Ethnic Disparities in Prenatal Care Utilization in Vietnam

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Abstract

With dedicated government effort, prenatal care coverage in Vietnam has been improving. However, ethnic minority women still remain behind in receiving adequate levels and types of care. We employ the 2002 Demographic and Health Survey (DHS) to examine the roots of ethnic disparity in prenatal care utilization in Vietnam. Controlling for individual, household and community characteristics, we find that ethnic minority women were only 45% as likely as majority women to have three or more prenatal care visits, and only 25% as likely as majority women to receive professional care. Surprisingly, ethnic minority women were 87% more likely than majority women to report receiving prenatal care in the first trimester. We attribute this finding to minority women's tendency to rely upon traditional birth attendants in their communities, rather than professional healthcare providers. Attending to other covariates, socioeconomic, regional and cultural factors help to explain why ethnic minority women lag behind majority women in utilizing prenatal care.

Keywords: Prenatal care utilization, Ethnic disparities, Vietnam

Introduction

Prenatal care, also known as antenatal care, first became a concern of public health in the late 1930s in Great Britain and quickly spread to other industrial countries (World Health Organization [WHO], 2003). Credited with lowering fetal and infant mortality and leading to the birth of healthier babies, that professional prenatal care is less widely available in developing, transitional societies partially explains global disparities in low birth weight, perinatal health problems and infant mortality. Where more and less developed societies converge is in the disparities that characterize racial-ethnic groups' access to and utilization of prenatal care. In affluent and poor countries particular ethnic minority groups exhibit lags in care utilization that persist in the face of health care expansion and campaigns aimed toward enhancing access to care as a means to improve public health. Vietnam, and its diverse ethnic minorities, most of which continue to reside the in country's remote, mountainous regions, is no exception.

In this paper we examine disparities in the utilization of prenatal care among Vietnamese women, attending to three distinct dimensions of care – timing of onset, frequency of visits, and type of provider – which, in combination, influence the potential of prenatal care to provide preventative and curative measures for the lives of pregnant women and newborns. We draw upon the nationally-representative sample and rich maternal, household and community questionnaires employed in the 2002 Demographic and Health Survey (DHS) to delineate the socioeconomic, demographic, spatial and cultural factors which mediate the association between maternal ethnicity and prenatal care utilization. Numerous scholars have noted the unique socio-cultural place of ethnic minorities in Vietnamese society (Lieu, Dibley, & Byles, 2006; Målqvist, Nguyen, Wallin, Dinh, & Persson, 2010; Simkhada, Teijlingen, Porter, & Simkhada, 2007). Our analyses will aid in understanding the extent to which often disadvantageous patterns of prenatal care utilization

among ethnic minority women stem from demographic, social structural or cultural features of the ethnic minorities vis-à-vis those of the Kinh and Hoa majority groups.

Background – Ethnicity and Disparities in Prenatal Care Utilization

A large body of research has indicated the global trend toward increased prenatal usage and coverage (Lieu et al., 2006, Tran, Nguyen, Nguyen, Eriksson, Bonjers, Gottvall, & Petzold, 2011). Yet movements toward inclusion and broader coverage encompass persistent disparities in access and utilization across women. Paul and Singh (2004) observe a "regional factor" in prenatal health care consumption. Houweling, Ronsmans, Campbell, and Kunst (2007) provide evidence of "poor-rich inequalities" in maternal and infant care. In comprehensive reviews of the literature, Say and Raine (2007), and Simkhada et al. (2007) find similarities in the influence of age, education, household income, maternal employment, and the availability and accessibility of services upon prenatal care usage across a number of countries. Other factors found to be significantly correlated with prenatal care are insurance coverage, quality and cost of services, history of obstetric complications, birth order, cultural beliefs and ideas about pregnancy, media exposure, and parity (Simkhada et al., 2007).

Among the determinants of prenatal care utilization, ethnicity plays a significant role, with access to prenatal care being stratified by ethnic minority status throughout the world. Studies by Caroland (2010), Choté, Koopmans, Redekop, Groot, Hoefman, Jaddoe, and Foets (2011), and Malin and Gissler (2009) point to ethnic minority women's disadvantageous use of prenatal care in developed countries. The same picture is seen in the developing world where ethnic minority groups experience higher risks of adverse pregnancy outcomes and relatively low levels of prenatal care utilization (Magadi, Madise, & Roddrigues, 2000; Pebley, Goldman, & Rodriguez, 1996; Say & Raine, 2007; Simkhada et al., 2007). For instance, Choté et al. (2011) sought an explanation for ethnic differences in late prenatal care

entry in Netherlands. They examined Dutch and non-Dutch women's entrance to prenatal care provided by community midwives. 2,093 pregnant women of Dutch, and other minorities of Moroccan, Turkish, Cape Verdean, Antillean, Surinamese Creole, and Surinamese Hindustani background were selected. The findings suggested that non-Dutch women, except Surinamese-Hindustani, were more likely to enter prenatal care later than Dutch women. Consequently, later receipt of prenatal care after week 14 of gestation reduced the opportunity of being advised about good health practice or being beneficial from suggestions to avoid complications of non-Dutch women, excluding Surinamese-Hindustani. Another example was found by Carolan (2010). Carolan (2010) followed a group of sub-Saharan women who had migrated to developed countries as refugees. Sub-Saharan women were considered as being a minority and were among a group at risk of pregnancy due to little prenatal care access. Poor health prior to pregnancy, co-existing disease, and traditional cultural practices were the determinants of high risk pregnancy for these minorities. Infant mortality and morbidity were predicted as possible pregnancy outcomes and were found comparatively high in the sub-Saharan refugee population in these developed countries.

Health care utilization disparities by ethnicity are often mediated by social and demographic characteristics which distinguish minority groups from the majority population. For instance, maternal age, birth parity, education, and employment, as well as region of residence, have proven to be significant determinants of prenatal care disparities (Simkhada et al. 2007). All of these are dimensions along which ethnic minority women tend to diverge from the majority group. Both Simkhada et al. (2007) and Do (2009) suggest that women are more cautious and more likely to seek prenatal care with the first pregnancy. In terms of education, in many contexts women with higher levels of education tend to consume more prenatal health services and bear healthier babies (Say & Rain, 2007; Simkhada et al., 2007). Employment in higher paying and formal/governmental sector positions correlates positively

with prenatal care utilization, in part due to employer-provided health insurance benefits (Graner, Mogren, Le, Krantz, and Klingbert-Alvin, 2010; Målqvist et al., 2011). Significant regional disparities exist in prenatal care utilization, reflecting socioeconomic differences and differences by region in health services coverage (United Nations Children's Fund, WHO, World Bank, United Nation Population Division, 2012).

One possible method whereby residents of remote regions and ethnic minority groups may be reached with public health messages about prenatal care is via mass media. Furthermore, the very ability to listen to radio and television broadcasts is indicative of women's connection with broader societal institutions; relatively poverty or remoteness would diminish such exposure. Studies of ethnic disparities in healthcare access in other less developed countries have shown media exposure to be a positive determinant of healthcare utilization in minority populations (Pebley, Goldman and Rodriguez, 1996). We undertake to assess whether media exposure in the Vietnamese context may bridge cultural distance and enhance utilization in ways consistent with public health prescriptions.

