EDUCATIONAL EXPANSION AND HEALTH DISPARITIES IN A RAPIDLY CHANGING SOCIETY: THE CASE OF ETHIOPIA

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Introduction

Education plays a vital role in improving public health. Numerous studies, both associative and causal, confirm that even a few years of basic education leads to better health outcomes. Some also suggest that education can promote better health at the community-level through spillover effects (Armer and Yourtz 1971; Baker et al. 2011; Behrman 2015; Hahn and Truman 2015). Living in communities with higher literacy rate is associated with lower under-five mortality and higher child vaccination rate across low-income countries (Smith-Greenaway 2017; Burroway and Hargorove 2018). As a result, education rightly receives top billing in the development agenda for improving global health (Lutz and Kebede 2018). What is largely been missing in this discourse, however, is whether educational expansion dampens health disparities. That is, does the march towards universal primary education reduce one of the most persistent disparities observed in almost every human society?

Within-country health disparities across educational groups are both persistent and substantial across the globe -- characteristic of both economically prosperous countries and low-income countries in the Global South (Link and Phelan 1995; Beckfield et al. 2013; Machkenbach 2012). In low-resource countries where basic healthcare system is near absent, education explains much of the inequality in health, independent of income and other measures of socioeconomic status (Baker et al. 2011; Marmot 2005). Countless health outcomes are stratified by educational level, from HIV infection (Behrman 2015) to child mortality (Bado and

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Susuman 2016) to access to healthcare services (Ulrika et al. 2016; Mezmur et al. 2017; Alam et al. 2015). Despite this ample evidence, only a handful of studies assess the directional association between educational expansion and health disparities and report contradictory findings (Sosnaud and Beckfield 2017; Ostergren et al. 2017). In short, while the sustained international effort to promote universal primary education continues to document positive effects of education on health outcomes, we still lack an understanding of the more complex association between educational expansion and health disparities in places where educational expansion is rapidly reshaping social landscape.

My study extends the previous literature by assessing the directional effect of educational expansion on health disparities and quantifying the magnitude of its effect. Using decomposition of rates, I decompose disparities in the healthcare utilization rate of educated and uneducated women in Ethiopia. This allows me to examine whether the extent of inequality has changed with the expansion of education, and how much of this change can be attributed to an increase in the percentage of formally educated women. Most of our the current theories and findings are based in the experience of industrialized countries, where educational expansion gradually took place at the tertiary level. In low-resource countries, educational expansion happens rapidly and comes along with other aspects of social development -- a shifting social landscape across multiple sectors (Barber 2004). This simultaneous development obscures and likely biases the magnitude and directional effect of educational expansion on health disparities. The decomposition of rates is a useful tool, since it parses health disparities into components -- one attributable to the change in educated population - *effect of educational expansion* - and another attributable to the change in healthcare utilization across groups -*effect of improvement in healthcare system*.

In addition, I use Blinder-Oaxaca decomposition to identify some determinants of health disparities and explore how their role evolves over time, as the educated population drastically increases. This investigation has important policy implications, as it provides evidence that can be used to guide decisions about how to allocate resources where the goal is to reduce health disparities. Previous studies based on cross-sectional analysis have identified some sources of health disparities, but fail to tell us how these determinants change over time, given educational expansion and other, secular changes. I explore three major sources of disparities in healthcare utilization among women in Ethiopia and show how these sources have changed over a ten-year period. For at least three reasons, Ethiopia is an ideal case for advancing research on this topic. First, Ethiopia underwent recent improvements in health and education that resulted in large-scale institutional changes. Moreover, its decentralized healthcare system allows enough variation in healthcare and education within its eleven regions to explore the diverse contextual effects while effectively accounting for the unobserved confounders which often raises concern for cross-national studies.

Educational Expansion and Determinants of Health Disparities

Social advancement generates new dynamics in health disparities (Deaton 2003; Baker et al. 2017), and education is no exception. Rooted in institutional intervention framework, education is a positive social intervention, designed to educate general population with a common set of knowledge and skills, which should facilitate equality within the population (Caldwell 1980; Ram 1990). This hypothesis proposes that educational expansion would reduce health disparities. Indeed, in the past few decades, studies have identified convergence across educational groups in a number of health outcomes, most notably in the domain of reproductive health (Kradval 2002; Giroux et al. 2008; Eloundou-Enyegue et al. 2017). Extending this type of

analysis to child mortality, Sosnaud and Beckfield (2017) find that across the Global South, the proportion educated population in a given area is negatively correlated with child mortality.

In contrast to the institutional intervention hypothesis, other lines of inquiry find that disparities across educational groups tend to persist – in some cases even increase – when new advancements or technologies are introduced into the population (Glied and Lleras-Muney 2008; Baker et al.2017). This view is built on the fundamental-cause hypothesis, which asserts that social position is an irreversible cause of health disparities. Higher status grants a socially grounded ability to avoid health risks and minimize the consequences of illness (Link and Phelan 1995). Education is a key factor in generating this social position, so by distributing new credentials and qualifications to its recipients (Meyer 1977), the expansion of education almost necessarily introduces new institutional determinants of disparities by reshaping existing social hierarchies (Meyer 1977; Beckfield 2013). Confirming this perspective, educational expansion has been found to increase disparities in mortality rate across Europe (Ostergren et al. 2017).

These contradictory hypotheses leave open many questions about what to expect in sub-Saharan Africa as education becomes more readily available. Throughout the region, wealth is the single most important driver of inequality in access to health care (Bonfrer et al. 2014). Educational expansion reduces economic barriers to education, which in turn, increases the overall living condition of the population as poor families bear smaller costs of education (Breen et al. 2009). This reduced cost of education is thought to increase investments in health and nutrition (Erikson and Jonsson 1996). And from this view, wealth should lose its significance as a determinant of health disparities as educational opportunities expand, reaching formerly disadvantaged populations.

Another way in which education influences health disparities is through literacy. Education provides skills and knowledge that are directly translated into health outcome, generating health disparities between those with and without education (Mirowsky 2003). In many African countries, literacy enhances people's ability to communicate and navigate through complex medical procedure and increases the overall accessibility to quality treatment (Smith-Greenaway 2013; Meinert 2009). However, as more people obtain formal education, literacy may lose its significance as a stratifying force and may, instead, assert a positive spillover effect within the community (Smith-Greenaway 2017).

