenous births were attended by a relative of the mother – while attendance by nurses was much lower at 21.88%. Birth attendance by a doctor or nurse surpassed 70% of children born to women of Andean Highland decent compared to just over 30% of children born to Amazonian Indigenous women.

Table 2: Reported Birth Locations and Birth Attendance for Children of Andean Highland and Amazonian Indigenous Decent. There is a significant difference in both outcomes between ethnic groups.

	Ethnic Group, n (%)		
	Andean Highlands	Amazon Indigenous	
Birth Location			
Public Hospital	503 (41.43%)	30 (8.52%)	
MOH Post	439 (36.16%)	85 (24.15%)	
Private Hospital/Clinic	86 (7.08%)	10 (2.84%)	
In My House	183 (15.07%)	202 (57.39%)	
Other	3 (0.25%)	25 (7.10%)	
Total	1,214	352	*Pearson chi-squared (4) = 377.06 P =< 0.001*
	Andean Highlands	Amazon Indigenous	
Birth Attendance			
Nobody	3 (0.25%)	7 (1.99%)	
Doctor	467 (38.47%)	31 (8.81%)	
Nurse	455 (37.48%)	77 (21.88%)	
Midwife	163 (13.43%)	29 (8.24%)	
Relative	112 (9.23%)	190 (53.98%)	
Other	14 (1.15%)	18 (5.11%)	
Total	1,214	352	*Pearson chi-squared (5) = 418.33 P = <0.001*

Tables 3 and 4 display trends in birth location birth attendance over time for Andean Highland and Amazonian Indigenous women, respectively. Public hospitals have been reliably the most utilized location for Andean Highland women to give birth since 2000. Home births sharply decreased from 40.27% in pre-2000 to 2.39% in 2010-2015. Similarly, health posts have been a popular place to give birth among Andean Highland women and now host 42% of their births. The percentage of births in public hospitals among Amazonian Indigenous women remain low at 12.62% but has increased since pre-2000. The percentage of Amazonian Indigenous children born at health posts has also increased, from 19.19% in the pre-2000s to a peak of 33.71% in 2005-2009. Meanwhile, the percentage of Amazonian Indigenous women births at home has decreased slightly from two-thirds in the pre-2000s to 53.40% in 2010-2015. However, home births remain by far the most popular birth location for Amazonian Indigenous women. Similarly, birth attendance by a relative remains the most common choice of Amazonian Indigenous women but has decreased to 43.69% in 2010-2015 from 67.68% in pre-2000s; meanwhile, the percentage of births attended by nurses among Amazonian Indigenous women has approximately doubled.

Table 3: Birth Location and Birth Attendance Trends of Andean Highland Women Across Time. Public hospitals and Ministry of Health posts remain the most likely place for these women to give birth, while home birth percentages have drastically decreased over time. Attendance by nurses has steadily increased, while attendance by a relative is approaching zero.

	Birth Year, n (%)			
	Pre-2000	2000-2004	2005-2009	2010-2015
Birth Location				
Public Hospital	87 (29.69%)	88 (41.51%)	136 (46.90%)	192 (45.82%)
MOH Post	68 (23.21%)	76 (38.85%)	119 (41.03%)	176 (42.00%)
Private Hospital/Clinic	20 (6.83%)	13 (6.13%)	14 (4.83%)	39 (9.31%)
In My House	118 (40.27%)	35 (16.51%)	20 (6.90%)	10 (2.39%)
Other	0 (0%)	0 (0%)	1 (0.34%)	2 (0.48%)
Total	293	212	290	419
	Pre-2000	2000-2004	2005-2009	2010-2015
Birth Attendance				
Nobody	1 (0.34%)	0 (0%)	1 (0.34%)	1 (0.24%)
Doctor	79 (26.96%)	77 (36.32%)	133 (45.86%)	178 (42.48%)
Nurse	84 (28.67%)	81 (38.21%)	110 (37.93%)	180 (42.92%)
Midwife	55 (18.77%)	29 (13.68%)	29 (10.00%)	50 (11.93%)
Relative	72 (24.57%)	20 (9.43%)	13 (4.48%)	7 (1.67%)
Other	2 (0.68%)	5 (2.36%)	4 (1.38%)	3 (0.72%)
Total	293	212	290	419

Table 4: Birth Location and Birth Attendance Trends of Amazonian Indigenous Women Across Time. Homes remain the most popular location to give birth, but percentages of births given at home have declined over time while births in health posts have generally increased. Attendance by relatives follows a similar pattern, with women increasingly being attended by doctors and nurses.

	Birth Year, n (%)			
	Pre-2000	2000-2004	2005-2009	2010-2015
Birth Location				
Public Hospital	7 (7.07%)	2 (3.28%)	8 (8.99%)	13 (12.62%)
MOH Post	19 (19.19%)	9 (14.75%)	30 (33.71%)	27 (26.21%)
Private Hospital/Clinic	2 (2.02%)	1 (1.64%)	3 (3.37%)	4 (3.88%)
In My House	66 (66.67%)	39 (63.39%)	42 (47.19%)	55 (53.40%)
Other	5 (5.05%)	10 (16.39%)	6 (6.74%)	4 (3.88%)
Total	99	61	89	103
	Pre-2000	2000-2004	2005-2009	2010-2015
Birth Attendance				
Nobody	0 (0%)	1 (1.64%)	2 (2.25%)	4 (3.88%)
Doctor	5 (5.05%)	3 (4.92%)	10 (11.24%)	13 (12.62%)
Nurse	13 (13.13%)	9 (14.75%)	28 (31.46%)	27 (26.21%)
Midwife	11 (11.11%)	4 (6.56%)	6 (6.74%)	8 (7.77%)
Relative	67 (67.68%)	39 (63.93%)	39 (43.82%)	45 (43.69%)
Other	3 (3.03%)	5 (8.20%)	4 (4.49%)	6 (5.83%)
Total	99	61	89	103

GEE logistic regression modeling was used to formally test for differences in the utilization of birth locations and birth attendants between Andean Highland and Amazonian Indigenous women across the defined periods of time, and to account for data clustering by mother. The model for birth location tested for differences in delivery at a health care structure (public hospital, health post, or private clinic) versus home birth, while the model for birth attendance tests for differences in delivery with a skilled birth attendant ("SBA;"doctor, nurse, or midwife) versus attendance by a relative. The GEE regression model output tables for both outcomes as discussed in chapter 2.6 can be viewed in Appendix A. Presented in Table 5 are marginal odds ratios of health structure births and attendance by an SBA across the defined time periods with 95% confidence intervals.

Table 5: Marginal Odds of Giving Birth in a Health Structure & Attendance by SBAs Over Time by Ethnicity.

	Birth Year, Marginal Odds Ratio (95% CI)			
Birth in Health Struct.	Pre-2000	2000-2004	2005-2009	2010-2015
Andean Highlands (n=1,214)	2.62 (2.01, 3.41)	6.75 (4.79, 9.52)	12.75 (8.57, 18.97)	23.33 (14.58, 37.34)
Amz. Indigenous (n=359)	0.59 (0.37, 0.95)	0.61 (0.37, 1.00)	1.13 (0.74, 1.71)	0.81 (0.54, 1.22)
Birth with SBA	Pre-2000	2000-2004	2005-2009	2010-2015
Andean Highlands (n=1,214)	3.57 (2.66, 4.79)	13.24 (8.28, 21.18)	24.01 (13.98, 41.25)	41.57 (22.26, 77.63)
Amz. Indigenous (n=359)	0.59 (0.36, 0.94)	0.62 (0.38, 1.03)	1.17 (0.76, 1.78)	1.11 (0.73, 1.69)

The odds of Andean Highland women giving birth in a public hospital, health post, or private health facility versus birth at home have steadily and significantly increased over time. In the pre-2000s era, Highland women's odds of giving birth in a health facility was 2.62 times the odds of Highland women giving birth at home, while the odds of Highland women giving birth in a health structure in 2010-2015 was 23.33 times the odds of Highland women giving birth at home. Likewise, the odds of Amazonian Indigenous women giving birth in a health structure have generally increased over time; Indigenous women were 81% as likely in 2010-2015 to give birth in a health structure versus at home, compared to just 59% in the pre-2000s era. While this trend is encouraging, utilization of health structures by Amazonian Indigenous women is still much less than utilization by Andean Highland women and appears to have stagnated. From 2005-2009, Amazonian Indigenous women were nearly as likely to give birth in a health structure as at home, while these odds dropped to 0.81 in 2010-2015. These odds of giving birth in a health structure relative to home birth are much less than the Andean Highland odds of 23.33.