Due to historical conflict and division, uneven degrees of social and institutional incorporation, discrimination in policy or practice, as well as cultural differences that create barriers to minority and majority group contact and communication, it is quite common for ethnic minority women to reside in more remote, underdeveloped geographic regions, to have low levels of education and to be laboring in informal subsistence work, if not unemployed or underemployed. To assess the mechanisms at work, and whether the underlying sources of disparity are socioeconomic or geospatial, we are careful to analyze the socioeconomic, demographic, and family structural correlates that may mediate ethnicity and prenatal care utilization.

Ethnic Disparities in Vietnam

Vietnamese society is ethnically diverse (Baulch, Truong, Haugton, & Haughton, 2008). The lowland Vietnamese, also known as Kinh or Viet people, are the majority, making up 86 percent of the population of Vietnam (General Statistics Office [GSO], 2012). The rest of the population is composed of 53 ethnic minority groups. Known as "upland peoples" or "Montagnards" in French colonial parlance, Vietnam's ethnic minorities are indigenous to the Southeast Asian highlands and today they concentrate largely in two mountainous regions of Vietnam: the Northern Uplands and the Central Highlands. Studies of ethnic inequality in Vietnam generally group Kinh and Hoa (Chinese) into an ethnic majority group. The other 52 ethnic groups are defined as ethnic minorities (Baulch et al., 2008), and are distinct from the Kinh, the Hoa, and one another ethnically, linguistically, and in terms of many social and cultural practices, such as religious beliefs and practices. Within this umbrella minority category (the official term "*dan toc thieu so*" encompasses 52 distinct peoples), the most numerous are Tay, Thai, Muong, Khmer, and H'mong, with more than one million people in each group (GSO, 2012). In contrast to the Kinh and Hoa groups, ethnic minorities are collectively the poorest and the least educated group of people in Vietnam. The Kinh and Hoa households have substantially higher living standards, as measured by per capita expenditures, than ethnic minority households. A sizable gap between ethnic minorities and majorities in Vietnam is also shown in the proportion of children enrolled in school, total fertility rate, and access to health services (Baulch et al., 2008). In virtually every aspect, minority households reflect disadvantage when compared with Kinh or Hoa households. Ethnic minorities are also more vulnerable to various shocks, namely those related to natural disaster or communicable disease, than the ethnic majority (Imai, Gaiha, and Kang, 2011). Differences across the uplands groups are many, with broad based comparisons suggesting that minority groups residing in the Northern Uplands are economically better off than the

ethnic minorities in the Central Highlands, and particular ethnic minority groups, such as the Tay, Nung and Muong, being relatively well off in comparison to other groups, with the H'mong being among the poorest and most disadvantaged of all (Baulch et al., 2008).

Several explanations have been offered for the patterns of inequality across Vietnam's ethnic groups. The first explanation of ethnic inequalities is the persistence of geographic inequalities (Walle & Gunewardena, 2001). Ethnic minorities reside in "less productive areas, with difficult terrain, poor infrastructure, and lower accessibility to the market economy and off-farm work" (Walle & Gunewardena, 2001, p. 203). Nonetheless, the most agreeable explanation of ethnic disparities is not geographic inequalities. Van de Walle and Gunewardena (2001), Baulch et al. (2008), and Imai et al. (2011) agree that ethnic inequalities are not only the result of concentration in remote locations with poor infrastructure, but also low levels of physical and human capital endowments in ethnic minority communities. They may also have low returns on the endowments they do have based on social discrimination, cultural differences, inadequate information, and remoteness. Recent instances of ethnic minority population resettlement for hydropower development, restrictions on unsanctioned religious practices, and military responses to ethnic minority public protests suggest that ethnicity remains politicized, and minority-majority relations contentious, in contemporary Vietnam (Minority Rights Group International, 2012).

Some studies have suggested the existence of disparities in health care consumption (Teerawichitchainan and Phillips, 2008) and prenatal care disparities among ethnic minorities and majorities in Vietnam (Do, 2009; Lieu, Dibley, & Byles, 2007; Målqvist, Sohel, Do, Eriksson, & Persson, 2010; Sepehri, Sarma, Simpson, & Moshiri, 2008). Existing studies, consisting largely of local case studies or regional analyses, have found that ethnic minority pregnant women tend to enter prenatal care at later gestation ages, have fewer pregnancy check-ups, lack adequate vaccinations, prefer home delivery, and rely upon traditional birth

attendants during delivery. These studies also shed light on ethnic inequalities in rates of neonatal, perinatal, and maternal mortality among women of ethnic minority status in Vietnam (Målqvist et al., 2010).

Our overall hypothesis is that, on several dimensions, ethnic minority women will be less likely than majority women in Vietnam to receive the appropriate level and types of prenatal care as prescribed by the Vietnamese Ministry of Health and in accordance with World Health Organization guidelines. We anticipate that ethnic minority women's utilization will be lower on several dimensions of access. Specifically, we hypothesize that ethnic minority women will be less likely than majority women to receive prenatal care in the first trimester of pregnancy (H1). We also hypothesize that they will be less likely than majority women to receive three or more prenatal checkups (H2), and that they will be less likely than majority women to receive prenatal care from professional (as opposed to informal, nonprofessional) caregivers (H3). Following previous research, we expect that demographic, socioeconomic, geospatial, and cultural distance factors will mediate the association between ethnicity and prenatal care utilization. Accordingly, we hypothesize that women of high socioeconomic status, residing in relatively developed regions, and with exposure to dominant cultural ideas and practices through mass media, will be more likely to practice prenatal care in line with governmental public health prescriptions (H4).

Research Methods

Data

We analyze prenatal care utilization in Vietnam using data from the DHS, conducted in 2002. Conducted in numerous countries throughout the world, the DHS yield data for diverse, comparative analyses of demographic and health issues. Through nationally representative household surveys, the DHS collect a wide range of information on issues

pertinent to our study. The 2002 Vietnam DHS was conducted in October to December, 2002, in 205 random enumeration areas spread throughout 53 provinces or cities in Vietnam.

We rely primarily upon data collected in the DHS Individual Women's Questionnaire. The Individual Women's Questionnaire investigates topics such as reproductive history, family planning knowledge and practices, and practices related to maternal and child health among women of reproductive age. The survey gathered data from 5,706 eligible women, who were married and between the ages of 15 and 49. Of these, 5,665 women were successfully interviewed. Of these, between 1999 and 2002, there were 4,444 women who experienced no birth. To minimize bias, we analyze only most recent, singleton births. Therefore, 1,220 women who had one singleton birth, and 96 women who had more than one singleton birth in the 1999-2002 period are included in our analytical sample. For the 96 women who had more than one pregnancy in the three year observation period, information for the most recent birth is analyzed. The 4,444 women who did not give birth between 1999 and 2002 are excluded from the analysis.

We also rely upon data from the DHS Household and Community and Service Availability Surveys. The household Survey provides information on household characteristics used by DHS to calculate household wealth and construct wealth quintiles. We rely on household wealth quintiles as one measure of maternal socioeconomic position. Additionally, we rely upon household and community survey measures of remoteness and modernity to further characterize the geospatial and socioeconomic characteristics of surveyed mothers.