Contextual factors – both cultural and geographical – also drive health disparities in this context. In low-resource settings, educational credentials are often manifest as cultural and attitudinal differences. Educational expansion in sub-Saharan Africa came at the expense of educational quality. The region's unusually high rate of grade repetition indicates that many students fail to retain the knowledge and skills that get "delivered" in their classrooms (Pritchett 2001). However, the expansion of secular, Western education nurtures "modern" identities and provide a new behavioral and cultural hierarchies across educational groups (Armer and Youtz 1971). These cultural and attitudinal differences are manifest in large and small ways, ranging from an individual women's ability to travel alone to visit health facility to the redefinition of traditional gender roles and the social relations that define who can access to healthcare services. The distance patients must travel to receive treatment is another important determinant of healthcare utilization, generating stark disparities between access rates that characterize rural areas and those we observe in urban centers (Stock 1983; Masters et al. 2013). Educational attainment in the earliest stage of expansion is likely to be correlated with residential disparities as educated population is concentrated in urban centers where schools and other health facilities

are located. Expansion of primary education would mitigate geographical barrier as it penetrates to rural population.

While some findings suggest that economic and contextual gaps should dissipate with educational expansion, others lead us to expect health disparities to increase (if only temporarily) with educational expansion. Staple population-health measures like the under-five mortality rate and life expectancy are confounded with age-specific needs and other accumulative behavioral differences that are not directly influenced by education. To parse out as much of these unobserved confounders, I focus specifically on general facility utilization. General facility utilization not only minimizes the age-specific needs – such as delivery – but also effectively reduces selection effect as demand for healthcare is uniformly high across educational groups in this context. Using general facility utilization rate as a measure of inequality would accurately assess the relationship between educational expansion and health disparities as uneducated women are known to make the least use of health facilities (Memirie et al. 2016).

Study Setting: Primary Education and Healthcare in Ethiopia

With an estimated population of 102 million, Ethiopia is currently the second most populous country in sub-Saharan Africa. Despite its population size and rich natural resources, Ethiopia lagged behind in economic development during much of the 20th century, ranking second poorest country around the world. Its performance in health is pessimistic due to prolonged warfare and a series of devastating famine. Life expectancy in Ethiopia is little over 57 years (Tsehaye and Hill 2014). According to the 2016 Ethiopian Demographic and Health Survey report, 62% of pregnant women receive inadequate antenatal care and only 26% of the women give birth in health facilities (CSA/Ethiopia). These figures are among the lowest in the

world along with Cambodia, Nigeria, Uganda, the Democratic Republic of Congo and Afghanistan.

Recently, Ethiopian government strived to improve accessibility to healthcare in a series of targeted interventions. In 2001, Health Sector Development Program (HDSP-1) was launched to lay out disease prevention system throughout the country. This effort continued until 2004 with a close collaboration with international NGOs to expand basic healthcare (Wamai 2009). However, the provision of universal healthcare is not all positive with the government's push towards more decentralized, autonomous regional healthcare system operated under separate budgets (Regassa 2011). Although autonomous management of public health services at the sub-national level enables each region to devise more efficient system to meet their own needs, many fear that it will also exacerbate regional disparities. Regional differences in poverty rates are already high in Ethiopia, with 96.3% of the poor concentrated in rural regions like Somali and Oromiya. Poverty rates in urban cities such as Addis Ababa and Dire Dawa are less than half of the national average. These regional variations took a direct toll on the quantity and quality of healthcare services available within each region. For example, the average public health expenditure in Addis Ababa is 26.8 Birr per person (roughly equivalent to $1) whereas the public health expenditure for Oromiya is less than 14 Birr (Ali 2014). After decentralization, many community-level health centers and clinics are left severely under-budgeted and under-utilized. As a result, Ethiopia is experiencing an uneven progress in access to healthcare (United Nations Population Fund).

Promoting universal primary education to a diverse population poses another challenge. Rampant practice of child labor and early marriage of girls systematically keep disadvantaged children out of school (Engel and Pauline 2011). For the majority of women, primary school is

the highest level of schooling ever attended or completed and only 4% of them have completed beyond secondary school. Since 1994, Ethiopia has abolished school fees for primary schools and made a remarkable progress in expanding primary education. Despite many challenges, the proportion of educated women increased 15 percentage-point in just 15 years. As of 2016, roughly half of women (55%) have come to receive formal education. Alternative basic education system and innovations in mobile schools are increasing enrollment among disadvantaged children in remote rural areas (Bishaw and Lasser 2012). However, access to primary school still varies from region to region with the slowest expansion rate in pastoral regions in the north and agricultural regions in the south.

Data

I use data from the three most recent rounds of the Ethiopian Demographic and Health Survey (EDHS); these were fielded in 2005, 2011 and 2016. The DHS fields nationally representative surveys in more than 90 developing countries, collecting comprehensive data on population, health, HIV, nutrition, literacy and many other aspects of household and community level dynamics. Pooled together, EDHSs surveyed a total of 46,268 women between the ages of 15 and 49. I use listwise deletion to exclude 2.4% of the total sample whose answer is missing in one or more key variables used in the analysis. Thus, my analytic sample includes 45,180 women. For decomposition analyses, I primarily use 2005 and 2016 EDHSes with 29,238 observations.

Dependent and Independent Variables

The primary outcome of interest in this study is healthcare utilization. Healthcare utilization is measured as a dichotomous variable indicating whether women visited any type of health facility in the past 12 months to attend to either their own or their children's illness.

Key Independent Variable

Education is also measured as a dichotomous variable at the individual-level to calculate the percentage of population with formal education in a given region. Dichotomous classification of education has several advantages over average years of education since this paper mostly concerns with a changing educational threshold. With high grade repetition and drop-out rate prevalent in sub-Saharan Africa, categorization between women with and without any formal education provides an unambiguous, yet definitive threshold that is changing at an unprecedented rate and captures the new "left behind" population and their behavioral changes (Moultrie 2014).

Wealth

I use three distinct measures available in EDHS to measure difference in wealth between educated and uneducated women: household wealth, financial barrier to healthcare utilization, and employment status of a woman. Household wealth is a five-quantile wealth index as provided in DHS, calculated based on household assets and service amenities such as electricity and access to clean water. Financial barrier to healthcare utilization is a dichotomous variable based on the question; "[m]any different factors can prevent women from getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not a big problem: Getting money needed for advice or treatment?" If financial barrier poses a big problem, it was coded as 1. Although household wealth and financial barrier are correlated, wealth index measures the relative economic status of women's household while financial barrier captures broader availability of extra cash in times of need as well as women's ability to manage finance. Women's employment status is also

dichotomous; 1 if women is engaged in any income-generating activities other than housework and subsistent farming.