Similarly, Andean Highland women have substantially higher odds in 2010-2015 of having a doctor, nurse, or midwife attend their birth (41.57) compared to the pre-2000s (3.57). Utilization has markedly increased over the course of the time periods indicated. Amazonian Indigenous women have also general increases in utilization of skilled birth attendants; the odds of indigenous women using a skilled birth attendant in

2010-2015 are almost equal to the odds of indigenous women having a relative attend the birth in the same time period. This is a noticeable increase from the 0.59 and 0.62 odds ratios seen in pre-2000 and 2000-2004. However, much like the trend in birth location, gains in skilled birth attendant utilization appear to have stagnated since 2005 and are much lower than the odds ratios seen in Andean Highland women.

4. Discussion

Both Andean Highland and Amazonian Indigenous women have increased giving birth in hospitals, health posts, and private clinics over time relative to home births. Andean Highland and Amazonian Indigenous women also have increased their utilization of doctors, nurses, and midwives as birth attendants relative to family members. In the time periods of 2000-2015, there is not a statistically significant difference in the odds of Amazonian Indigenous women giving birth in a health structure versus at home, nor in the odds of giving birth with a skilled birth attendant versus a relative. In fact, the odds ratio estimates for these outcomes hover around 1 during 2005-2009 and 2010-2015, indicating that Amazonian Indigenous women were approximately as likely to utilize health structures and SBAs as to give birth at home under the care of a relative. This is encouraging, as these odds are higher than those seen among Amazonian Indigenous women in the pre-2000s and from 2000-2004 - especially considering the striking disparities in maternal mortality estimates within the Madre de Dios region during this time [25].

Despite these trends, the odds ratio estimates obtained via GEE logistic regression show quite the disparity in health structure and SBA utilization between Andean Highland and Amazonian Indigenous women. The odds ratio estimates of health structure birth for Andean Highland women relative to home birth have never been below 2.62 and peak at 23.33 (2010-2015), while the odds ratio estimates for Amazonian Indigenous women surpassed 1 only in 2005-2009. Similarly, odds ratio estimates for SBA utilization were 3.57 for Andean Highland women at the lowest (pre-2000s), while odds ratio estimates for SBA utilization of Amazonian indigenous women surpassed 1 in 2005-2009 and 2010-2015. In the most recent study time period (2010-2015), large odds ratio estimates indicate that Andean Highland women rarely gave birth at home in attendance of a relative and mostly deliver at health structures in the care of a SBA. This is in stark contrast to the utilization behaviors of Amazonian Indigenous women, where there is no statistically significant difference in the odds of giving birth at home versus at a health structure or being attended by a SBA versus a relative.

However, this regression model does not show the fact that home births and attendance by relatives remain, by far, the most frequented location and attendance option for Amazonian Indigenous women when disaggregated. In 2010-2015, indigenous women gave birth to over 53% of their children at home, with relatives or

family members attending 43% of births. The next-most utilized birth location and birth attendant was health posts and nurses, both at 26.21% of births.

The trend of increasing odds of health structure and SBA utilization among Amazonian Indigenous communities stagnates from 2005-2015. While the overall change in odds ratios is much improved in terms of indigenous women increasingly receiving protective labor and delivery services compared to the past, the plateau in the trend indicates that additional barriers to utilization may exist for Amazonian Indigenous women as opposed to Andean Highland women, who continued to dramatically increased utilization of these services across these time periods. While the beliefs, history, and culture that accompany indigenous ethnic groups are major factors in influencing allopathic health care utilization, other determinants create a multifactorial environment that may prevent indigenous peoples from accessing allopathic delivery services and skilled birth attendants if needed. From the study sample characteristics in Table 1, Amazonian Indigenous women live mostly in Native communities, are significantly less likely to complete secondary schooling than Andean Highland women and have statistically different income levels in the study-defined income brackets – usually making less than the amount that the question presents. These determinants are consistent with barriers to utilization of delivery services in the body of literature, among many others, including maternal age, ease of transportation, child's birth order, and ability of the mother to make decisions regarding her own care [10, 34].

This objective of this preliminary study did not include examining the effects of these accompanying determinants on delivery service utilization. Additional research and statistical modeling is necessary to determine the true impact of these determinants on birth location and birth attendance outcomes among women in the ACR. The Hunt Baseline Study, while extensive in its coverage of several demographic variables, was not designed to probe participants as to why they used or did not use certain birth locations or attendants. Both advanced modeling, such as backwards elimination, complemented with deeper, targeted qualitative investigations into the preferences of women in the ACR may provide vital information on why Amazonian Indigenous women in this region still have high home birth and relative birth attendant rates.

Such information is critical in informing potential programs for pregnant Amazonian women. From elsewhere in Latin America (Guatemala), interviews with traditional birth attendants revealed mixed results on attitudes regarding birth in hospitals. Some stated that the care at the hospital was of good quality, but few, if any, traditional birth attendants had ever sent patients to the hospital - many of them stating that the women in the community vehemently resist delivering at a hospital [30]. Community women often believed that clinic staff did not attend to them well, and/or that they would be injured or die if transferred to a hospital [30]. Attitudes, preferences, and beliefs regarding birth should be investigated in these indigenous groups before

adjusting existing maternal health care provision in the ACR, as women are generally increasing their utilization of allopathic health structures and attendants with the systems currently in place. From this, it could be inferred that barriers to access to these structures – whether they be cultural, geographic, or otherwise – are changing in some manner. The inception and paving of the Interoceanic Highway in 2006 could be contributing to this trend, although this has not been the case in nearby indigenous communities in Brazil [17]. Examining the influences of this ecological complex of determinants on delivery service utilization is not possible without both qualitative and quantitative expansion of Hunt Baseline Study data beyond that seen in this sub study.

4.1 Implications for Policy and Practice

Utilization of allopathic health structures and skilled birth attendants among both Andean Highland and Amazonian Indigenous women have increased since pre-2000 – however, Amazonian Indigenous women still have high odds of giving birth at home with a relative. Data from other parts of Latin America indicate that women may avoid giving birth at allopathic health structures because of poor perceptions, negative beliefs regarding visits to the hospital, and fear of abuse or mistreatment [19, 30, 31, 34]. Successful global health programs and policies are built on valid evidence and values of all involved – from the policymaker, to the implementer, and consumer [32]. If the overarching goal is to improve the health of these disadvantaged populations and eliminate preventable maternal death as called for in the SDGs, then policies and

programs should be changed or implemented to reflect the values of those at the receiving end of the service – in this case, the indigenous people. Further qualitative and quantitative research done in an engaging manner with Amazonian Indigenous women assessing all barriers to health structure and SBA utilization can assist in assessing the effectiveness and gaps in current policies and programs.

4.2 Implications for Further Research

The need for supplementary qualitative data has been described above. Without critical, detailed data to support the quantitative trends found in this analysis, it will be impossible to implement a successful program or policy that is well informed by the beliefs and opinions of women and their families. Possible themes to be examined could include: exploration of traditional birthing practices and beliefs among the indigenous population, perceptions and/or experiences regarding allopathic health care and delivery, and discussing previous births with mothers to examine why they made the decisions to give birth where and with whom they did at the time. Additionally, the bivariate analyses of income, urban status, and education level suggest that there are demographic differences between Andean Highland and Amazonian Indigenous that are associated with delivery service utilization outcomes in the current body of literature. An advanced multivariate modeling approach beyond that used in this study, such as backwards elimination, may provide key information on how these variables are affecting the relationship between utilization outcomes and ethnicity.

Questions addressing these determinants should also be included in qualitative data collection guide and will help put a story and descriptive emphasis on quantitative findings.