Measurements

Prenatal care involves receiving professional prescribed medical and other care during pregnancy that is identified as increasing the health of pregnant women. In 2007, the WHO

published the Standards for Maternal and Neonatal Care, outlining suggested health behaviors and a schedule of routine check-ups during pregnancy. These suggestions aimed at preventing, alleviating, and treating the health problems or diseases causing unfavorable outcomes of pregnancy. The WHO standards defined the provision of adequate prenatal care as follows: "All pregnant women should have at least four antenatal care assessments by or under the supervision of a skilled attendant. These should, as a minimum, include all the interventions outlined in the new WHO antenatal care model and be spaced at regular intervals throughout pregnancy, commencing as early as possible in the first trimester" (WHO, 2007, p. 1).

We construct three dependent variables, derived from a series of questions about the timing of first prenatal care, its frequency, and the type of provider delivering said care. Prenatal care is deemed timely in our models if the first visit takes place in the first trimester of pregnancy. Instead of using the "four visit model" suggested by the WHO, this paper will adopt the "three visit model" consistent with the National Maternal Health Program suggested by the Vietnam Ministry of Health (VMOH) in 2002. Finally, we delineate whether the caregiver pregnant women consult is a professional heath care provider or a nonprofessional, the latter likely to have less training and to rely upon folk knowledge and practices to 'treat' pregnant women and newborns. Disaggregating prenatal care usage patterns in this way permits us to investigate each dimension (onset, frequency, skill of provider) distinctly, and thereby provides greater insight into the nature and origins of ethnic disparity.

To meet the analysis criteria, all dependent variables are recoded into dichotomous variables as shown in Appendix Table A1. In order to run logistic regression in Statistical Package for Social Sciences (SPSS) and Stata Intercooled 12, all the categories referring to preferred practice of prenatal care, per WHO and VMOH guidelines, are coded as "1". In

contrast, categories indicating less preferred, or inadequate practice per WHO combined with VMOH guidelines, are coded as "0".

Our main independent variable is self-reported ethnicity of women who have given birth in the five years leading up to the DHS survey. The question on ethnicity in DHS 2002 asked each Vietnamese woman which group of ethnicities she belonged to. They gave the answers of being a Viet (also known as Kinh), Tay, Thai, Chinese, Khmer, Muong, Nung, Hre, Phu La, Ede, Dao, Co Tu, Cham, or Other. Due to small sample size in the individual ethnic minority groups, we recode the ethnicity question into a dichotomous variable in this paper. Viet/Kinh and Chinese are grouped as "ethnic majority," with the rest aggregated in the category of "ethnic minority."

To examine our fourth hypothesis, we employ a series of nested models that incrementally incorporate socioeconomic, demographic, spatial, and media exposure variables posited to mediate the relationship between ethnicity and prenatal care utilization. These mediating variables include women's age and birth parity (demographic factors); women's education, women's occupation, household wealth quintile, household ownership of a TV or a radio, and household toilet facilities (socioeconomic factors); the spatial factors included as mediators including major geographic region, commune/district distance to the nearest urban center, and antenatal service availability (spatial factors). Media exposure is an individual level variable based on women's self-reports of frequency of consuming radio, television and print media. Appendix Table A2 indicates how we recoded the original DHS questions into the categorical variables included in the analyses.

Analytical Techniques

We employ descriptive analysis and binary logistic regression analysis to explore the relationship between ethnicity and prenatal care usage. The descriptive analysis shows the

percentage distribution and number of cases for prenatal utilization, ethnicity and each of the mediating or control variables, followed by bivariate cross tabulations that show the relationships between prenatal care and each other variable. Chi square tests of statistical significance are employed. Logistic regression analyses follow and are conducted using the Complex Sampling Model in SPSS 19.0 and Stata IC 12.

Results

Bivariate Relationships

Table 1 displays the bivariate relationship between ethnicity and each of the mediating/control variables measured at the individual level. These results indicate statistically significant differences between the majority and minority groups on all variables with $p<.01$, *95% CI*. In general most of the women in our sample were between 20 to 29 years old (69.0% of ethnic minority and 63.5% of ethnic majority). While 72.4% of ethnic majority women received secondary or higher education, only 29.3% of ethnic minority women had received secondary or higher education. Greater than 30% of ethnic minority women had no formal education, as compared to less than 3% of ethnic majority women. With respect to employment, ethnic minority women are less likely to have a non-farm occupation, i.e. governmental or private enterprise occupation (7.6%), when compared with ethnic majority women (41.5%). A higher percentage (14.1%) of the women in the majority group than women in the minority group (3.8%) reported that they do not work for pay. For both groups of women, a higher percentage of minority women (35.9%) than majority women (21.3%) report that they have had more than two previous births.

Table 1

Characteristics of minority and majority women in the sample (%)

Variables	Minority N=184	Majority N=1,036
Individual characteristics		
*Women's age****		
40-49	6.5	2.9
30-39	19.0	32.1
20-29	69.0	63.5
15-19	5.4	1.5
*Women's education****		
No education	35.9	2.2
Primary	34.8	25.4
Secondary and higher	29.3	72.4
Women's occupation		
No occupation***	3.8	14.1
Farm	88.6	44.4
Non-farm	7.6	41.5
*Parity****		
One or two	64.1	78.7
More than two	35.9	21.3

***p<.001, **p<.01, *<.05

Table 2 displays the household level characteristics of minority and majority women. All of the variables, except having a radio in the household, are statistically significant at the *P<.001* level. For media exposure level, most of the women, both ethnic majority (45.4%) and minority (42.9%) in our sample rank in the low level. Minority women have higher share of no media exposure (27.7%) compared with the majority household (9.1%) percent. Household wealth quintile demonstrates clearly the disadvantage of ethnic minority households. Most ethnic minority women (71.2%) are members of households ranked in the lowest quintile, while only 1.1% are members of top quintile households Ethnic majority households are evenly distributed across all five quintiles. Only 23.4% of the minority women's households reported having a TV, while 70.6% of majority women's households possess a television. The traditional and pit toilet are commonly used in minority households. Only 2.2% of minority women's households report having a pit toilet relative to 30.3% of the

majority households. We include radio ownership as an indicator of assets, but also as a control pertinent to media exposure; a nearly balanced share of majority and minority households report possessing a radio.