Literacy

Literacy is measured as a dichotomous variable, coded as 1 if women can partially or fully read a sentence in their preferred language.

Contextual Factors

Contextual factors come from four dichotomous variables: urban residence, geographical barrier, and two cultural barriers to healthcare utilization. Geographical barrier is coded as 1 if the respondent reports that "distance to travel" poses a big problem in visiting health facility. Cultural barriers are each coded as 1 if women indicate 1) getting permission to travel, and 2) not wanting to go alone as big problems in visiting health facility. Appendix A provides mean values for each variable included in the analysis.

Methods

Disparities in Healthcare Utilization

To assess the directional effect of educational expansion on health disparities and the size of its effect, I first calculate relative inequality in healthcare utilization between educated and uneducated women using the concentration index (CI). Epidemiologists widely adopted the concentration index in measuring dichotomous health outcomes as its clearly defined range (-1 to 1) and the ability to distinguish "beneficiary" group gives natural advantage over other commonly used measures of inequality (Regidor 2004; Etches et al. 2006; Saidi and Hamdaoui 2017). The generic formulation for the concentration index is shown below:

$$\mathrm{CI} = \frac{2}{r}\left[\sum_{j=0}^{j} w_j r_j R_j\right] - 1$$

Where,

j refers to each educational group (2 groups),

w_j is the proportion of educational group *j* ,

r_j is the healthcare utilization rate for group *j* and,

R_j indicates the relative rank of each educational group

The concentration index ranges from -1 to 1, and is 0 when healthcare utilization is evenly distributed across population (perfect equality). Positive CI closer to 1 indicates higher concentration of healthcare utilization among educated women (inequality) whereas negative CI closer to -1 indicates higher concentration among uneducated women (reverse inequality). For the purpose of this paper, I treat reverse inequality as meeting equity in healthcare utilization. I decompose the changes in healthcare utilization rate between 2005 and 2016 using a standard decomposition method, where:

$$\Delta\, rate \;=\; \sum_{j=0}^{j} \Delta w_j \overline{r_j} + \overline{w_j} \Delta r_j$$

w_j is the proportion of each educational group *j* and,

r_j is the healthcare utilization rate for group *j*

The decomposition of this rate assesses the extent to which changes in health disparities are attributable to the changes in proportion (i.e., an increase in the educated population), and which are attributable to changes in rate itself (i.e., increased healthcare utilization within the groups). The first term captures the effect of educational expansion and the second term captures the effect of improvement in healthcare system.

Sources of Disparities in Healthcare Utilization

I use Blinder-Oaxaca decomposition to analyze the changes in determinants of health disparities between educated and uneducated women. This technique uses separate regression models to estimate healthcare utilization for each group (educated and uneducated):

$$y_{educated} = \beta_{educ} X_{educ} + \varepsilon_{educ}$$
$$y_{uneducated} = \beta_{noeduc} X_{noeduc} + \varepsilon_{noeduc}$$

Where *y* is the healthcare utilization rate for each educational group and **X** is a vector of determinants. Then, the difference in the mean outcome between the two can be written as:

$$\bar{y}_{educ} - \bar{y}_{noeduc} = (\bar{X}_{educ} - \bar{X}_{noeduc})\hat{\beta}_{educ} + \bar{X}_{noeduc}(\hat{\beta}_{educ} - \hat{\beta}_{noeduc})$$

The first part of the equation identifies a proportion of disparities explained by the differences in determinants - such as wealth and literacy - and second part of the equation explains the proportion that cannot be accounted by the mean differences in determinants between the two. This unexplained portion is widely used as a proxy measure for inequality (O'Donnell et al. 2008). Since the outcome variable is dichotomous, I use non-linear decomposition methods proposed by Sinning, Hahn, and Bauer (2003). I run a total of 22 models comparing educated and uneducated women in each region for the baseline (2005) and the endline (2016) and compare relative effect of each determinant across time and region.

Results

General Trends in Primary Education and Healthcare Utilization in Ethiopia, 2005-2016

First, I lay out general trends in primary educational expansion and healthcare utilization in Ethiopia from 2005 to 2016 to capture the dynamic changes in social landscape during this period. Table 1 presents changes in primary education attainment and healthcare utilization in

Ethiopia, sorted by the percentage of educated women in 2005. At the national level, educational attainment among women of reproductive age greatly increased over the past decade, from 37% in 2005 to 54% in 2016. In urban districts (Addis Ababa, Harari, and Dire Dawa), more than half of the women are formally educated, whereas agro-pastoral regions (Somali and Affar) have the smallest proportion of educated women in 2005. Between 2005 and 2016, Benishangul-Gumuz, Southern Nations, Nationalities, and People's Regions (SNNPR), and Gambela experienced the most notable expansion in primary education, with nearly 30 percentage point increase in the percentage of women who received at least one year of formal education. Affar and Somali still lag behind national average with less than 30% of the population ever attended school, yet Addis Ababa is close to achieve universal primary education with more than 90% of the population with at least one year of formal education. Although each region shows considerable variations in initial educational composition and expansion rates, all regions in Ethiopia achieved notable educational expansion by 2016.

[Table 1: Changes in Primary Education and Healthcare Utilization in Ethiopia, 2005-2016]

Healthcare utilization, in general, shows less regional variation compared to primary education. From 2005 to 2016, healthcare utilization rate among women increased from 24% to 43%. Similar to primary education, Somali has the lowest healthcare utilization rate of 7% in 2005. In 2016, 21% of women in Somali come to visit health facilities. Greatest improvement came from Dire Dawa (24 percentage-point), Gambela (26 percentage-point) and Tigray (30 percentage-point). By 2016, facility utilization rate was highest in Addis Ababa (57%) and lowest in Somali (21%).

Figure 1 provides detailed changes in healthcare utilization among women by age, cohort, and period. Two lexis diagrams are presented – left is for women without primary education and

right is for women with at least one year of formal education. Healthcare utilization improved among women with all ages and birth cohorts. For instance, 22.85% of the uneducated women between the ages of 20-24 visited health facility in 2005. Following the dotted diagonal line, facility utilization rates for the same cohort of women rose to 34.66% (ages 25-29) and 44.97% (ages 30-34) in 2011 and 2016, respectively. Healthcare utilization rate increased by period as well. Only 22.85% of uneducated women utilized health facility in 2005. Following the horizontal line, utilization rates for the same age group in 2011 and 2016 increased to 29.73% and 37.16%, suggesting an overall increase in facility utilization even after controlling for the age-specific demand for healthcare during this period of life.