4.3 Study Strengths and Limitations

The Hunt Baseline Study contains data on perhaps the largest known cohort to date of Amazonian indigenous Peruvians. The study's protocol strength is that it is a robust community-based sample with self-reported demographic and health information. This serves as a strength in contrast to facility-based studies, which are likely miss data on women who give birth outside of a health structure. In the context of the ACR, a facility-based approach would have excluded most of the Amazonian Indigenous population. Another strength of this study is that it used logistic regression to provide statistically significant comparisons between ethnic groups odds of birth location and birth attendance across time, allowing us to see the increasing utilization of health structures and SBAs among the study sample.

There are weaknesses in this study that should be noted. First, study the methods used could have been more robust. The method for collecting data regarding ethnicity via a partnering anthropologist was a quick fix action that arguably should have taken place in the original Hunt Baseline Study. However, given the resources available, this was the best way to obtain the data, though there is potential for inaccuracies and missing data on the grounds of human error. It may be worthwhile, if further data

collection ensues in this region, to add a survey item asking about household member ethnicity.

The classification of urban/rural status is additional issue for further analysis. By the definition of "Urban, Rural, and Native" status of communities as seen in the Hunt Baseline Study, this variable is likely to be collinear with indigenous status, as few Amazonian Indigenous women were found living in urban and rural communities. Proximity to allopathic health structures and/or ease of travel to should be considered in future models to assess the true potential effect of ethnicity and household distance to health structures on the outcomes of birth location and birth attendance, as urban/rural status may not appropriately define the difficulties in accessing allopathic care.

Lastly, the logistic regression model used in this preliminary analysis was implemented to examine utilization of birth locations and attendants over time by Amazonian Indigenous and Andean Highland women and did not account for potential confounding or modifying factors such as distance to health post, ability to pay for services, or women's education level. In order to examine the true effect of ethnicity on delivery service utilization in this region, a mixed method approach that utilizes GEE and/or backwards elimination will need to be performed.

5. Conclusion

Emphasis on utilization of skilled birth attendants has long been championed by international bodies such as the WHO to reduce the risk of maternal mortality, which

occurs most often at the time of birth or within 48 hours. However, numerous factors may prevent women from delivering in the attendance of a skilled birth attendant or in an allopathic health location, such as ethnicity and cultural beliefs, inability to pay for or travel to services, and poor perceived quality of care at the hands on allopathic health workers. These barriers can result in higher maternal mortality ratios, and current literature indicates that indigenous populations in Latin America are experiencing significantly higher maternal mortality ratios than baseline populations. In the ACR, Amazonian Indigenous women are poorer than Andean Highland women and primarily live in native communities yet are increasing their use of allopathic health structures and personnel for deliveries. Still, attendance by family members and giving birth at home remain the most common way in which these women deliver their children. Further research and advanced multivariate modeling beyond the methods used in this preliminary analysis should be considered in order to assess the true effect of ethnicity on utilization, and in depth qualitative studies should be considered to supplement these findings before implementing new policies and programs targeting maternal health in these communities. With this study and those that have been suggested, culturally appropriate solutions are within reach for a population whose estimated number of maternal deaths is unacceptably high.

Appendix A

The following tables display GEE logistic regression outputs for the birth location (Table A) and birth attendance (Table B) outcomes. Displayed are log-odds ratios of giving birth in a health structure vs. at home, or odds of giving birth with a SBA vs. with a relative.

Table A: GEE logistic regression model for Birth Location in a health structure compared to home birth.

Birth Location Logit Model	Log-Odds Coefficient	P > |z|	95% CI
Indigenous	-1.48	<0.001	-2.03, -0.94
Birth Year			
2000-2004	0.95	<0.001	0.62, 1.27
2005-2009	1.58	<0.001	1.20, 1.97
2010-2015	2.19	<0.001	1.73, 2.64
Birth Year * Indigenous (interaction)			
2000-2004	-0.92	0.001	-1.48, -0.35
2005-2009	-0.94	0.001	-1.52, -0.36
2010-2015	-1.87	<0.001	-2.53, -1.22
_cons (A. Highand, Pre-2000)	0.96	<0.001	0.70, 1.23

Table B: GEE logistic regression output for Birth Attendance with a SBA compared to attendance by a relative.

Birth Attendance Logit Model	Log-Odds Coefficient	P > |z|	95% CI
Indigenous	-1.81	<0.001	-2.37, -1.24
Birth Year			
2000-2004	1.31	<0.001	0.87, 1.75
2005-2009	1.91	<0.001	1.38, 2.43
2010-2015	2.46	<0.001	1.85, 3.06
Birth Year * Indigenous (interaction)			
2000-2004	-1.25	<0.001	-1.90, -0.60
2005-2009	-1.22	0.001	-1.91, -0.52
2010-2015	-1.81	<0.001	-2.60, -1.03
_cons (A. Highand, Pre-2000)	1.27	<0.001	0.98, 1.57

Appendix B

The text below is a copy of the commands within Stata .do files used for this study's