Table 2

Characteristics of minority and majority household in the sample (%)

Variables	**Minority** N=184	**Majority** N=1,036
Household characteristics		
*Media exposure level****		
No exposure	27.7	9.1
Low exposure	42.9	45.4
High exposure	29.3	45.5
*Wealth quintile****		
Lowest quintile	71.2	15.7
Second quintile	20.1	22.0
Middle quintile	6.0	19.9
Fourth quintile	1.6	18.4
Highest quintile	1.1	23.9
*Toilet facilities****		
No toilet	46.4	17.3
Pit toilet	51.4	52.4
Flush toilet	2.2	30.3
*Having TV****		
No TV	76.6	29.4
TV	23.4	70.6
Having radio		
No radio	54.3	50.9
Radio	45.7	49.1

***p<.001, **p<.01, *<.05

Table 3 shows the characteristics of surveyed women's geographic locations and service availability. All three variables significantly related to prenatal care utilization in the bivariate view (p<.001). While most of the majority households are located 15 or fewer kilometers from the nearest urban center (63.5%), a large percentage of the minority households report living from 16 to 29 kilometers (37.5%) or 30 kilometers or more (28.3%) from metropolitan areas. This is consistent with the remoteness of ethnic minority villages in uplands and highlands regions. Information on antenatal care availability is reported as

unknown for 48.9% of the minority households. Among the rest, 34.2% of the minority households report not having this service in the community relative to 59.5% of the majority household. Considering the geographic concentration of ethnic minorities relative to ethnic majority groups, we see that ethnic minority women in our analytical sample concentrate heavily in the Northern Uplands (51.1%) and Central Highlands regions (16.3%). Only 12.3% and 3.2% of ethnic majority women in the sample reside in these regions, respectively. As "uplands residence" is often cited as an explanation for minority-majority group disparities, we attend to "uplands" versus "lowlands" residence as a mediating factors, as the latter suggests possibly superior socioeconomic and infrastructural resources, as well as proximity and potentially greater social contact/integration with majority groups and Vietnamese institutions.

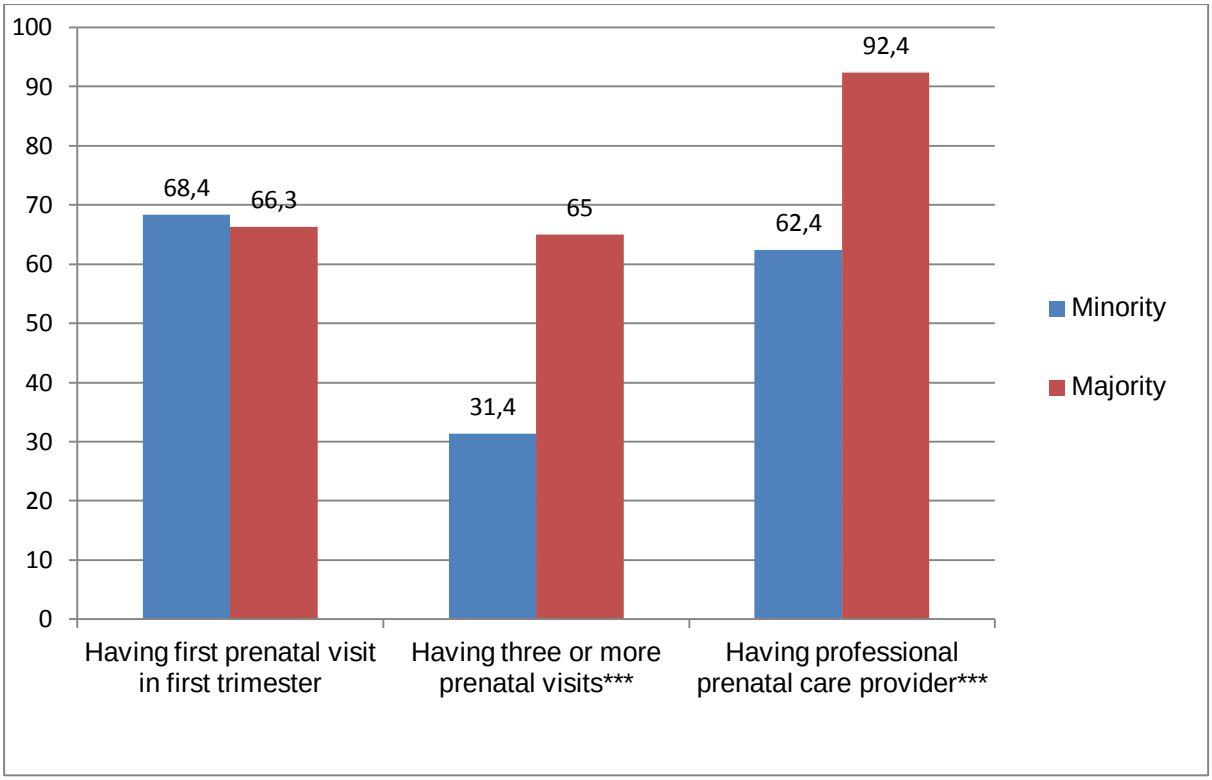
Table 3

Community characteristics and service availability (%)

Variables	**Minority** N=184	**Majority** N=1,036
Community and service availability		
*Distance to nearest urban center****		
30 km or more	28.3	1.4
16-29 km	37.5	10.4
15 km or less	32.1	63.5
Don't know	2.2	24.6
*Antenatal care service availability****		
Service not available	34.2	59.5
Service available	16.8	25.7
Missing	48.9	14.8
*Region****		
Northern Uplands	51.1	12.3
Northern Central and Coast	23.4	27.8
Central Highlands	16.3	3.2
Mekong River Delta and Southeast	8.7	36.8
Red River Delta	.5	20.0

***p<.001, **p<.01, *<.05

Figure 1 illustrates prenatal care utilization outcomes for the most recent birth for women in the 2002 DHS. Ethnic minorities show almost no difference from ethnic majority women with respect to the percentage having their first prenatal care visit during the first three months of pregnancy (difference is not statistically significant). Of the minority women, 68.4% report obtaining prenatal care during the first trimester compared to 66.3% of the women in the majority group. Other measures of prenatal care usage diverge significantly across the ethnic majority and ethnic minority groups ($p<.001$). There is a huge gap between the ethnic majority and minority groups in the proportion that are making three or more visits for prenatal care as recommended by the VMOH. Figure 1 shows that only 31.4% of minority women made three or more visits for prenatal care, whereas 65.0% of ethnic majority women receive prenatal care three or more times during their pregnancy. Furthermore, women belonging to the ethnic majority were much more likely than minority women to receive prenatal care from a professional during their pregnancies. Indeed, 92.4% of majority women received care from a professional caregiver whereas only 62% of minority women reported receiving professional care.



***p<.001, **p<.01, *<.05

Figure 1

Descriptive statistics (%) for ethnic minority and ethnic majority women in the sample

Logistic Regression Results for Prenatal Care Utilization during Pregnancy

Table 4 reports estimated logistic regression coefficients for four models for women reporting whether they received prenatal care in the first trimester. Results reported in this table lead to rejection of our first hypothesis, that minority women will be less likely than majority women to receive prenatal care during the first trimester of their pregnancies. The baseline model, with ethnicity as the only independent variable, indicates that members of the minority groups and the majority groups are approximately equally likely to receive prenatal care in the first trimester. Unexpectedly, the coefficients of minority women receiving prenatal care during the first trimester become significantly greater than those of majority women in models 2, 3 and 4, when other mediating variables are taken into account. Among the control variables, education level, especially for those with secondary and higher level,

has the most significant, positive association with prenatal care access in the first trimester (1.30 in model 2, 1.13 in model 2 and 1.10 in model 3). Women's occupation, farm (-0.46) vs. no occupation, also influences entrance into prenatal care in the first three months of pregnancy when controlling for other individual characteristics. This finding is indicative of the higher socioeconomic position of women who are not working for pay in the labor force as compared to those working in farm occupations. The effect of wealth in first trimester prenatal care utilization is seen in model 3, where women whose households are in the highest wealth quintile are significantly more likely to obtain prenatal care in the first trimester. Wealth quintile does not remain significant in model 4, suggesting that household wealth disparities coincide with spatial disparities. The remaining individual, household and community characteristics are not statistically significant in the any of the models.