Healthcare utilization among educated women follows a similar trend between 2005 and 2016. Cohort-specific healthcare utilization rate (diagonal) for educated women who were 20-24 years old in 2005 rose from 36.22% to 53.42% in 2011 and 63.21% in 2016. Age-specific healthcare utilization rate (horizontal) for 20-24 year-old educated women increased from 36.22% to 45.49% and 52.49% in 2011 and 2016, respectively. In sum, healthcare utilization rate increased for both educated and uneducated women during this period. Healthcare utilization rate is age-specific, with the highest utilization rate among women over 25. However, lexis diagrams conveniently show that healthcare utilization increased across all age groups and periods.

[Figure 1: Healthcare Utilization in Ethiopia, by Age, Cohort, and Period]

Decomposition of Disparities in Healthcare Utilization

In this sub-section, I calculate the concentration index to examine whether the overall increase in healthcare utilization is evenly distributed across educational groups, accounting for the rapid change in the proportion of educated population. Table 2 displays inequality measures for healthcare utilization between educated and uneducated women. First two columns show the

indices for each region in 2005 and 2016, sorted by the percentage of educated women (highest to lowest). Bolded indices indicate reverse inequality (equity). In 2005, disparities in healthcare utilization in Ethiopia is moderate, with the average concentration index of 0.0614. However, the magnitude of disparities varies substantially across regions, ranging from the highest inequality in Gambela (0.1750) to the lowest in Amhara (0.0128). As indicated, Tigray (bolded) is the only region where uneducated women have higher healthcare utilization rate in 2005.

[Table 2: The Concentration Indices for Healthcare Utilization by Region and Year]

By 2016, disparities in healthcare utilization decreased by 68% in Ethiopia. In Gambela, where inequality was highest in 2005, the concentration index dropped to 0.0462 (75% decrease). Amhara had the greatest fall, reaching equity in healthcare utilization as uneducated women come to outweigh educated women. SNNPR reached equity as well, closely followed by Oromiya. However, in two urban regions – Harari and Dire Dawa – disparities in healthcare utilization increased substantially (217.65% and 31.45%, respectively). In just a ten-year period, health disparities in Ethiopia are diverging despite overall increase in healthcare utilization at the national level.

How much of these changes in health disparities are accounted by educational expansion? Column 4 shows the percentage of change in healthcare utilization accounted by an increase in educated population and column 5 shows the percentage of change accounted by an increase in overall healthcare utilization rate across educational groups. In general, changes in health disparities are largely due to increase in healthcare utilization rate, accounting for roughly 94% of the total change. Educational expansion accounts for 6% of the overall change in healthcare utilization. The effect of educational expansion is largest in Somali (14.59%), suggesting that the increase in educated population alone is powerful enough to reduce health disparities. In Dire

Dawa and Harari, educational expansion contributes towards greater health disparities; although the effect of educational expansion is negligible in Harari (2.97%), increase in educated population has a considerable stratifying effect in Dire Dawa (11.37%). In Tigray and Amhara, the effect of educational expansion is negative, indicating that educational expansion would have increased health disparities if healthcare utilization rate remained constant.

As with educational expansion, advancement in healthcare system works in two directions. In most of the regions, improved accessibility reduces disparities in healthcare utilization. Harari and Dire Dawa are two exceptions where disparities in healthcare utilization increased with overall improvement in access to healthcare. These results from decomposition analysis underline three important findings: First, educational expansion does not always decrease health disparities and may aggravate inequality under certain conditions. However, the magnitude of its effect is smaller than what was previously assumed. Second, social advancement in multiple sectors - educational expansion and improvement in healthcare system - has varying magnitude and directional effect on health disparities. They do not always work in unison and the directional changes are versatile in times of rapid social change. Third, within-country variations in health disparities are substantial and so is the effect of educational expansion in country with a diverse population and administrative units.

Determinants of Health Disparities during Rapid Social Change

Using Blinder-Oaxaca decomposition, I further examine how various determinants contribute to disparities in healthcare utilization and how their effects change over time. For conciseness, I report the average contribution of each determinant by categories (wealth, literacy, and contextual effects) in Figure 2, which summarizes the explanatory power of each determinant as a percentage, and present the full results in an Appendix. In 2005, wealth and

literacy explains the majority of health disparities between educated and uneducated women, with wealth as the biggest source of disparities at the national level. Literacy also explains much of the disparities in 2005. In other words, difference in literacy between educated and uneducated women explain roughly 40% of the disparities in healthcare utilization. Contextual differences have negative effect in 2005, suggesting that on average, geographical and attitudinal traits mitigate the effects of other determinants. By 2016, literacy loses significance while wealth still remains a strong source of disparities in healthcare utilization. Unlike 2005, contextual differences now contribute to health disparities. Unexplained portion of health disparities more than tripled in 2016.

[Figure 2: Average Effect of Each Determinant of Disparities in Healthcare Utilization, 2005 and 2016]

However, national average masks regional variations and does not explain why health disparities decreased in some regions but increased in others. To further analyze the effect of each determinant, I present contributions of each determinant by region, relative to the size of inequality (Figure 3). Variables stacked in the positive side (right) contribute to health disparities while determinants listed in the negative side (left) counterbalance them. Thus, the size of absolute inequality is calculated as bars on the positive side minus bars on the negative side.

[Figure 3: Determinants of Disparities in Healthcare Utilization over time by Region]

As mentioned earlier, difference in wealth between educated and uneducated women explains a bulk of health disparities in all regions but Somali. In 2005, the effect of wealth is largest in Harari and Dire Dawa, accounting for the majority of health disparities. In 2016, economic difference still remains a major source of disparities in healthcare utilization in Dire Dawa but its effect is reduced in Harari. This finding suggests that stark increase in health

disparities in these two regions are not triggered by the difference in wealth between educated and uneducated women. Interestingly though, wealth became a significant source of disparities in Affar and many other regions with relatively low educational attainment in 2016. These regional differences in the effect of wealth is attributable to the employment prospect of women. Detailed analysis suggests that in urban settings, women's employment status mitigates the effect of household wealth whereas in rural regions, it complements the negative effect of household wealth. Generally, employment opportunities for uneducated women are more readily available in cities like Addis Ababa and Dire Dawa whereas employment opportunities for all women are limited in Affar. This indicates that when women's economic opportunities are limited, health disparities between educate and uneducated women are pronounced. In sum, educational expansion did not fully eradicate economic differences, either due to social selection effect into school or increased return to education. And these differences in economic circumstances are stubborn sources of disparities in healthcare utilization even though overall utilization rate increased over time.