analysis.

```
clear all
set linesize 80
capture log close
set more off

**Load database
use "C:\Users\clayj\Desktop\THESIS.dta"


****************************** VARIABLE GENERATION ****************

**Collapse indigenous groups
gen indig = (.)
replace indig = 0 if Ethnicity == 6
replace indig = 1 if Ethnicity == 0 | Ethnicity == 1 | Ethnicity == 2 | Ethnicity == 4

label define indig_lbl 0 "Andean Highlands" 1 "Amz Indigenous"
label values indig indig_lbl

****Amazonian Indigenous ethnicities
gen amineth = (.)
replace amineth = 0 if Ethnicity == 0 | Ethnicity == 1
replace amineth = 1 if Ethnicity == 2
replace amineth = 2 if Ethnicity == 4

label define amineth_lbl 0 "Harakbut" 1 "Machigenga" 2 "Yine"
label values amineth amineth_lbl

**Birth location
gen bloc_1 = (.)
replace bloc_1 = 1 if fseccq151 == 1 | fseccq151 == 3
```

```
replace bloc_1 = 2 if fseccq151 == 4
replace bloc_1 = 3 if fseccq151 == 2 | fseccq151 == 5 | fseccq151 == 6
replace bloc_1 = 4 if fseccq151 == 8
replace bloc_1 = 5 if fseccq151 == 9 | fseccq151 == 7

label define bloc_1_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_1 bloc_1_lbl

gen bloc_2 = (.)
replace bloc_2 = 1 if fseccq152 == 1 | fseccq152 == 3
replace bloc_2 = 2 if fseccq152 == 4
replace bloc_2 = 3 if fseccq152 == 2 | fseccq152 == 5 | fseccq152 == 6
replace bloc_2 = 4 if fseccq152 == 8
replace bloc_2 = 5 if fseccq152 == 9 | fseccq152 == 7

label define bloc_2_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_2 bloc_2_lbl

gen bloc_3 = (.)
replace bloc_3 = 1 if fseccq153 == 1 | fseccq153 == 3
replace bloc_3 = 2 if fseccq153 == 4
replace bloc_3 = 3 if fseccq153 == 2 | fseccq153 == 5 | fseccq153 == 6
replace bloc_3 = 4 if fseccq153 == 8
replace bloc_3 = 5 if fseccq153 == 9 | fseccq153 == 7

label define bloc_3_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_3 bloc_3_lbl

gen bloc_4 = (.)
replace bloc_4 = 1 if fseccq154 == 1 | fseccq154 == 3
replace bloc_4 = 2 if fseccq154 == 4
replace bloc_4 = 3 if fseccq154 == 2 | fseccq154 == 5 | fseccq154 == 6
replace bloc_4 = 4 if fseccq154 == 8
replace bloc_4 = 5 if fseccq154 == 9 | fseccq154 == 7
```

```
label define bloc_4_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_4 bloc_4_lbl

gen bloc_5 = (.)
replace bloc_5 = 1 if fseccq155 == 1 | fseccq155 == 3
replace bloc_5 = 2 if fseccq155 == 4
replace bloc_5 = 3 if fseccq155 == 2 | fseccq155 == 5 | fseccq155 == 6
replace bloc_5 = 4 if fseccq155 == 8
replace bloc_5 = 5 if fseccq155 == 9 | fseccq155 == 7

label define bloc_5_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_5 bloc_5_lbl

gen bloc_6 = (.)
replace bloc_6 = 1 if fseccq156 == 1 | fseccq156 == 3
replace bloc_6 = 2 if fseccq156 == 4
replace bloc_6 = 3 if fseccq156 == 2 | fseccq156 == 5 | fseccq156 == 6
replace bloc_6 = 4 if fseccq156 == 8
replace bloc_6 = 5 if fseccq156 == 9 | fseccq156 == 7

label define bloc_6_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_6 bloc_6_lbl

gen bloc_7 = (.)
replace bloc_7 = 1 if fseccq157 == 1 | fseccq157 == 3
replace bloc_7 = 2 if fseccq157 == 4
replace bloc_7 = 3 if fseccq157 == 2 | fseccq157 == 5 | fseccq157 == 6
replace bloc_7 = 4 if fseccq157 == 8
replace bloc_7 = 5 if fseccq157 == 9 | fseccq157 == 7

label define bloc_7_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_7 bloc_7_lbl

gen bloc_8 = (.)
replace bloc_8 = 1 if fseccq158 == 1 | fseccq158 == 3
```

```
replace bloc_8 = 2 if fseccq158 == 4
replace bloc_8 = 3 if fseccq158 == 2 | fseccq158 == 5 | fseccq158 == 6
replace bloc_8 = 4 if fseccq158 == 8
replace bloc_8 = 5 if fseccq158 == 9 | fseccq158 == 7

label define bloc_8_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_8 bloc_8_lbl

gen bloc_9 = (.)
replace bloc_9 = 1 if fseccq159 == 1 | fseccq159 == 3
replace bloc_9 = 2 if fseccq159 == 4
replace bloc_9 = 3 if fseccq159 == 2 | fseccq159 == 5 | fseccq159 == 6
replace bloc_9 = 4 if fseccq159 == 8
replace bloc_9 = 5 if fseccq159 == 9 | fseccq159 == 7

label define bloc_9_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_9 bloc_9_lbl

gen bloc_10 = (.)
replace bloc_10 = 1 if fseccq1510 == 1 | fseccq1510 == 3
replace bloc_10 = 2 if fseccq1510 == 4
replace bloc_10 = 3 if fseccq1510 == 2 | fseccq1510 == 5 | fseccq1510 == 6
replace bloc_10 = 4 if fseccq1510 == 8
replace bloc_10 = 5 if fseccq1510 == 9 | fseccq1510 == 7

label define bloc_10_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_10 bloc_10_lbl

gen bloc_11 = (.)
replace bloc_11 = 1 if fseccq1511 == 1 | fseccq1511 == 3
replace bloc_11 = 2 if fseccq1511 == 4
replace bloc_11 = 3 if fseccq1511 == 2 | fseccq1511 == 5 | fseccq1511 == 6
replace bloc_11 = 4 if fseccq1511 == 8
replace bloc_11 = 5 if fseccq1511 == 9 | fseccq1511 == 7
```

```
label define bloc_11_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_11 bloc_11_lbl

gen bloc_12 = (.)
replace bloc_12 = 1 if fseccq1512 == 1 | fseccq1512 == 3
replace bloc_12 = 2 if fseccq1512 == 4
replace bloc_12 = 3 if fseccq1512 == 2 | fseccq1512 == 5 | fseccq1512 == 6
replace bloc_12 = 4 if fseccq1512 == 8
replace bloc_12 = 5 if fseccq1512 == 9 | fseccq1512 == 7

label define bloc_12_lbl 1 "Public Hospital" 2 "MOH Post" 3 "Private Hospital/Clinic" 4 "In My House" 5 "Other"
label values bloc_12 bloc_12_lbl

**Birth Attendance
gen batt_1 = (.)
replace batt_1 = 0 if fseccq161 == 0
replace batt_1 = 1 if fseccq161 == 1
replace batt_1 = 2 if fseccq161 == 2 | fseccq161 == 3
replace batt_1 = 3 if fseccq161 == 5
replace batt_1 = 4 if fseccq161 == 6
replace batt_1 = 5 if fseccq161 == 7 | fseccq161 == 4

label define batt_1_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5 "Other"
label values batt_1 batt_1_lbl

gen batt_2 = (.)
replace batt_2 = 0 if fseccq162 == 0
replace batt_2 = 1 if fseccq162 == 1
replace batt_2 = 2 if fseccq162 == 2 | fseccq162 == 3
replace batt_2 = 3 if fseccq162 == 5
replace batt_2 = 4 if fseccq162 == 6
replace batt_2 = 5 if fseccq162 == 7 | fseccq162 == 4

label define batt_2_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5 "Other"
label values batt_2 batt_2_lbl
```

```
gen batt_3 = (.)
replace batt_3 = 0 if fseccq163 == 0
replace batt_3 = 1 if fseccq163 == 1
replace batt_3 = 2 if fseccq163 == 2 | fseccq163 == 3