Table 4

Estimate coefficients for logistic models of probability of having first prenatal care visit in first trimester

Variables	Model 1	Model 2	Model 3	Model 4
Ethnic majority (ref: minority)	-0.13	-0.75**	-0.92***	-0.92**
	(0.24)	(0.26)	(0.25)	(0.28)
Women's age 30-39 (ref: age 40-49)		-0.07	-0.13	-0.11
		(0.39)	(0.40)	(0.41)
Women's age 20-29 (ref: age 40-49)		0.16	0.19	0.18
		(0.40)	(0.42)	(0.42)
Women's age 15-19 (ref: age 40-49)		0.25	0.30	0.37
		(0.65)	(0.67)	(0.67)
Women's education: primary (ref: no education)		0.44	0.47	0.45
		(0.35)	(0.34)	(0.34)
Women's education: secondary and higher (ref: no education)		1.30***	1.13**	1.10**
		(0.35)	(0.35)	(0.35)
Women's occupation: farm (ref: no occupation)		-0.46*	-0.18	-0.21
		(0.22)	(0.23)	(0.24)
Women's occupation: non-farm (ref: no occupation)		0.03	-0.03	-0.03
		(0.21)	(0.22)	(0.21)
Parity: Two or less (ref: more than two)		-0.16	-0.11	-0.06
		(0.18)	(0.19)	(0.20)
Media exposure level: low (ref: no exposure)			0.23	0.24

			(0.24)	(0.23)
Media exposure level: high (ref: no exposure)			0.25	0.19
			(0.26)	(0.25)
Wealth quintile: second (ref: lowest quintile)			0.09	0.06
			(0.21)	(0.21)
Wealth quintile: middle (ref: lowest quintile)			0.44	0.41
			(0.24)	(0.26)
Wealth quintile: fourth (ref: lowest quintile)			0.25	0.18
			(0.31)	(0.32)
Wealth quintile: highest (ref: lowest quintile)			0.86*	0.73
			(0.41)	(0.42)
Toilet facility: pit toilet (ref: no toilet)			0.17	0.03
			(0.18)	(0.18)
Toilet facility: flush toilet (ref: no toilet)			0.20	0.20
			(0.29)	(0.31)
Having TV (ref: no TV)			0.18	0.17
			(0.17)	(0.17)
Having radio (ref: no radio)			0.10	0.14
			(0.16)	(0.16)
Distance to nearest urban center: 16-29 km (ref: 30 km or more)				-0.09
				(0.48)
Distance to nearest urban center: 15 km or less (ref: 30 km or more)				0.04
				(0.47)
Distance to nearest urban center: don't know (ref: 30 km or more)				-0.01
				(0.53)
Antenatal care service: available (ref: no service)				0.17
				(0.19)
Antenatal care service: missing (ref: no service)				0.00
				(0.20)
Region: Northern Central and Coast (ref: Northern Uplands)				-0.47
				(0.25)
Region: Central Highland (ref: Northern Uplands)				-0.34
				(0.42)
Region: Mekong River Delta and Southeast (ref: Northern Uplands)				-0.26
				(0.27)
Region: Red River Delta (ref: Northern Uplands)				0.10
				(0.28)
Constant	0.89	1.21	0.66	0.99
	(0.47)	(0.73)	(0.71)	(0.87)
Valid cases (N)	1068	1068	1065	1065

Robust standard error in parentheses

***p<.001, **p<.01, *<.05

As we elaborate below, the significant differences between ethnic minority and majority women in obtaining first trimester prenatal care, and the model results indicating that ethnic minority women are in an advantaged position as compared to majority women, may be an artifact of questionnaire wording. Specifically, the DHS questionnaire does not distinguish between accessing professional versus non-professional care during the first trimester. Our model results for accessing professional care providers (Table Six) are indicative of significant ethnic disparity on this latter outcome. The next two logistic regression analyses provide further insights into the ways ethnic minority women differ from the majority in utilizing prenatal care.

Table 5 provides model results, in the form of logistic regression coefficients, for women reporting having had three or more prenatal visits during their most recent pregnancy. The results support Hypothesis 2, as they show ethnic minority women have significantly lower probability of reporting having three or more prenatal visits for model 1 (1.36) and 2 (.62). Supportive of our fourth hypothesis, ethnicity is no longer significant when household and community characteristics are added in the last two models (.37 and 0.43). Model 2 indicates a significant, positive effect of highest level of education (1.72) but negative effect of parity (-0.55) on number of prenatal visits. Women with more than two children are significantly less likely to have three or more prenatal care checkups. Media exposure is introduced in model 3 and indicates a positive impact (0.44 for low level and 0.55 for high level) on having three or more prenatal care visits. Women in the two top-most wealth quintiles also experience a significantly greater likelihood of having three or more prenatal care visits.

Table 5

Estimate coefficients for logistic models of probability of having three prenatal care visits

Variables	Model 1	Model 2	Model 3	Model 4
Ethnic majority (ref: minority)	1.36***	0.62*	0.37	0.43
	(0.34)	(0.31)	(0.31)	(0.31)
Women's age 30-39 (ref: age 40-49)		0.50	0.42	0.44
		(0.35)	(0.34)	(0.35)
Women's age 20-29 (ref: age 40-49)		0.25	0.26	0.27
		(0.35)	(0.35)	(0.36)
Women's age 15-19 (ref: age 40-49)		-0.08	-0.02	-0.01
		(0.51)	(0.49)	(0.50)
Women's education: primary (ref: no education)		0.53	0.44	0.54
		(0.39)	(0.38)	(0.41)
Women's education: secondary and higher (ref: no education)		1.72***	1.32***	1.35**
		(0.40)	(0.39)	(0.42)
Women's occupation: farm (ref: no occupation)		-0.14	0.16	0.04
		(0.20)	(0.20)	(0.20)
Women's occupation: non-farm (ref: no occupation)		0.06	-0.01	-0.08
		(0.20)	(0.21)	(0.21)
Parity: Two or less (ref: more than two)		-0.55**	-0.47**	-0.38*
		(0.17)	(0.18)	(0.18)
Media exposure level: low (ref: no exposure)			0.44*	0.45*
			(0.20)	(0.20)
Media exposure level: high (ref: no exposure)			0.55**	0.46
			(0.21)	(0.21)
Wealth quintile: second (ref: lowest quintile)			0.29	0.24
			(0.20)	(0.21)
Wealth quintile: middle (ref: lowest quintile)			0.43	0.33
			(0.23)	(0.23)
Wealth quintile: fourth (ref: lowest quintile)			0.57*	0.41
			(0.26)	(0.26)
Wealth quintile: highest (ref: lowest quintile)			1.51**	1.15**
			(0.39)	(0.40)
Toilet facility: pit toilet (ref: no toilet)			0.31	0.07
			(0.17)	(0.19)
Toilet facility: flush toilet (ref: no toilet)			0.06	-0.10
			(0.32)	(0.33)
Having TV (ref: no TV)			0.09	0.08
			(0.18)	(0.19)
Having radio (ref: no radio)			0.04	0.09
			(0.14)	(0.15)
Distance to nearest urban center: 16-29 km (ref: 30 km or more)				0.38

