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# BMJ Open

## A discrete choice experiment to determine facility-based childbirth services desired by women and men in rural Ethiopia

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Complete List of Authors:	Beam, Nancy Bekele Dadi, Gezehegn; Hawassa University College of Medicine and Health Sciences, School of Nursing and Midwifery Rankin, Sally; UCSF School of Nursing, Family Health Care Nursing Weiss, Sandra; UCSF School of Nursing, Dean's Office and Community Health Services Cooper, Bruce ; UCSF, Dean's Office Thompson, Lisa; UCSF School of Nursing, Family Health Care Nursing
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10 **Authors:**

11 Nancy K. Beam<sup>a</sup>, Gezahegn Bekele Dadi<sup>b</sup>, Sally H. Rankin<sup>a</sup>, Sandra Weiss<sup>c</sup>, Bruce Cooper<sup>d</sup>, Lisa  
12 Thompson<sup>a</sup>  
13  
14  
15  
16  
17  
18

19 <sup>a</sup>Family Health Care Nursing, School of Nursing, University of California, San Francisco, 2  
20 Koret Way, Box 0606, San Francisco, CA 94143-0606  
21  
22

23 <sup>b</sup>School of Nursing and Midwifery, College of Medicine and Health Sciences, Hawassa  
24 University, PO Box 1560, Hawassa, Ethiopia.  
25  
26  
27

28 <sup>c</sup>Dean's Office and Community Health Services, School of Nursing, University of California,  
29 San Francisco, 2 Koret Way, Box 0608, San Francisco, CA 94143-0606  
30  
31  
32

33 <sup>d</sup>Dean's Office, School of Nursing, University of California, San Francisco, 2 Koret Way, Box  
34 0604, San Francisco, CA 94143-0606  
35  
36  
37  
38  
39

40 **Corresponding Author:** Nancy Beam, Department of Family Health Care Nursing, School of  
41 Nursing, University of California, San Francisco, 2 Koret Way, Box 0606, San Francisco, CA  
42 94143-0606, USA. Phone: +011-510-593-0235. E-mail: docbeamphd@gmail.com  
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## Abstract

**Objectives:** Despite global efforts to increase facility-based (FB) delivery, 90% of women in rural Ethiopia deliver at home without a skilled birth attendant. Men have an important role in increasing FB deliveries, but this is largely unexplored. This study aimed to determine differences between the facility-based delivery care attributes preferred by women and men, and whether poverty or household decision-making are associated with choice to deliver in a facility.

**Setting and Participants:** We conducted a cross-sectional discrete choice experiment in 109 randomly selected households in rural Ethiopia in September-October 2015. We interviewed women, who were pregnant or who had a child < 2 years old, and their male partners.

**Results:** Both women and men preferred health facilities where medications and supplies were available (OR=3.08 (2.03 to 4.67),  $p<0.001$ ; OR=2.68 (1.79 to 4.02),  $p<0.001$ ), a support person was allowed in the delivery room (OR=1.69 (1.37 to 2.07),  $p<0.001$ ; OR=1.74 (1.42 to 2.14),  $p<0.001$ ), delivery cost was low (OR=1.15 (1.12 to 1.18),  $p<0.001$ ; OR=1.14 (1.11 to 1.17),  $p<0.001$ ), and doctors performed the delivery. Women valued free ambulance service (OR=1.37 (1.09 to 1.70),  $p=0.006$ ), while men favored nearby facilities (OR=1.09 (1.06 to 1.13),  $p<0.001$ ) with friendly providers (OR=1.30 (1.03 to 1.64),  $p=0.030$ ). Men are disproportionately involved in making household decisions ( $X^2$  (1, N=216)= 72.18,  $p<0.001$ ), including decisions to seek health care ( $X^2$  (1, N=216)= 55.39,  $p<0.001$ ), yet men were often unaware of their partners' prenatal care attendance ( $X^2$  (1, N=215)= 82.59,  $p<0.001$ ).

**Conclusions:** The Ethiopian government and health facilities could increase facility births in rural areas by responding to both women's and men's delivery service preferences and considering men's influence on delivery service choices.