replace batt_3 = 3 if fseccq163 == 5
replace batt_3 = 4 if fseccq163 == 6
replace batt_3 = 5 if fseccq163 == 7 | fseccq163 == 4

label define batt_3_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_3 batt_3_lbl

gen batt_4 = (.)
replace batt_4 = 0 if fseccq164 == 0
replace batt_4 = 1 if fseccq164 == 1
replace batt_4 = 2 if fseccq164 == 2 | fseccq164 == 3
replace batt_4 = 3 if fseccq164 == 5
replace batt_4 = 4 if fseccq164 == 6
replace batt_4 = 5 if fseccq164 == 7 | fseccq164 == 4

label define batt_4_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_4 batt_4_lbl

gen batt_5 = (.)
replace batt_5 = 0 if fseccq165 == 0
replace batt_5 = 1 if fseccq165 == 1
replace batt_5 = 2 if fseccq165 == 2 | fseccq165 == 3
replace batt_5 = 3 if fseccq165 == 5
replace batt_5 = 4 if fseccq165 == 6
replace batt_5 = 5 if fseccq165 == 7 | fseccq165 == 4

label define batt_5_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_5 batt_5_lbl

gen batt_6 = (.)
replace batt_6 = 0 if fseccq166 == 0
```

```
replace batt_6 = 1 if fseccq166 == 1
replace batt_6 = 2 if fseccq166 == 2 | fseccq166 == 3
replace batt_6 = 3 if fseccq166 == 5
replace batt_6 = 4 if fseccq166 == 6
replace batt_6 = 5 if fseccq166 == 7 | fseccq166 == 4

label define batt_6_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_6 batt_6_lbl

gen batt_7 = (.)
replace batt_7 = 0 if fseccq167 == 0
replace batt_7 = 1 if fseccq167 == 1
replace batt_7 = 2 if fseccq167 == 2 | fseccq167 == 3
replace batt_7 = 3 if fseccq167 == 5
replace batt_7 = 4 if fseccq167 == 6
replace batt_7 = 5 if fseccq167 == 7 | fseccq167 == 4

label define batt_7_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_7 batt_7_lbl

gen batt_8 = (.)
replace batt_8 = 0 if fseccq168 == 0
replace batt_8 = 1 if fseccq168 == 1
replace batt_8 = 2 if fseccq168 == 2 | fseccq168 == 3
replace batt_8 = 3 if fseccq168 == 5
replace batt_8 = 4 if fseccq168 == 6
replace batt_8 = 5 if fseccq168 == 7 | fseccq168 == 4

label define batt_8_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_8 batt_8_lbl

gen batt_9 = (.)
replace batt_9 = 0 if fseccq169 == 0
replace batt_9 = 1 if fseccq169 == 1
replace batt_9 = 2 if fseccq169 == 2 | fseccq169 == 3
replace batt_9 = 3 if fseccq169 == 5
```

```
replace batt_9 = 4 if fseccq169 == 6
replace batt_9 = 5 if fseccq169 == 7 | fseccq169 == 4

label define batt_9_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_9 batt_9_lbl

gen batt_10 = (.)
replace batt_10 = 0 if fseccq1610 == 0
replace batt_10 = 1 if fseccq1610 == 1
replace batt_10 = 2 if fseccq1610 == 2 | fseccq1610 == 3
replace batt_10 = 3 if fseccq1610 == 5
replace batt_10 = 4 if fseccq1610 == 6
replace batt_10 = 5 if fseccq1610 == 7 | fseccq1610 == 4

label define batt_10_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_10 batt_10_lbl

gen batt_11 = (.)
replace batt_11 = 0 if fseccq1611 == 0
replace batt_11 = 1 if fseccq1611 == 1
replace batt_11 = 2 if fseccq1611 == 2 | fseccq1611 == 3
replace batt_11 = 3 if fseccq1611 == 5
replace batt_11 = 4 if fseccq1611 == 6
replace batt_11 = 5 if fseccq1611 == 7 | fseccq1611 == 4

label define batt_11_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_11 batt_11_lbl

gen batt_12 = (.)
replace batt_12 = 0 if fseccq1612 == 0
replace batt_12 = 1 if fseccq1612 == 1
replace batt_12 = 2 if fseccq1612 == 2 | fseccq1612 == 3
replace batt_12 = 3 if fseccq1612 == 5
replace batt_12 = 4 if fseccq1612 == 6
replace batt_12 = 5 if fseccq1612 == 7 | fseccq1612 == 4
```

```
label define batt_12_lbl 0 "Nobody" 1 "Doctor" 2 "Nurse" 3 "Midwife" 4 "Relative" 5
"Other"
label values batt_12 batt_12_lbl

**Birth year
gen birthyr_1 = (.)
replace birthyr_1 = 0 if fseccq14yyyy1 == 1980 | fseccq14yyyy1 == 1981 | fseccq14yyyy1
== 1982 | fseccq14yyyy1 == 1983 | fseccq14yyyy1 == 1984 | fseccq14yyyy1 == 1985 |
fseccq14yyyy1 == 1986 | fseccq14yyyy1 == 1987 | fseccq14yyyy1 == 1988 | fseccq14yyyy1
== 1989 | fseccq14yyyy1 == 1990 | fseccq14yyyy1 == 1991 | fseccq14yyyy1 == 1992 |
fseccq14yyyy1 == 1993 | fseccq14yyyy1 == 1994 | fseccq14yyyy1 == 1995 | fseccq14yyyy1
== 1996 | fseccq14yyyy1 == 1997 | fseccq14yyyy1 == 1998 | fseccq14yyyy1 == 1999
replace birthyr_1 = 1 if fseccq14yyyy1 == 2000 | fseccq14yyyy1 == 2001 | fseccq14yyyy1
== 2002 | fseccq14yyyy1 == 2003 | fseccq14yyyy1 == 2004
replace birthyr_1 = 2 if fseccq14yyyy1 == 2005 | fseccq14yyyy1 == 2006 | fseccq14yyyy1
== 2007 | fseccq14yyyy1 == 2008 | fseccq14yyyy1 == 2009
replace birthyr_1 = 3 if fseccq14yyyy1 == 2010 | fseccq14yyyy1 == 2011 | fseccq14yyyy1
== 2012 | fseccq14yyyy1 == 2013 | fseccq14yyyy1 == 2014 | fseccq14yyyy1 == 2015

label define birthyr_1_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_1 birthyr_1_lbl

gen birthyr_2 = (.)
replace birthyr_2 = 0 if fseccq14yyyy2 == 1980 | fseccq14yyyy2 == 1981 | fseccq14yyyy2
== 1982 | fseccq14yyyy2 == 1983 | fseccq14yyyy2 == 1984 | fseccq14yyyy2 == 1985 |
fseccq14yyyy2 == 1986 | fseccq14yyyy2 == 1987 | fseccq14yyyy2 == 1988 | fseccq14yyyy2
== 1989 | fseccq14yyyy2 == 1990 | fseccq14yyyy2 == 1991 | fseccq14yyyy2 == 1992 |
fseccq14yyyy2 == 1993 | fseccq14yyyy2 == 1994 | fseccq14yyyy2 == 1995 | fseccq14yyyy2
== 1996 | fseccq14yyyy2 == 1997 | fseccq14yyyy2 == 1998 | fseccq14yyyy2 == 1999
replace birthyr_2 = 1 if fseccq14yyyy2 == 2000 | fseccq14yyyy2 == 2001 | fseccq14yyyy2
== 2002 | fseccq14yyyy2 == 2003 | fseccq14yyyy2 == 2004
replace birthyr_2 = 2 if fseccq14yyyy2 == 2005 | fseccq14yyyy2 == 2006 | fseccq14yyyy2
== 2007 | fseccq14yyyy2 == 2008 | fseccq14yyyy2 == 2009
replace birthyr_2 = 3 if fseccq14yyyy2 == 2010 | fseccq14yyyy2 == 2011 | fseccq14yyyy2
== 2012 | fseccq14yyyy2 == 2013 | fseccq14yyyy2 == 2014 | fseccq14yyyy2 == 2015

label define birthyr_2_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_2 birthyr_2_lbl
```

```
gen birthyr_3 = (.)
replace birthyr_3 = 0 if fseccq14yyyy3 == 1980 | fseccq14yyyy3 == 1981 | fseccq14yyyy3
== 1982 | fseccq14yyyy3 == 1983 | fseccq14yyyy3 == 1984 | fseccq14yyyy3 == 1985 |
fseccq14yyyy3 == 1986 | fseccq14yyyy3 == 1987 | fseccq14yyyy3 == 1988 | fseccq14yyyy3
== 1989 | fseccq14yyyy3 == 1990 | fseccq14yyyy3 == 1991 | fseccq14yyyy3 == 1992 |
fseccq14yyyy3 == 1993 | fseccq14yyyy3 == 1994 | fseccq14yyyy3 == 1995 | fseccq14yyyy3