				(0.49)
Distance to nearest urban center: 15 km or less (ref: 30 km or more)				0.38
				(0.44)
Distance to nearest urban center: don't know (ref: 30 km or more)				0.86
				(0.50)
Antenatal care service: available (ref: no service)				-0.14
				(0.20)
Antenatal care service: missing (ref: no service)				0.25
				(0.22)
Region: Northern Central and Coast (ref: Northern Uplands)				-0.63*
				(0.28)
Region: Central Highland (ref: Northern Uplands)				-0.96**
				(0.34)
Region: Mekong River Delta and Southeast (ref: Northern Uplands)				-0.44
				(0.27)
Region: Red River Delta (ref: Northern Uplands)				0.27
				(0.30)
Constant	-2.16**	-2.17**	-2.76***	-2.69***
	(0.67)	(0.70)	(0.69)	(0.82)
Valid cases (N)	1220	1220	1217	1217

Robust standard error in parentheses

***p<.001, **p<.01, *<.05

The full model conveys statistically significant effects of women's education, media exposure, wealth quintile and region of residence on frequency of prenatal care utilization. Our results suggest that women residing in the Northern Central and Central Coast (-0.63) and Central Highlands (-0.96) regions are less likely to obtain prenatal care at the recommended level of frequency in comparison to women residing in the Northern Uplands. Other variables are found to be insignificant predictors of prenatal visit frequency. These results make clear that sizable disparities separate ethnic minority and ethnic majority groups in use of prenatal care and that those disparities are attenuated by socioeconomic and spatial factors as indicated by the significant coefficients in the full model for educational attainment, household wealth, and geographic region. Media exposure, which is a significant predictor of prenatal care frequency in model 3, is attenuated in model 4. This suggests that

that media exposure is one of the factors salient to prenatal care utilization that diverges across regions and communities of Vietnam.

Table 6 reports coefficients for women's receipt of prenatal care from a professional (as opposed to nonprofessional) provider. These results, which indicate that minority women are far less likely to receive prenatal care from a professional provider, support our third hypothesis. The likelihood for a majority woman to seek care from a professional is significantly higher than their minority counterparts (2.03 in model 1) but is reduced in subsequent models when other mediating variables are added, thus providing clear support for our fourth hypothesis. Women's education and media exposure are each significant factors associated with obtaining a professional prenatal care provider. Models 2-4 indicate a positive association between household wealth quintile and obtaining prenatal care from a professional provider, the association being strongest for women in the top wealth quintile.

The full, final model suggests that distance to the nearest urban center is a significant, positive predictor of visiting a professional care provider. Women closer to urban centers are more likely to seek care from professionals (1.23 for 16-29 km and 0.88 for 15 km or less). In these settings women likely have easier access to professional care providers and are likely more integrated into dominant Vietnamese cultural and public institutions. Where information on distance to the nearest urban center is missing or unknown, we observe a negative association (-0.04) with professionally provided prenatal care. While the data do not permit a full investigation, it is likely that community members unable to report on their distance to the nearest urban center are likely to reside in relatively remote and inaccessible locations. In general, we see that remoteness of location underlies women's likelihood of seeking prenatal care from professional providers. The full model also suggests that, having accounted for individual and household level covariates, and community remoteness from

urban centers, geographic region does not correlate significantly with professional prenatal care seeking.

Table 6

Estimate coefficients for logistic models of probability of having professional prenatal care provider

Variables	Model 1	Model 2	Model 3	Model 4
Ethnic majority (ref: minority)	2.03***	1.10***	0.82**	0.84**
	(0.35)	(0.27)	(0.29)	(0.34)
Women's age 30-39 (ref: age 40-49)		0.88*	0.77	0.76
		(0.41)	(0.42)	(0.45)
Women's age 20-29 (ref: age 40-49)		0.86	0.90*	0.86
		(0.45)	(0.45)	(0.48)
Women's age 15-19 (ref: age 40-49)		0.39	0.42	0.35
		(0.77)	(0.75)	(0.77)
Women's education: primary (ref: no education)		0.80	0.78	0.75*
		(0.45)	(0.43)	(0.38)
Women's education: secondary and higher (ref: no education)		2.43***	1.98***	1.90***
		(0.48)	(0.43)	(0.41)
Women's occupation: farm (ref: no occupation)		-0.08	0.29	0.30
		(0.35)	(0.35)	(0.33)
Women's occupation: non-farm (ref: no occupation)		0.01	-0.03	0.07
		(0.34)	(0.36)	(0.36)
Parity: Two or less (ref: more than two)		-0.28	-0.22	-0.25
		(0.29)	(0.29)	(0.30)
Media exposure level: low (ref: no exposure)			0.90***	0.99***
			(0.23)	(0.24)
Media exposure level: high (ref: no exposure)			0.78**	0.78**
			(0.30)	(0.29)
Wealth quintile: second (ref: lowest quintile)			0.29	0.39
			(0.30)	(0.29)
Wealth quintile: middle (ref: lowest quintile)			0.78*	0.92*
			(0.39)	(0.41)
Wealth quintile: fourth (ref: lowest quintile)			0.64	0.92
			(0.47)	(0.50)
Wealth quintile: highest (ref: lowest quintile)			1.80*	2.19**
			(0.82)	(0.84)
Toilet facility: pit toilet (ref: no toilet)			0.23	0.18
			(0.24)	(0.26)
Toilet facility: flush toilet (ref: no toilet)			0.72	1.17
			(0.56)	(0.67)
Having TV (ref: no TV)			-0.04	-0.22
			(0.27)	(0.27)

Having radio (ref: no radio)			0.06	0.09
			(0.23)	(0.23)
Distance to nearest urban center: 16-29 km (ref: 30 km or more)				1.23**
				(0.43)
Distance to nearest urban center: 15 km or less (ref: 30 km or more)				0.88*
				(0.39)
Distance to nearest urban center: don't know (ref: 30 km or more)				-0.04
				(0.59)
Antenatal care service: available (ref: no service)				-0.03
				(0.28)
Antenatal care service: missing (ref: no service)				0.17
				(0.30)
Region: Northern Central and Coast (ref: Northern Uplands)				-0.32
				(0.40)
Region: Central Highland (ref: Northern Uplands)				-0.01
				(0.39)
Region: Mekong River Delta and Southeast (ref: Northern Uplands)				-0.10
				(0.40)
Region: Red River Delta (ref: Northern Uplands)				0.00
				(0.62)
Constant	-1.63*	-2.16**	-3.01***	-3.74***
	(0.65)	(0.78)	(0.78)	(0.91)
Valid cases (N)	1220	1220	1217	1217

Robust standard error in parentheses

***p<.001, **p<.01, *<.05

Conclusion and Discussion

Recently, Vietnam has shown marked improvement in prenatal care coverage (Lieu et al., 2006; Tran et al., 2011). Although the government has dedicated significant effort toward implementing health care programs for pregnant women, the country still experiences high neonatal and infant mortality rates (CIA, 2011; WHO, 2006). Målqvist et al. (2010) identified a significant association between ethnicity and neonatal survival in Quang Ninh province in Northern Vietnam. When controlled for household income and household highest education level, being an ethnic minority mother doubled the risk of neonatal death. When adjusted for

health care utilization during pregnancy and delivery, the risk of neonatal mortality is five times higher for women of ethnic minorities. These facts bring up a question: Why, when implemented by the government, are prenatal care programs and associated behavioral changes ineffective in reducing the rates of neonatal and infant mortality among ethnic minority women?