Literacy, on the other hand, works differently from wealth. In 2005, literacy explains much of the disparities in all regions. This is because skills and knowledge obtained at school are directly transferrable to health outcome when no more than 40% of the population are formally educated. In 2016, however, the effect of literacy is reversed in many regions. This is in line with previous research that affirms a possible spillover effect of literacy as schooling becomes more common (Smith-Greenaway 2017). However, there is no visible association between the size of its effect and the educational level. In other words, counterbalancing effect of literacy is not necessarily higher in regions with larger proportion of literate population. One interesting thing to note is that literacy is still a diverging source in Addis Ababa where 91% of the women are

formally educated and 89% of the women are literate. This finding underscores the importance of residential segregation and network cluster as moderators of spillover effect (Admassie 2008).

Contextual differences such as geographical residence and attitudes are significant sources of inequality in a number of regions, most notably in Somali. This is not surprising given that Somali has the lowest accessibility to healthcare due to frequent armed conflict and poor infrastructure. On the other hand, in Dire Dawa, contextual effect counterbalances the effect of wealth and literacy. In 2016, geographical barrier is removed in most of the regions. However, cultural differences in willingness to travel alone and getting permission to travel are persistent sources of disparities. This suggests that unlike literacy, changing social norm via education is slower to close the gap in health behavior and physical accessibility often guarantees faster adoption of health behaviors in this setting.

Most notable difference between 2005 and 2016 is the drastic increase in the contribution of unexplained factors. In 2005, unexplained difference between educated and uneducated women often counterbalanced the effect of other determinants. However, in 2016, the directional effect is shifted in many regions, with the unexplained force now contributing to health disparities. Drastic increase in health disparities in Harari and Dire Dawa are mostly coming from these unexplained factors. Unexplained factors may include higher demand for healthcare among uneducated women (if they are less healthy than their educated counterparts) or distrust in the public healthcare system if the quality of care is compromised or low for this population. Although concentration of healthcare utilization became more evenly distributed over the course of the years in many regions, increase in unexplained factors signals a potential that health disparities might increase in the future due to unforeseen reasons.

Conclusion

Evidence from Ethiopia shows that educational expansion and overall improvement in healthcare system have varying effects on health disparities. At the national level, health disparities significantly decreased in the past ten years. However, educational expansion has mixed effects, reducing health disparities in some regions yet exacerbating in others. This finding, along with its relatively small effect, draws attention to the unintended consequences of social advancement, which inevitably increases inequality in a short term (Ram 1990). This is particularly salient in places like Ethiopia where rapid social changes are happening in multiple sectors, constantly redefining social structure and hierarchies. However, few counterexamples also provide a positive provision that social advancement can take place without compensating for equality. Subsequent analysis suggests that meso-level contextual differences may generate these diverging pathways.

Blinder-Oaxaca decomposition analysis details which determinant of health disparities mitigates or exacerbates the effect of educational expansion. Once enough proportion of population is educated, basic skills such as literacy mitigates health disparities. On the other hand, wealth constantly contributes towards health disparities between educated and uneducated women. In low-resource settings like Ethiopia, contextual effect such as geographical barriers and attitudes also contribute to health disparities. Although urban cities have higher percentage of educated women in general, contextual components both increase and reduce health disparities across regions, underscoring the importance of community-specific effects in moderating the relationship between education and health outcomes (Burroway and Hargrove 2018). These findings, along with an increase in “unexplained” portion of health disparities, all

indicate that educational expansion does not always guarantee healthier population and needs careful investigation on its multifaceted roles.

Although findings from this study only pertain to the relationship between educational expansion and health disparities, rich literature on inequality raises additional questions about the unintended consequences of educational expansion. The Millennium Development Goals, and subsequently, the Sustainable Development Goals all prioritize universal primary education as a "foundation to improving people's lives" (United Nations 2018). However, educational expansion in developing countries all too often happens in haste without adequate social infrastructure and resources. This makes schools less discriminating, yet not quite strong enough to engender massive shifts in societies to fully eliminate selection effect (Foster 1980). In this context, much of the international effort in promoting universal education may generate a new group of "truly disadvantaged" as people without education have become an increasingly select group (Dowd and Hamoudi 2014).

If inequality has fluid, Durkheimian effect on societies (Wilkinson and Pickett 2011) and inequality in one dimension inescapably leads to inequality in another, educational expansion surely reduces inequality in educational attainment but may increase perceived inequality among people who are left behind, engendering status anxiety and other relative deprivation that has real, tangible consequences in health (Layte and Whelan 2014). Health disparities tend to be high in countries where levels of inequality in income and education are also high (Beckfiled 2013). Thus, policy makers and development practitioners should approach educational expansion with much caution and preparation. As Deaton once argued, it would be less healthy for both advantaged and disadvantaged to live in an unequal society (2003).

At the policy level, relative importance of educational expansion and general improvement in healthcare services in shaping health disparities is worth mentioning. There is an ongoing debate on whether basic healthcare system weights more than education in shaping population health. In industrialized countries, studies have shown that education weighs far more than healthcare system in shaping later-life health disparities (Preston 1975; Hendi 2015). However, at least in context of Ethiopia, the effect of healthcare is much robust than what was previously known and highlights the importance of the basic health infrastructure in low-resource countries (Mladovsky and Ba 2017; O'Donnell 2007). Of course, decomposition analysis does not establish direct causal link between variables of interest and findings in this study do not indicate that improving healthcare system would mitigate health disparities. However, decomposition methods nonetheless identify dominant factors behind the changes in health disparities and provide a vital insight into how social determinants shift over time. Given the importance of the accessibility of healthcare services in this setting, future policy should pay closer attention to the role of healthcare system as a way to promote population health.

Regional diversity in health disparities opens up further promising area for future research. Many studies on education and health disparities use country as an unit of analysis and often overlook within-country variations. However, results from this study indicate that regional variations in health disparities are substantial and so are the effect of educational expansion and other moderators in act. This adds on to the recent scholarly effort to highlight the importance of meso-level as an important source of variation of its own (Burroway and Hargrove 2018). Sub-country-level analysis is particularly important in sub-Saharan African context where single country consists of diverse environments, political interests, and populations. In case of Ethiopia, regional-specific experiences with warfare, natural disasters, and political atmosphere directly

translate into the availability of resources and strategic adaptation of healthcare services that would significantly alter the social dynamics encompassing education and health inequality (Khan, Faguet, and Ambel 2017; Onarheim et al. 2015). Regional-specific analysis might reduce generalizability of the findings; however, investigation on institutional influence on education and health disparities would identify other important mechanisms that often remain unobserved in survey data.