== 1996 | fseccq14yyyy3 == 1997 | fseccq14yyyy3 == 1998 | fseccq14yyyy3 == 1999
replace birthyr_3 = 1 if fseccq14yyyy3 == 2000 | fseccq14yyyy3 == 2001 | fseccq14yyyy3
== 2002 | fseccq14yyyy3 == 2003 | fseccq14yyyy3 == 2004
replace birthyr_3 = 2 if fseccq14yyyy3 == 2005 | fseccq14yyyy3 == 2006 | fseccq14yyyy3
== 2007 | fseccq14yyyy3 == 2008 | fseccq14yyyy3 == 2009
replace birthyr_3 = 3 if fseccq14yyyy3 == 2010 | fseccq14yyyy3 == 2011 | fseccq14yyyy3
== 2012 | fseccq14yyyy3 == 2013 | fseccq14yyyy3 == 2014 | fseccq14yyyy3 == 2015

label define birthyr_3_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_3 birthyr_3_lbl

gen birthyr_4 = (.)
replace birthyr_4 = 0 if fseccq14yyyy4 == 1980 | fseccq14yyyy4 == 1981 | fseccq14yyyy4
== 1982 | fseccq14yyyy4 == 1983 | fseccq14yyyy4 == 1984 | fseccq14yyyy4 == 1985 |
fseccq14yyyy4 == 1986 | fseccq14yyyy4 == 1987 | fseccq14yyyy4 == 1988 | fseccq14yyyy4
== 1989 | fseccq14yyyy4 == 1990 | fseccq14yyyy4 == 1991 | fseccq14yyyy4 == 1992 |
fseccq14yyyy4 == 1993 | fseccq14yyyy4 == 1994 | fseccq14yyyy4 == 1995 | fseccq14yyyy4
== 1996 | fseccq14yyyy4 == 1997 | fseccq14yyyy4 == 1998 | fseccq14yyyy4 == 1999
replace birthyr_4 = 1 if fseccq14yyyy4 == 2000 | fseccq14yyyy4 == 2001 | fseccq14yyyy4
== 2002 | fseccq14yyyy4 == 2003 | fseccq14yyyy4 == 2004
replace birthyr_4 = 2 if fseccq14yyyy4 == 2005 | fseccq14yyyy4 == 2006 | fseccq14yyyy4
== 2007 | fseccq14yyyy4 == 2008 | fseccq14yyyy4 == 2009
replace birthyr_4 = 3 if fseccq14yyyy4 == 2010 | fseccq14yyyy4 == 2011 | fseccq14yyyy4
== 2012 | fseccq14yyyy4 == 2013 | fseccq14yyyy4 == 2014 | fseccq14yyyy4 == 2015

label define birthyr_4_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_4 birthyr_4_lbl

gen birthyr_5 = (.)
replace birthyr_5 = 0 if fseccq14yyyy5 == 1980 | fseccq14yyyy5 == 1981 | fseccq14yyyy5
== 1982 | fseccq14yyyy5 == 1983 | fseccq14yyyy5 == 1984 | fseccq14yyyy5 == 1985 |
fseccq14yyyy5 == 1986 | fseccq14yyyy5 == 1987 | fseccq14yyyy5 == 1988 | fseccq14yyyy5
== 1989 | fseccq14yyyy5 == 1990 | fseccq14yyyy5 == 1991 | fseccq14yyyy5 == 1992 |
```

```
fseccq14yyyy5 == 1993 | fseccq14yyyy5 == 1994 | fseccq14yyyy5 == 1995 | fseccq14yyyy5
== 1996 | fseccq14yyyy5 == 1997 | fseccq14yyyy5 == 1998 | fseccq14yyyy5 == 1999
replace birthyr_5 = 1 if fseccq14yyyy5 == 2000 | fseccq14yyyy5 == 2001 | fseccq14yyyy5
== 2002 | fseccq14yyyy5 == 2003 | fseccq14yyyy5 == 2004
replace birthyr_5 = 2 if fseccq14yyyy5 == 2005 | fseccq14yyyy5 == 2006 | fseccq14yyyy5
== 2007 | fseccq14yyyy5 == 2008 | fseccq14yyyy5 == 2009
replace birthyr_5 = 3 if fseccq14yyyy5 == 2010 | fseccq14yyyy5 == 2011 | fseccq14yyyy5
== 2012 | fseccq14yyyy5 == 2013 | fseccq14yyyy5 == 2014 | fseccq14yyyy5 == 2015

label define birthyr_5_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_5 birthyr_5_lbl

gen birthyr_6 = (.)
replace birthyr_6 = 0 if fseccq14yyyy6 == 1980 | fseccq14yyyy6 == 1981 | fseccq14yyyy6
== 1982 | fseccq14yyyy6 == 1983 | fseccq14yyyy6 == 1984 | fseccq14yyyy6 == 1985 |
fseccq14yyyy6 == 1986 | fseccq14yyyy6 == 1987 | fseccq14yyyy6 == 1988 | fseccq14yyyy6
== 1989 | fseccq14yyyy6 == 1990 | fseccq14yyyy6 == 1991 | fseccq14yyyy6 == 1992 |
fseccq14yyyy6 == 1993 | fseccq14yyyy6 == 1994 | fseccq14yyyy6 == 1995 | fseccq14yyyy6
== 1996 | fseccq14yyyy6 == 1997 | fseccq14yyyy6 == 1998 | fseccq14yyyy6 == 1999
replace birthyr_6 = 1 if fseccq14yyyy6 == 2000 | fseccq14yyyy6 == 2001 | fseccq14yyyy6
== 2002 | fseccq14yyyy6 == 2003 | fseccq14yyyy6 == 2004
replace birthyr_6 = 2 if fseccq14yyyy6 == 2005 | fseccq14yyyy6 == 2006 | fseccq14yyyy6
== 2007 | fseccq14yyyy6 == 2008 | fseccq14yyyy6 == 2009
replace birthyr_6 = 3 if fseccq14yyyy6 == 2010 | fseccq14yyyy6 == 2011 | fseccq14yyyy6
== 2012 | fseccq14yyyy6 == 2013 | fseccq14yyyy6 == 2014 | fseccq14yyyy6 == 2015

label define birthyr_6_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_6 birthyr_6_lbl

gen birthyr_7 = (.)
replace birthyr_7 = 0 if fseccq14yyyy7 == 1980 | fseccq14yyyy7 == 1981 | fseccq14yyyy7
== 1982 | fseccq14yyyy7 == 1983 | fseccq14yyyy7 == 1984 | fseccq14yyyy7 == 1985 |
fseccq14yyyy7 == 1986 | fseccq14yyyy7 == 1987 | fseccq14yyyy7 == 1988 | fseccq14yyyy7
== 1989 | fseccq14yyyy7 == 1990 | fseccq14yyyy7 == 1991 | fseccq14yyyy7 == 1992 |
fseccq14yyyy7 == 1993 | fseccq14yyyy7 == 1994 | fseccq14yyyy7 == 1995 | fseccq14yyyy7
== 1996 | fseccq14yyyy7 == 1997 | fseccq14yyyy7 == 1998 | fseccq14yyyy7 == 1999
replace birthyr_7 = 1 if fseccq14yyyy7 == 2000 | fseccq14yyyy7 == 2001 | fseccq14yyyy7
== 2002 | fseccq14yyyy7 == 2003 | fseccq14yyyy7 == 2004
```

```
replace birthyr_7 = 2 if fseccq14yyyy7 == 2005 | fseccq14yyyy7 == 2006 | fseccq14yyyy7
== 2007 | fseccq14yyyy7 == 2008 | fseccq14yyyy7 == 2009
replace birthyr_7 = 3 if fseccq14yyyy7 == 2010 | fseccq14yyyy7 == 2011 | fseccq14yyyy7
== 2012 | fseccq14yyyy7 == 2013 | fseccq14yyyy7 == 2014 | fseccq14yyyy7 == 2015

label define birthyr_7_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_7 birthyr_7_lbl

gen birthyr_8 = (.)
replace birthyr_8 = 0 if fseccq14yyyy8 == 1980 | fseccq14yyyy8 == 1981 | fseccq14yyyy8
== 1982 | fseccq14yyyy8 == 1983 | fseccq14yyyy8 == 1984 | fseccq14yyyy8 == 1985 |
fseccq14yyyy8 == 1986 | fseccq14yyyy8 == 1987 | fseccq14yyyy8 == 1988 | fseccq14yyyy8
== 1989 | fseccq14yyyy8 == 1990 | fseccq14yyyy8 == 1991 | fseccq14yyyy8 == 1992 |
fseccq14yyyy8 == 1993 | fseccq14yyyy8 == 1994 | fseccq14yyyy8 == 1995 | fseccq14yyyy8
== 1996 | fseccq14yyyy8 == 1997 | fseccq14yyyy8 == 1998 | fseccq14yyyy8 == 1999
replace birthyr_8 = 1 if fseccq14yyyy8 == 2000 | fseccq14yyyy8 == 2001 | fseccq14yyyy8
== 2002 | fseccq14yyyy8 == 2003 | fseccq14yyyy8 == 2004
replace birthyr_8 = 2 if fseccq14yyyy8 == 2005 | fseccq14yyyy8 == 2006 | fseccq14yyyy8
== 2007 | fseccq14yyyy8 == 2008 | fseccq14yyyy8 == 2009
replace birthyr_8 = 3 if fseccq14yyyy8 == 2010 | fseccq14yyyy8 == 2011 | fseccq14yyyy8
== 2012 | fseccq14yyyy8 == 2013 | fseccq14yyyy8 == 2014 | fseccq14yyyy8 == 2015

label define birthyr_8_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_8 birthyr_8_lbl

gen birthyr_9 = (.)
replace birthyr_9 = 0 if fseccq14yyyy9 == 1980 | fseccq14yyyy9 == 1981 | fseccq14yyyy9