We make inroads toward the answer to this question by analyzing a nation-wide representative sample of childbearing women in Vietnam. Their behaviors around prenatal care suggest disparities between ethnic minorities and the majority Kinh. Our results, supportive of two of three hypotheses we propose, lend strong support to the overarching hypothesis on ethnic disparity in prenatal care use in Vietnam. Our first hypothesis, that minority women are less likely to seek care at the first trimester, is rejected. The most likely reason for this result is that the question about care in the first trimester did not ask respondents to distinguish between traditional and professional prenatal care during this time of their pregnancy. Our support for hypothesis three lends credence to the view that minority women tend to receive and report nonprofessional care during the first trimester. Even if they pay a visit to a professional care provider to determine whether or not they are pregnant, minority women discontinue care and are less likely to report having three or more visits. This explanation fits with the results shown for hypothesis two and three which shows the lag of ethnic minority women in seeking professional prenatal care and following the suggestion of having three visits.

Our last hypothesis on what mechanisms underlie the prenatal care utilization practices between minority and majority women is tested along the three hypotheses. Comparing ethnic minority and majority women, minority women who reported giving birth between 1999 and 2002 are overrepresented on those characteristics that put women at risk of inadequate prenatal care utilization. Specifically, they tended to give birth at younger ages

than women of ethnic majority, had lower levels of education, very rarely worked in formal/government sector employment as non-farm workers, and had higher numbers of children. Minority household were much poorer than majority households, they were also less likely to possess a television and less likely to utilize a modern or pit toilet facility. Their exposure to the media was lower, a significant factor given that we find that radio listening, TV watching, or their combination, improve the likelihood of having a professional provider and accessing care at the recommended frequency.

We also highlight remoteness or region as a critical line stratifying prenatal care utilization among Vietnamese women, especially on the frequency of care dimension. An average ethnic minority women's community is characterized with less information on antenatal care service and with greater distance from the metropolitan area than ethnic majority women's communities. Most of the ethnic minority groups are located in the Northern Uplands, Central Highlands, Northern Center and Central Coast, while the vast majority of Kinh and Hoa reside in the Red River Deltas and Mekong River Delta and Southeast region. None of the sampled ethnic minority women resides in the Southeast. Clearly, ethnic divisions in Vietnam map onto regional divisions and correlate with the distance from the nearest urban center. These findings are similar to findings from prior research on ethnic disparities in Vietnam. Baulch et al. (2007), Imai et al. (2011), and Van de Walle and Gunewardena (2001) which recognize that ethnic minorities continue to be defined as "Uplands People," stratified and separate from "Lowlands People." Our study results are consistent, and begin to delineate the correlates of region that influence prenatal care seeking, and likely adverse pregnancy outcomes, among ethnic minority residents of mountainous communities.

Although this research employs high quality data from the DHS 2002 in Vietnam, some limitations remain. The first limitation relates to self-reported information on prenatal

care visits. One of the problems rests with the DHS measurement of "traditional birth attendants". The DHS data collection instrument does not establish whether the traditional birth attendant has received professional medical education or any other professional qualifications. In other words, DHS provided no information on the qualifications of "traditional birth attendants," and thus the category may include a wide range of individuals, from trained midwifes to untrained spiritual healers and other figures. If the category aggregates a mix of trained and untrained persons, our findings likely overestimate ethnic minority women's visits to professional caregivers in the first trimester. And while we recognize the valuable information and support that can be imparted to pregnant women from traditional and folk healers, we also recognize their potential limits in providing informed healthcare information or in diagnosing medical conditions that may lead to pregnancy or delivery complications.

While Vietnamese culture may subscribe to biological or essentialist views of ethnic differences, ethnicity is very much a social and cultural concept. Women's self-reports likely convey these social and cultural meanings. At the same time, nuances in ethnic group membership and acculturation are not captured well in the DHS or in our analyses, and these nuances may go a long way in explaining variation among ethnic minority women in their orientation to Vietnam's healthcare system. For instance, some cases may be characterized by intermarriage of an ethnic minority woman with an ethnic majority man. Our measures do not capture such a configuration, which is a serious shortcoming given the powerful voice that men exercise in families and women's reproductive and health decision-making in the patriarchal, Confucian culture characteristic of the majority Kinh population. Another limitation linked with the measurement of ethnicity is the problematic grouping of individual, distinct ethnic groups into the ethnic minority and ethnic majority categories. Historical and anthropological knowledge establishes the Kinh/Viet as a single, majority ethnic group within

Vietnam. In following established practice, we included the ethnic Hoa (Chinese) within ethnic majority group, alongside the Kinh. On many socioeconomic dimensions, the Chinese are comparable to the Kinh/Viet; they also have far better economic standing than the other, indigenous ethnic minority groups. Nonetheless, the Hoa maintain ethnic and cultural distinctiveness as comared to the Kinh. Likewise, the fifty-two other, indigenous ethnic minorities of Vietnam encompass wide socioeconomic and cultural variation. In further investigation we hope to delineate differences among the ethnic minority women in their cultural practices, family belief systems, and extent of integration and/or social distance/resistance vis-à-vis the majority Vietnamese. Unfortunately, we face obstacles in meeting such an objective given the relatively small numbers of DHS respondents who belong to the Hoa or any other one specific ethnic minority group.

All retrospective reports have in common the possibility of recall error and associated underestimations, overestimation or mischaracterization of actual prenatal care utilization. Recall error may be more likely for those women whose most recent birth took place further in the past, for instance three years ago as opposed to three months ago. Furthermore, previous research indicates that ethnic minorities are unlikely to report an illness without adequate understanding of the medical situation (Kogan, Kotelchuck, Alexander, & Johnson, 1994). Extending this logic, it may be the case that ethnic minority women, without understanding of professional care during pregnancy and delivery, may report that they were provided care by qualified doctors or nurses when in fact any care they received was delivered by folk doctors or others outside mainstream healthcare institutions. These and other limitations of the data and the current study provide the impetus for further study which investigates variance among Vietnam's diverse ethnic groups in health practices, perinatal health outcomes, and the association of health status and health care utilization with meaningful measures of integration-distance relative to mainstream Vietnamese society. Our

findings begin to suggest that ethnic minority women are separated from the Kinh majority by more than region, education, and employment status. Further investigation is needed to delineate the mechanisms that stratify minorities' access to health care, as well as the protective and risk factors related to maternal and infant health that distinguish among ethnic minority women.