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Table 1: Changes in Primary Education and Healthcare Utilization in Ethiopia, 2005-2016

	Proportion with education			Healthcare Utilization		
Region	2005	2016	Diff	2005	2016	Diff
Addis Ababa†	0.82	0.91	0.09	0.44	0.57	0.13
Harari†	0.57	0.65	0.08	0.27	0.42	0.15
Dire Dawa†	0.56	0.68	0.12	0.24	0.48	0.24
Gambela	0.41	0.68	0.27	0.17	0.47	0.30
SNNPR	0.35	0.56	0.21	0.22	0.35	0.13
Oromiya	0.33	0.49	0.16	0.26	0.38	0.12
Tigray	0.33	0.57	0.24	0.25	0.55	0.30
Benishangul-Gumuz	0.28	0.49	0.21	0.25	0.45	0.20
Amhara	0.24	0.44	0.20	0.26	0.44	0.18
Affar	0.12	0.26	0.14	0.25	0.42	0.17
Somali	0.07	0.25	0.18	0.07	0.21	0.14
AVERAGE	0.37	0.54	0.17	0.24	0.43	0.19

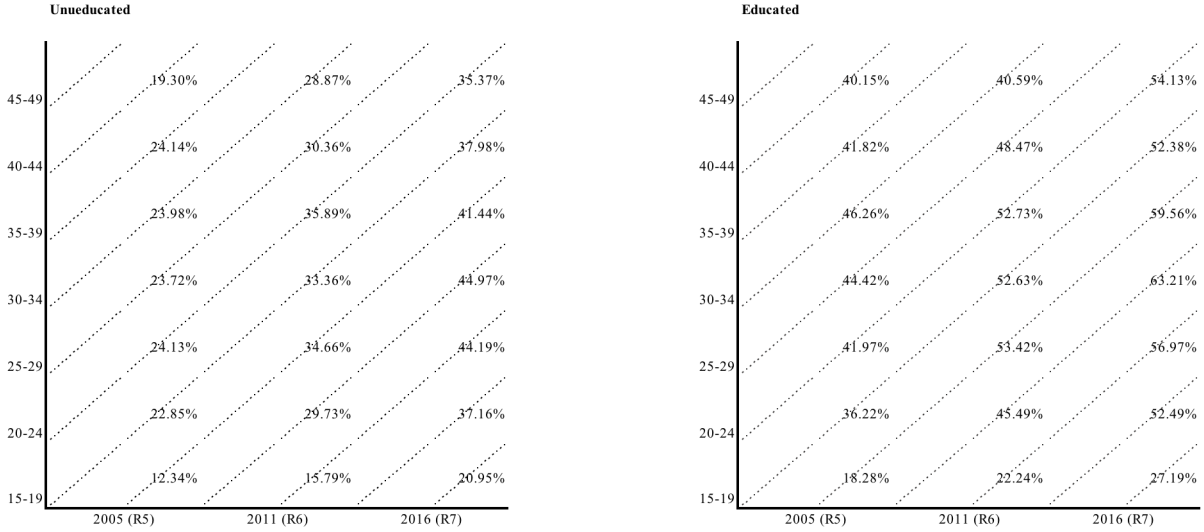
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016
Notes: † indicates urban districts

Table 2: The Concentration Indices for Healthcare Utilization by Region and Year

	Healthcare Utilization				
Region	CI (2005)	CI (2016)	Percentage change	Change due to educational expansion	Change due to difference in uptake
Addis Ababa†	0.0379	0.0118	-68.73%	7.91%	92.09%
Harari†	0.0180	0.0570	217.65%	2.97%	97.03%
Dire Dawa†	0.0278	0.0365	31.40%	11.37%	88.63%
Gambela	0.1750	0.0462	-73.57%	9.72%	90.28%
SNNPR	0.0752	**-0.0096**	-112.70%	4.61%	95.39%
Oromiya	0.0558	0.0074	-86.66%	3.40%	96.60%
Tigray	**-0.0235**	**-0.0274**	16.44%	-3.40%	103.40%
Benishangul-Gumuz	0.1306	0.0115	-91.17%	9.46%	90.54%
Amhara	0.0128	**-0.0375**	-392.85%	-2.72%	102.72%
Affar	0.0495	0.0307	-38.03%	7.76%	92.24%
Somali	0.1168	0.0877	-24.89%	14.59%	85.41%
AVERAGE	0.0614	0.0195	68.25%	5.97%	94.03%

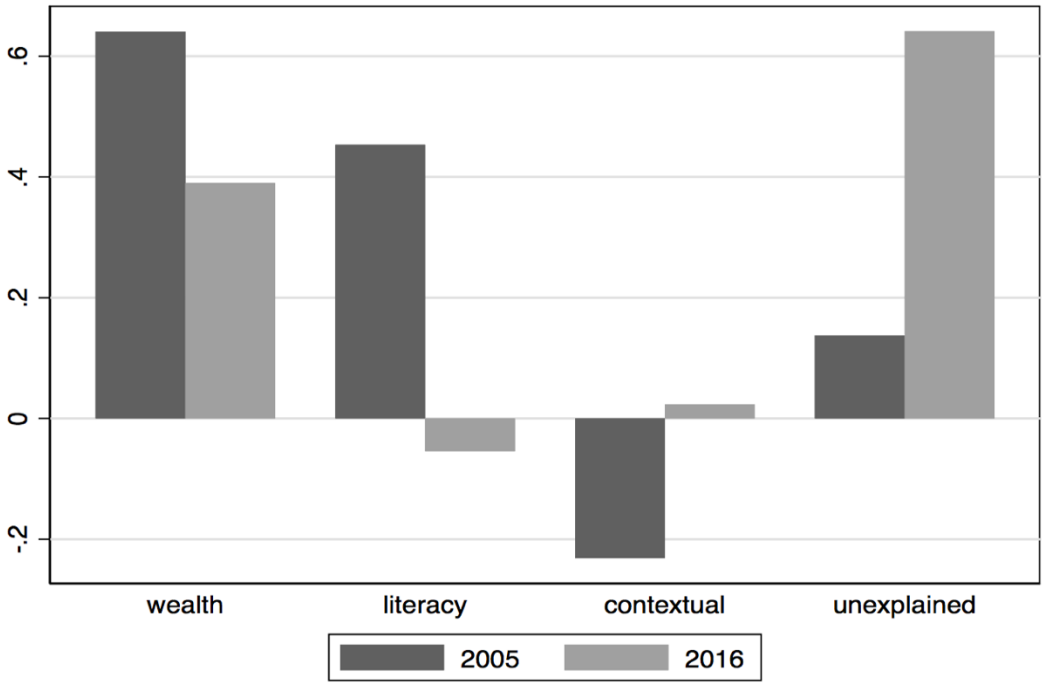
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016
Notes: † indicates urban districts