== 1982 | fseccq14yyyy9 == 1983 | fseccq14yyyy9 == 1984 | fseccq14yyyy9 == 1985 |
fseccq14yyyy9 == 1986 | fseccq14yyyy9 == 1987 | fseccq14yyyy9 == 1988 | fseccq14yyyy9
== 1989 | fseccq14yyyy9 == 1990 | fseccq14yyyy9 == 1991 | fseccq14yyyy9 == 1992 |
fseccq14yyyy9 == 1993 | fseccq14yyyy9 == 1994 | fseccq14yyyy9 == 1995 | fseccq14yyyy9
== 1996 | fseccq14yyyy9 == 1997 | fseccq14yyyy9 == 1998 | fseccq14yyyy9 == 1999
replace birthyr_9 = 1 if fseccq14yyyy9 == 2000 | fseccq14yyyy9 == 2001 | fseccq14yyyy9
== 2002 | fseccq14yyyy9 == 2003 | fseccq14yyyy9 == 2004
replace birthyr_9 = 2 if fseccq14yyyy9 == 2005 | fseccq14yyyy9 == 2006 | fseccq14yyyy9
== 2007 | fseccq14yyyy9 == 2008 | fseccq14yyyy9 == 2009
replace birthyr_9 = 3 if fseccq14yyyy9 == 2010 | fseccq14yyyy9 == 2011 | fseccq14yyyy9
== 2012 | fseccq14yyyy9 == 2013 | fseccq14yyyy9 == 2014 | fseccq14yyyy9 == 2015
```

```
label define birthyr_9_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_9 birthyr_9_lbl

gen birthyr_10 = (.)
replace birthyr_10 = 0 if fseccq14yyyy10 == 1980 | fseccq14yyyy10 == 1981 |
fseccq14yyyy10 == 1982 | fseccq14yyyy10 == 1983 | fseccq14yyyy10 == 1984 |
fseccq14yyyy10 == 1985 | fseccq14yyyy10 == 1986 | fseccq14yyyy10 == 1987 |
fseccq14yyyy10 == 1988 | fseccq14yyyy10 == 1989 | fseccq14yyyy10 == 1990 |
fseccq14yyyy10 == 1991 | fseccq14yyyy10 == 1992 | fseccq14yyyy10 == 1993 |
fseccq14yyyy10 == 1994 | fseccq14yyyy10 == 1995 | fseccq14yyyy10 == 1996 |
fseccq14yyyy10 == 1997 | fseccq14yyyy10 == 1998 | fseccq14yyyy10 == 1999
replace birthyr_10 = 1 if fseccq14yyyy10 == 2000 | fseccq14yyyy10 == 2001 |
fseccq14yyyy10 == 2002 | fseccq14yyyy10 == 2003 | fseccq14yyyy10 == 2004
replace birthyr_10 = 2 if fseccq14yyyy10 == 2005 | fseccq14yyyy10 == 2006 |
fseccq14yyyy10 == 2007 | fseccq14yyyy10 == 2008 | fseccq14yyyy10 == 2009
replace birthyr_10 = 3 if fseccq14yyyy10 == 2010 | fseccq14yyyy10 == 2011 |
fseccq14yyyy10 == 2012 | fseccq14yyyy10 == 2013 | fseccq14yyyy10 == 2014 |
fseccq14yyyy10 == 2015

label define birthyr_10_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_10 birthyr_10_lbl

gen birthyr_11 = (.)
replace birthyr_11 = 0 if fseccq14yyyy11 == 1980 | fseccq14yyyy11 == 1981 |
fseccq14yyyy11 == 1982 | fseccq14yyyy11 == 1983 | fseccq14yyyy11 == 1984 |
fseccq14yyyy11 == 1985 | fseccq14yyyy11 == 1986 | fseccq14yyyy11 == 1987 |
fseccq14yyyy11 == 1988 | fseccq14yyyy11 == 1989 | fseccq14yyyy11 == 1990 |
fseccq14yyyy11 == 1991 | fseccq14yyyy11 == 1992 | fseccq14yyyy11 == 1993 |
fseccq14yyyy11 == 1994 | fseccq14yyyy11 == 1995 | fseccq14yyyy11 == 1996 |
fseccq14yyyy11 == 1997 | fseccq14yyyy11 == 1998 | fseccq14yyyy11 == 1999
replace birthyr_11 = 1 if fseccq14yyyy11 == 2000 | fseccq14yyyy11 == 2001 |
fseccq14yyyy11 == 2002 | fseccq14yyyy11 == 2003 | fseccq14yyyy11 == 2004
replace birthyr_11 = 2 if fseccq14yyyy11 == 2005 | fseccq14yyyy11 == 2006 |
fseccq14yyyy11 == 2007 | fseccq14yyyy11 == 2008 | fseccq14yyyy11 == 2009
replace birthyr_11 = 3 if fseccq14yyyy11 == 2010 | fseccq14yyyy11 == 2011 |
fseccq14yyyy11 == 2012 | fseccq14yyyy11 == 2013 | fseccq14yyyy11 == 2014 |
fseccq14yyyy11 == 2015

label define birthyr_11_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
```

```
label values birthyr_11 birthyr_11_lbl

gen birthyr_12 = (.)
replace birthyr_12 = 0 if fseccq14yyyy12 == 1980 | fseccq14yyyy12 == 1981 |
fseccq14yyyy12 == 1982 | fseccq14yyyy12 == 1983 | fseccq14yyyy12 == 1984 |
fseccq14yyyy12 == 1985 | fseccq14yyyy12 == 1986 | fseccq14yyyy12 == 1987 |
fseccq14yyyy12 == 1988 | fseccq14yyyy12 == 1989 | fseccq14yyyy12 == 1990 |
fseccq14yyyy12 == 1991 | fseccq14yyyy12 == 1992 | fseccq14yyyy12 == 1993 |
fseccq14yyyy12 == 1994 | fseccq14yyyy12 == 1995 | fseccq14yyyy12 == 1996 |
fseccq14yyyy12 == 1997 | fseccq14yyyy12 == 1998 | fseccq14yyyy12 == 1999
replace birthyr_12 = 1 if fseccq14yyyy12 == 2000 | fseccq14yyyy12 == 2001 |
fseccq14yyyy12 == 2002 | fseccq14yyyy12 == 2003 | fseccq14yyyy12 == 2004
replace birthyr_12 = 2 if fseccq14yyyy12 == 2005 | fseccq14yyyy12 == 2006 |
fseccq14yyyy12 == 2007 | fseccq14yyyy12 == 2008 | fseccq14yyyy12 == 2009
replace birthyr_12 = 3 if fseccq14yyyy12 == 2010 | fseccq14yyyy12 == 2011 |
fseccq14yyyy12 == 2012 | fseccq14yyyy12 == 2013 | fseccq14yyyy12 == 2014 |
fseccq14yyyy12 == 2015

label define birthyr_12_lbl 0 "Pre-2000" 1 "2000-2004" 2 "2005-2009" 3 "2010-2015"
label values birthyr_12 birthyr_12_lbl

**urban
gen urban = (.)
replace urban = 0 if Comunidad == "Boca Manu" | Comunidad == "Caychihue" |
Comunidad == "Choque" | Comunidad == "Punquiri" | Comunidad == "Puquiri" |
Comunidad == "Quebrada Nueva" | Comunidad == "Quimiri" | Comunidad == "Setapo"
replace urban = 1 if Comunidad == "Boca Colorado" | Comunidad == "Huepetuhue" |
Comunidad == "Quincemil" | Comunidad == "Salvacion"
replace urban = 9 if Comunidad == "Boca Isiriwe" | Comunidad == "Diamante" |
Comunidad == "Isa de los Valles" | Comunidad == "Masenawa" | Comunidad ==
"Palotoa Teparo" | Comunidad == "Puerto Azul" | Comunidad == "Puerto Luz" |
Comunidad == "Queros"| Comunidad == "San Lorenzo" | Comunidad == "Shintuya" |
Comunidad == "Shipetiari"

label define urban_lbl 0 "Rural" 1 "Urban" 9 "Native"
label values urban urban_lbl

**WCBA education
gen wcbaedu = (.)
```

```
replace wcbaedu = 0 if (secaq12_1 == 0 | secaq12_1 == 1 | secaq12_1 == 2 | secaq12_1 == 3
| secaq12_1 == 4 | secaq12_1 == 5) & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 | batt_1 == 3 |
batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
replace wcbaedu = 1 if (secaq12_1 == 6 | secaq12_1 == 7 | secaq12_1 == 8 | secaq12_1 == 9
| secaq12_1 ==10 | secaq12_1 ==11) & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 | batt_1 == 3
| batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
replace wcbaedu = 2 if (secaq12_1 ==12 | secaq12_1 ==13 | secaq12_1 ==14)& (batt_1 == 0
| batt_1 == 1 | batt_1 == 2 | batt_1 == 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1
==7)

label define wcbaedu_lbl 0 "None/Some Primary" 1 "Compl Primary/Some Sec" 2
"Compl Sec or Higher"
label values wcbaedu wcbaedu_lbl

***income
destring seceq21, replace
destring seceq22, replace
destring seceq25, replace
gen famincome600 = (.)