Results from this research provide valuable lessons for policy makers. Our results provide insights into the existing and expanding health disparities in Vietnam. The Vietnamese Government and the Communist Party have issued policies to foster ethnic equity and to help ethnic minorities. Such policies, for example poverty reduction programs and health insurance for the poor, have proven ineffective in promoting ethnic equity. Kogan et al. (1994) once found that health care insurance for the poor actually benefits the non-poor. Our results suggest that improving educational attainment among ethnic minority women is one of the changes that would be most likely to help ethnic minority women and enhance their use of health status and healthcare utilization. However, given the diversity inherent in the ethnic minority population and, for many, their tense relations with Vietnamese government in recent history, programs to enhance women's education will be most likely to succeed if they are formulated in ways that address and respect ethnic minority culture, beliefs and ways of knowing.

Besides ethnicity there are other mechanisms promoting prenatal care utilization. Findings from this research urge a special need for a prenatal care program aimed at women in these high risk groups including those living in low socioeconomic household and remote area or cultural isolation. Only by promoting education and by issuing specific programs to meet the needs of high risk women will prenatal care coverage and quality be enhanced in degrees that lessen perinatal and maternal health risks. Besides programming geared toward high risk women, other policies on gender equity are also needed. The influence of

Confucianism on Vietnamese society is still well-preserved, such that son preference affects women's reproduction and childbearing behaviors. Gender equity education should be emphasized in schools and broadcast in state-sponsored media.

Moreover, quality of prenatal care should be taken into consideration. Although this research does not study quality of prenatal care, previous research stresses the importance of better services for pregnant women and better interaction between care providers and patients (Graner et al., 2010). Professional health care providers accentuate the need for training programs, human resources, and better medical equipment to diagnose and address complications during pregnancy and delivery. Besides health professionals, traditional health providers play important roles in providing health care service in communities, in particular in the uplands communities where ethnic minority women concentrate. Counter-productive practices of health care for pregnant women should be eliminated. Additional or adequate medical education for traditional care health providers are strongly suggested in remote areas where hospitals or health facilities is inaccessible. To improve the state of public health in Vietnam overall it is essential to consider the barriers to care and risks to health that plague ethnic minority populations. This can only be achieved by making improvements to the quality of healthcare services provided, irrespective of region of residence; increasing and improving interactions between professional health providers, traditional caregivers and patients; and, at the same time, promoting women's education and gender and ethnic equity.

Although there are limitations of using DHS and other limitations in analysis, research on ethnic disparities in prenatal care utilization should be continued. The most important addition that needs to be made in future research is developing a better set of measurements in studying prenatal care utilization in Vietnam. More information on content of prenatal care check-ups and behaviors during pregnancy and delivery should be added. Obtaining additional information on community composition (ethnic mix, intermarriage) and

indicators of cultural isolation versus integration (e.g., language spoken in schools and clinics) would provide further insight into ways that community membership contextualizes healthcare seeking. Oversampling of particular ethnic minority women would allow for greater insights into inter-ethnic group differences. With the release of new DHS phase V or later, and the existence of DHS phase II, conducting a longitudinal study on prenatal care utilization in Vietnam is possible. Women followed up in different periods of time can result in interesting findings of the pattern of prenatal care behaviors. Furthermore, this research should be extended to the effects of prenatal care utilization on delivery care and perinatal health, namely the association between previous prenatal care during pregnancy and the women's decisions on place of delivery. Another new approach is linking health care behaviors during pregnancy and delivery with health outcomes, for example prenatal care utilization and neonatal risk. Moreover, the DHS program makes it possible to conduct international comparative research on ethnic disparities in prenatal care utilization and maternal/perinatal health. The findings of comparative research can yield insights on the particular ways that Vietnamese social structure and ethnic composition shape health disparities.

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Appendix

Table A1

Original and Recoding of the Three Dependent Variables

Original Questions	Recoded Variables/Hypotheses
"How many months pregnant were you when you first received prenatal care?" Months Don't know (98)	Reporting first prenatal visit at first trimester: First trimester (1), Not first trimester (0) Hypothesis One (H1)
"How many times did you receive prenatal care during this pregnancy?" Number of times Don't know (98)	Reporting having three or more prenatal visits: Three or more (1), Not three or more (0) Hypothesis Two (H2)
"When you were pregnant with [Name of child], did you see anyone for prenatal care for this pregnancy?", "If Yes, whom did you see? Anyone else?" Health professional: Doctor (a), Doctor's assistant (b), Midwife (c), Nurse (d) Other person: Traditional birth attendant (e) Others (Specify) (x) No one (y)	Reporting having professional care providers: (doctor, doctor's assistant, midwife, nurse): Yes (1), No (0) Hypothesis Three (H3)

Table A2

Original and Recoding of the Main Independent and the Control/Mediating Variables

Original Questions	Recoded Variables
Individual Characteristics	
What ethnic group do you belong to? Vietnamese (01), Tay (02), Thai (03), Chinese (04), Khmer (05), Muong (06), Nung (07), Hre (08), Phu La (10), Ede (11), Dao (12), Co tu (13), Cham (14), Other (Specify) (96)	Ethnicity: Minority (1), Majority (2)
How old were you at your last birthday? Age in completed year	Age: , 15-19 (4), 20-29 (3), 30-39 (2), 40-49 (1)
What is the highest grade of education you have completed? Grade College/university (15)	Education: No education (1), Primary (2), and Secondary and Higher (3)
Aside from your own housework, are you currently working? Yes (1), No (2)	Occupation: No occupation (1), Farm (2), Non-farm (3)
Aside from your own housework, are you currently working? Yes (1), No (2) What is your occupation, that is, what kind of work do you mainly do?	
First I would like to ask about all the births you have had during your life. Have you ever given birth? Yes (1), No (2)	Parity: More than two (1), Two or less (2)
Household Characteristics	
Does your household have: A radio? A television? Yes (1), No (2)	Having radio: No (1), Yes (2) Having TV: No (1), yes (2)
What kind of toilet facility does your household have? Flush toilet: Own (11), Shared (12) Traditional pit toilet/latrine (21) Ventilated improved pit toilet/latrine (22) No facility/bush/field (31) Other (96)	Toilet facility : No toilet (1), Pit toilet (2), Flush toilet (3)
Do you usually listen to a radio everyday? Yes (1), No (2) Do you usually watch television at least once a week? Yes (1), No (2)	Media exposure level: No exposure (1), Low level (2), High level (3)
Wealth quintile (as calculated by DHS) Lowest quintile (1) Second quintile (2)	Same as question

Middle quintile (3) Fourth quintile (4) Highest quintile (5)	
Community Characteristics and Service Availability	
What is the name of the nearest urban area (town or city)? How far is it in kilometers to this place?	Distance to the nearest urban center? 30 kilometers or more (1) 16-29 kilometers (2) 15 kilometers or less (3) Don't know (4)
Now I would like to ask you about the maternal and child health services available at this commune health center? Antenatal: Yes (1), No (2)	Antenatal care availability: Yes (2), No (1)
In which province is that located? Name of province?	Region: Northern Uplands (1), Northern Center and Central Coast (2), Central Highlands (3), Mekong River Delta and Southeast (4), Red River Delta (5)