Figure 1: Facility Utilization in Ethiopia, by Age, Cohort, and Period



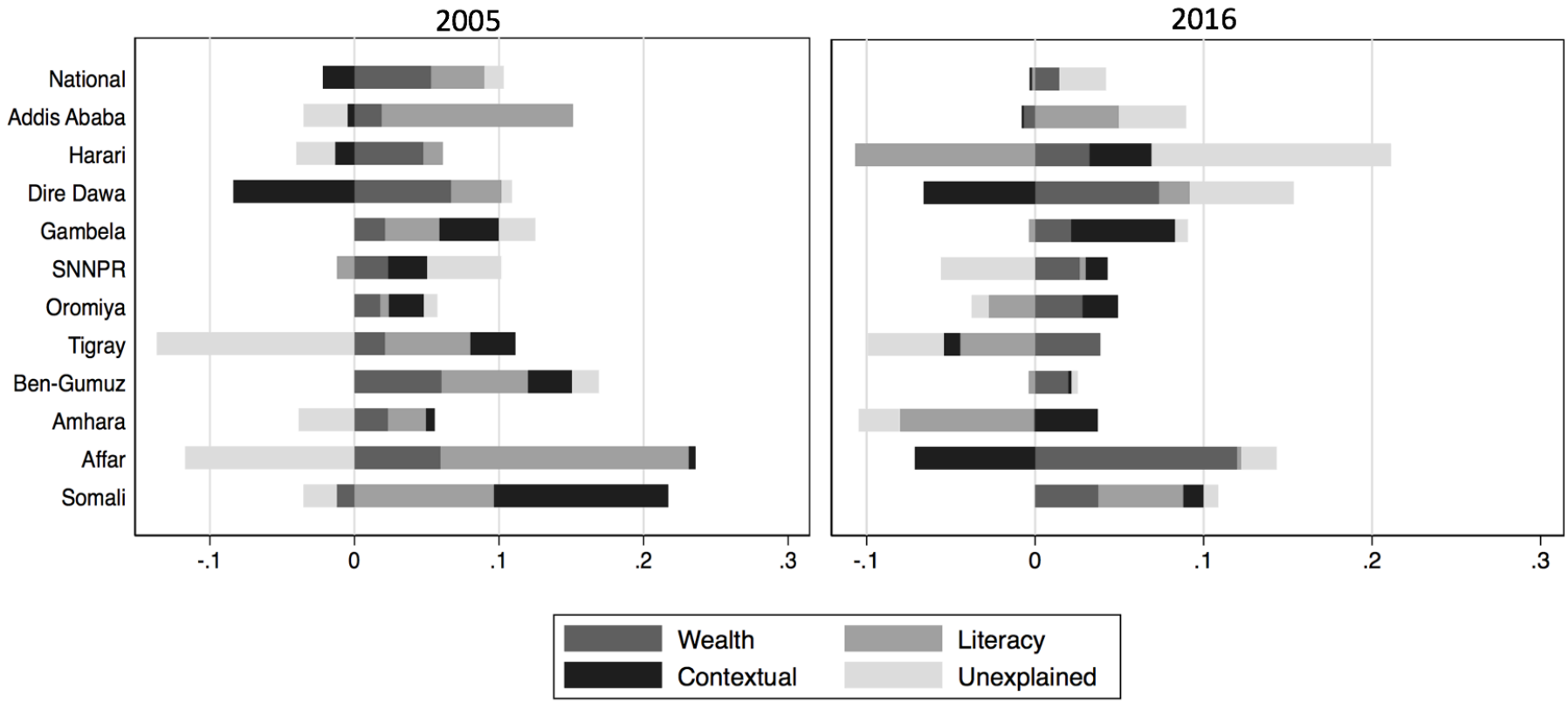
Source: Ethiopian Demographic and Health Survey (EDHS), 2005-2016

Figure 2: Average Effect of Each Determinant of Disparities in Healthcare Utilization, 2005 and 2016



Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016

Figure 3: Determinants of Disparities in Healthcare Utilization over time by Region



Appendix A: Summary of Variables by Educational Groups, 2005 and 2016

	2005			2016		
	Uneducated	Educated		Uneducated	Educated	
Healthcare utilization	0.22	0.32	***	0.39	0.46	***
Wealth						
Wealth index	2.72	4.29	***	2.40	3.90	***
Financial barrier	0.81	0.56	***	0.63	0.41	***
Employment	0.68	0.60	***	0.56	0.47	***
Literacy	0.02	0.87	***	0.03	0.81	***
Contextual						
Urban residence	0.13	0.60	***	0.13	0.52	***
Distance to travel	0.72	0.43	***	0.57	0.36	***
Permission to travel	0.34	0.19	***	0.34	0.23	***
Traveling alone	0.61	0.45	***	0.44	0.30	***
N	8,365	5,484		7,018	8,371	

Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016

Appendix B: Full Decomposition Results by Region, 2005

	Addis Ababa	Harari	Dire Dawa	Gambela	SNNPR	Oromiya	Tigray	Ben-Gumuz	Amhara	Affar	Somali
Utilization rate for educated	0.467	0.282	0.248	0.242	0.291	0.278	0.229	0.369	0.273	0.351	0.257
Utilization rate for uneducated	0.351	0.261	0.223	0.117	0.202	0.221	0.255	0.200	0.256	0.232	0.0615
Absolute difference	0.116	0.0209	0.0252	0.125	0.0894	0.0573	-0.0254	0.169	0.0169	0.119	0.196
Explained	0.0796	0.0694	-0.0191	0.0992	0.0141	0.0751	0.128	0.162	0.0911	0.219	0.193
Unexplained	0.0364	-0.0485	0.0442	0.0259	0.0753	-0.0178	-0.153	0.00747	-0.0742	-0.100	0.00277
Explained											
Household wealth index	0.0120	0.0410	0.0441	0.0145	0.0285	0.0175	0.0293	0.0915	0.0310	0.0930	-0.00663
Employment	0.00204	0.00354	0.00193	0.00404	-0.000390	0.000178	-0.00438	-0.00189	0.00142	-0.0300	0.00539
Financial barrier	0.00627	0.00359	0.0288	0.00297	-0.00148	-0.00109	-0.00460	-0.0315	-0.0109	-0.00259	-0.0111
Literacy	0.0623	0.0378	-0.00121	0.0363	-0.0449	0.0371	0.0780	0.0725	0.0638	0.148	0.0593
Urban residence	0.00154	-0.0709	-0.110	0.0443	0.0160	0.0161	0.0161	0.0111	0.00208	0.00148	0.0530
Distance to travel	-0.0183	0.0125	0.00780	0.000597	0.00871	0.00377	-0.00109	0.0152	0.0108	-0.0328	0.0476
Permission to travel	0.00923	0.0436	0.00428	-0.00351	0.00942	0.00255	0.00265	0.00700	-0.000652	0.00566	0.0135
Traveling alone	0.00443	-0.00170	0.00486	-0.0000479	-0.00173	-0.00108	0.0116	-0.00245	-0.00650	0.0367	0.0317
Unexplained											
Household wealth index	-0.201	0.00550	1.003	-0.0164	-0.0394	0.118	-0.0186	-0.0496	0.107	-0.210	0.444
Employment	-0.0459	-0.0327	-0.0596	-0.0382	-0.0307	0.0159	-0.0637	-0.00506	0.0110	-0.167	-0.0339
Financial barrier	-0.000930	0.0391	-0.0369	0.0383	0.0330	-0.0113	-0.00206	-0.000295	0.0119	0.0420	0.0140
Literacy	0.0250	-0.0405	-0.0986	0.00358	-0.0198	-0.0199	-0.0467	-0.00210	-0.0598	0.0227	-0.0737
Urban residence	-0.174	0.0286	0.229	-0.00593	0.0169	-0.00462	0.0215	-0.00746	0.00284	0.0175	-0.178
Distance to travel	0.0455	-0.0295	0.134	-0.0156	0.0208	0.00230	0.00763	0.0114	-0.0185	0.0492	-0.0500
Permission to travel	-0.0284	-0.0832	0.178	0.0170	-0.0359	-0.0141	-0.0383	0.00691	-0.0281	-0.00859	-0.0382
Traveling alone	-0.00975	-0.0723	-0.0782	-0.00804	-0.00254	-0.00266	-0.0224	-0.0199	-0.00859	-0.0923	-0.0901
_cons	0.426	0.136	-1.227	0.0511	0.133	-0.101	0.00965	0.0735	-0.0923	0.246	0.00824
N	1858	838	800	693	1995	2186	1252	827	1941	787	653

Appendix C: Full Decomposition Results by Region, 2016

	Addis Ababa	Harari	Dire Dawa	Gambela	SNNPR	Oromiya	Tigray	Ben-Gumuz	Amhara	Affar	Somali
Utilization rate for educated	0.579	0.460	0.509	0.488	0.350	0.389	0.521	0.461	0.404	0.351	0.257
Utilization rate for uneducated	0.497	0.356	0.421	0.401	0.363	0.378	0.581	0.440	0.472	0.232	0.0615
Absolute difference	0.0821	0.104	0.0872	0.0870	-0.0129	0.0114	-0.0606	0.0215	-0.0676	0.119	0.196
Explained	-0.0291	0.0408	0.0196	0.0820	0.0452	0.0156	0.00421	-0.0230	0.00238	0.219	0.193
Unexplained	0.111	0.0634	0.0676	0.00504	-0.0581*	-0.00418	-0.0648	0.0445	-0.0699	-0.100	0.00277
Explained											
Household wealth index	*omitted*	0.0438	0.0610	0.0270	0.0327	0.0223	0.0427	0.0379	0.00374	0.0930	-0.00663
Employment	0.0000439	0.000995	0.0111	0.00573	-0.00170	0.000997	-0.00294	-0.0153	-0.00115	-0.0300	0.00539
Financial barrier	-0.00476	-0.0208	0.00172	-0.0121	-0.00460	0.00540	0.000941	0.000679	-0.00586	-0.00259	-0.0111
Literacy	-0.0240	-0.0107	0.0109	-0.000132	0.00586	-0.0343	-0.0250	-0.0492	-0.0571	0.148	0.0593
Urban residence	*omitted*	0.00775	-0.0588	0.0417	0.0193	0.00431	-0.00811	-0.0173	0.0491	0.00148	0.0530
Distance to travel	0.0000456	-0.0156	-0.00000750	0.000256	-0.00794	0.00299	-0.00934	-0.00234	0.0114	-0.0328	0.0476
Permission to travel	-0.000411	0.0135	-0.00127	0.00828	0.00367	0.00673	0.00147	0.0116	0.00155	0.00566	0.0135
Traveling alone	-0.0000208	0.0220	-0.00507	0.0112	-0.00215	0.00722	0.00445	0.0109	0.000612	0.0367	0.0317
Unexplained											
Household wealth index	*omitted*	-0.230	-0.0708	-0.157	0.0237	0.0320	-0.0113	-0.0837	-0.118	-0.210	0.444
Employment	-0.0643	-0.0498	0.0110	0.0346	0.00877	-0.0207	0.0210	-0.0278	-0.0206	-0.167	-0.0339
Financial barrier	0.0263	0.0998	0.0104	-0.0445	0.0194	0.0160	0.0127	0.0269	-0.0190	0.0420	0.0140
Literacy	0.113	-0.00667	0.0195	0.0159	0.00252	0.00739	0.00484	0.00807	-0.0148	0.0227	-0.0737
Urban residence	*omitted*	0.0781	0.0883	0.0439	0.00340	-0.00207	0.0138	0.00739	0.0169	0.0175	-0.178
Distance to travel	-0.0969	-0.123	-0.0525	-0.00563	-0.0277	-0.00728	-0.00921	0.0514	0.0177	0.0492	-0.0500
Permission to travel	-0.187	0.0869	0.0156	0.0672	-0.0147	-0.0217	-0.0436	-0.0786	0.0378	-0.00859	-0.0382
Traveling alone	-0.000328	-0.0646	0.0256	0.113	-0.00890	-0.000749	-0.00541	-0.0383	0.0265	-0.0923	-0.0901
_cons	0.320	0.273	0.0205	-0.0619	-0.0645	-0.00712	-0.0475	0.179*	0.00383	0.246	0.00824
N	1806	900	1115	932	1807	1890	1681	1123	1718	787	653