replace famincome600 = 1 if seceq21 == 0 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 |
batt_1 == 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
replace famincome600 = 2 if seceq21 == 1 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 |
batt_1 == 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
gen famincome300 = (.)
replace famincome300 = 1 if seceq22 == 0 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 |
batt_1 == 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
replace famincome300 = 2 if seceq22 == 1 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 |
batt_1 == 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
gen famincome1k = (.)
replace famincome1k = 1 if seceq25 == 0 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 | batt_1
== 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)
replace famincome1k = 2 if seceq25 == 1 & (batt_1 == 0 | batt_1 == 1 | batt_1 == 2 | batt_1
== 3 | batt_1 == 4 | batt_1 == 5 | batt_1 == 6 | batt_1 ==7)


label define famincome600_lbl 1 "Less than 600 Soles" 2 "More than 600 soles"
label values famincome600 famincome600_lbl

label define famincome300_lbl 1 "Less than 300 soles" 2 "More than 300 Soles"
```

```
label values famincome300 famincome300_lbl

label define famincome1k_lbl 1 "Less than 1k soles" 2 "More than 1k Soles"
label values famincome1k famincome1k_lbl

save "C:\Users\clayj\Desktop\THESIS_META.dta", replace

keep pid indig amineth bloc_1 bloc_2 bloc_3 bloc_4 bloc_5 bloc_6 bloc_7 bloc_8 bloc_9
bloc_10 bloc_11 bloc_12 batt_1 batt_2 batt_3 batt_4 batt_5 batt_6 batt_7 batt_8 batt_9
batt_10 batt_11 batt_12 birthyr_1 birthyr_2 birthyr_3 birthyr_4 birthyr_5 birthyr_6
birthyr_7 birthyr_8 birthyr_9 birthyr_10 birthyr_11 birthyr_12 urban wcbaedu
famincome600 famincome300 famincome1k
drop if bloc_1 == . | batt_1 == . | birthyr_1 == .

reshape long bloc_ batt_ birthyr_ , i(pid) j(kid)
drop if bloc_ == . | batt_ == .
drop if indig == .
drop if birthyr_ == .

save "C:\Users\clayj\Desktop\THESIS_smol.dta", replace
*******************************************************************************
clear all
set linesize 120
capture log close
set more off

**Dataset for MOMS
use "C:\Users\clayj\Desktop\THESIS_META.dta"

***Descriptive Tables, Indig Women
drop if indig == .
drop if bloc_1 == .
drop if batt_1 == .
drop if birthyr_1 == .
tab urban indig, exact col
tab wcbaedu indig, chi2 col
tab famincome600 indig, chi2 col
tab famincome300 indig, chi2 col
tab famincome1k indig, chi2 col
```

```
**Change Dataset, for KIDS BORN (long form)
clear all
use "C:\Users\clayj\Desktop\THESIS_smol.dta"

***birth year as indicator variables
tab birthyr_, generate (pdborn)

***Table 2, Crude Bloc_ and Batt_ (expanded) comparing indig
tab bloc_ indig, chi2 col
tab batt_ indig, chi2 col

tab bloc_ birthyr_ if indig == 0, col
tab batt_ birthyr_ if indig == 0, col
tab bloc_ birthyr_ if indig == 1, col
tab batt_ birthyr_ if indig == 1, col

**Binary Outcome Variables
gen bloc_logit = (.)
replace bloc_logit = 0 if bloc_ == 4
replace bloc_logit = 1 if bloc_ == 1 | bloc_ == 2 | bloc_ == 3
label define bloc_logit_lbl 0 "Home birth" 1 "Health Structure"
label values bloc_logit bloc_logit_lbl

gen batt_logit = (.)
replace batt_logit = 0 if batt_ == 4
replace batt_logit = 1 if batt_ == 1 | batt_ == 2 | batt_ == 3
label define batt_logit_lbl 0 "Relative" 1 "Doctor/Nurse/Midwife"
label values batt_logit batt_logit_lbl

***generate interactions manually
gen birthyr_indig = birthyr_*indig

**new numeric PID
gen h3 = substr(pid,1,3)
gen h1 = ""
replace h1 = "01" if h3 == "HBC"
replace h1 = "02" if h3 == "HBI"
replace h1 = "03" if h3 == "HBM"
```

```
replace h1 = "04" if h3 == "HCH"
replace h1 = "05" if h3 == "HCY"
replace h1 = "06" if h3 == "HDM"
replace h1 = "07" if h3 == "HHU"
replace h1 = "08" if h3 == "HIV"
replace h1 = "09" if h3 == "HMN"
replace h1 = "10" if h3 == "HPA"
replace h1 = "11" if h3 == "HPL"
replace h1 = "12" if h3 == "HPN"
replace h1 = "13" if h3 == "HPT"
replace h1 = "14" if h3 == "HQI"
replace h1 = "15" if h3 == "HQM"
replace h1 = "16" if h3 == "HQN"
replace h1 = "17" if h3 == "HQR"
replace h1 = "18" if h3 == "HSA"
replace h1 = "19" if h3 == "HSH"
replace h1 = "20" if h3 == "HSL"
replace h1 = "21" if h3 == "HSP"

gen n1 = substr(pid,4,3)
gen a1 = substr(pid,7,1)
gen a2 = ""
replace a2 = "1" if a1 == "A"
replace a2 = "2" if a1 == "B"
replace a2 = "3" if a1 == "C"
replace a2 = "4" if a1 == "D"
replace a2 = "5" if a1 == "E"
replace a2 = "6" if a1 == "F"
replace a2 = "7" if a1 == "G"
replace a2 = "8" if a1 == "H"

*****GEE and lincoms
gen PID_C = h1+n1+a2
destring PID_C, gen (PID_N)

xtset PID_N
set matsize 1200
```

```
xtgee bloc_logit indig i.birthyr_ i.birthyr_indig, fam(bin) link (logit) eform
lincom _cons, eform /*indig = 0 and birth year = pre2000 */
lincom _cons + indig, eform /* indig = 1 and birth year = pre2000 */
lincom _cons + 1.birthyr_, eform /* indig = 0 and birth year = 2000-2004 */
lincom _cons + 1.birthyr_ + indig + 1.birthyr_indig, eform /* indig = 1 and birth year =
2000-2004 */
lincom _cons + 2.birthyr_, eform /* indig = 0 and birth year = 2005-2009 */
lincom _cons + 2.birthyr_ + indig + 2.birthyr_indig, eform /* indig = 1 and birth year =
2005-2009 */
lincom _cons + 3.birthyr_, eform /* indig = 0 and birth year = 2010-2015 */
lincom _cons + 3.birthyr_ + indig + 3.birthyr_indig, eform /* indig = 1 and birth year =
2010-2015 */

xtgee batt_logit indig i.birthyr_ i.birthyr_indig, fam(bin) link (logit) eform
lincom _cons, eform /*indig = 0 and birth year = pre2000 */
lincom _cons + indig, eform /* indig = 1 and birth year = pre2000 */
lincom _cons + 1.birthyr_, eform /* indig = 0 and birth year = 2000-2004 */
lincom _cons + 1.birthyr_ + indig + 1.birthyr_indig, eform /* indig = 1 and birth year =
2000-2004 */
lincom _cons + 2.birthyr_, eform /* indig = 0 and birth year = 2005-2009 */
lincom _cons + 2.birthyr_ + indig + 2.birthyr_indig, eform /* indig = 1 and birth year =
2005-2009 */
lincom _cons + 3.birthyr_, eform /* indig = 0 and birth year = 2010-2015 */
lincom _cons + 3.birthyr_ + indig + 3.birthyr_indig, eform /* indig = 1 and birth year =
2010-2015 */
```

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