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## Article Summary

### Strength and limitations of this study

- First known Discrete Choice Experiment to test preferences of both women and men around choice of facility-based birth services.
- Acknowledges role men play in making delivery decisions for their families
- Tests preferences predicted by the Three Delays model and based on literature to influence use of childbirth services
- Limited generalizability due to difference in wealth between study sample and general population

## Background/Rationale

Maternal mortality rate in Ethiopia decreased from 871 deaths/100,000 live births in 2000 to 676/100,000 in 2011,<sup>1</sup> but still remains above the 75% Millennium Development Goal (MDG) target reduction (218).<sup>2</sup> Neonatal mortality rate (NMR) has remained relatively unchanged since 2005 (39 deaths/1000 live births)<sup>1</sup> despite Ethiopia having achieved the MDG for infant mortality in 2013.<sup>2</sup> More than 90% of rural women deliver at home, a known barrier to reducing maternal and neonatal mortality.<sup>1</sup>

Recommendations for reducing maternal and neonatal mortality focus on skilled birth attendants (SBA) conducting delivery and referral care availability for emergencies.<sup>3</sup> While the SBA definition does not preclude home delivery, conditions in many developing countries make skilled birth attendance synonymous with facility-based birth (FB). If women are not delivering at facilities, they do not have access to emergency interventions.

The expanded three delays model<sup>4</sup> describes delays in receiving facility-based emergency and preventative delivery services: 1) Deciding to seek care; 2) Reaching the health facility; and 3) Receiving appropriate treatment. This study is primarily concerned with deciding to seek care. The decision to seek care may be influenced by sociocultural factors, perceived benefits and needs, perceived economic and physical accessibility, and perceived quality of care.

Despite government efforts to improve facility based deliveries by increasing health facility numbers and training health staff in Emergency Obstetric and Neonatal Care services provision, home delivery remains a strong tradition in Ethiopia. In Peru, where home births were similarly common, community members and providers identified facility-level changes that would make childbirth services more culturally acceptable and convenient to families. Changes that were both safe and acceptable to patients were instituted. Between 1999 and 2007, FB



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3 increased from 6% to 83% in targeted rural communities.<sup>5</sup> Ethiopian health facilities need to  
4 understand factors underlying delivery place choice to establish policies that respond to families'  
5 preferences.  
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10 A 54-study literature review examined factors associated with delivery location in  
11 Ethiopia's unique cultural context. Changeable facility-level factors included cultural, perceived  
12 benefits and needs, economic, and physical barriers. Cultural barriers to FB identified in  
13 qualitative studies were examinations by male providers,<sup>6,7</sup> cultural norms that emphasize  
14 support from family and friends during delivery;<sup>7-16</sup> and medical culture that allows mistreatment  
15 of pregnant women by providers.<sup>6-8,11,13</sup> Conversely, facilities offering delivery by higher level  
16 providers<sup>11,14,16,17</sup> and which were consistently stocked with medications and supplies were  
17 appreciated.<sup>11,17</sup>  
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28 Quantitative measures of cultural factors include women's autonomy and involvement in  
29 deciding where to deliver. Women's autonomy was not generally found to be associated with  
30 FB.<sup>18-22</sup> However, women involved in deciding where to deliver were more likely to have  
31 FBs.<sup>8,10,23-27</sup>  
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37 Perceived benefits and need for FB may be influenced by access to mass media, ANC use,  
38 and previous FB. FB may be more common among families who own radios and/or TVs,<sup>10,28,29</sup>  
39 but more frequently no association was found.<sup>23,27-32</sup> ANC use, which may both increase  
40 knowledge of perceived benefits and need for FB, and increase comfort with facility staff, was  
41 frequently,<sup>8,21,25,27,32-41</sup> but not always,<sup>19,23,42-44</sup> associated with FB. Previous experience with FB  
42 varied in its association with FB from positive<sup>34,43</sup> to negative<sup>37</sup> to no association.<sup>23</sup>  
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51 Although the Three Delays model shows perceived, rather than actual, economic  
52 accessibility predicts care-seeking behavior, most Ethiopian studies measure economic  
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3 accessibility as mother's occupation,<sup>10,18–20,27,30,31,36,38,39,45,46</sup> husband's  
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5 occupation,<sup>25,27,29,31,39,42,45,46</sup> monthly income,<sup>10,19,23,25,30,34,39,47</sup> or wealth  
6  
7 quintile.<sup>18,24,26,28,32,33,40,41,45</sup>  
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10 As with economic accessibility, physical accessibility to health facilities is most often  
11 measured as actual, rather than perceived, accessibility. Women living in urban areas are more  
12 likely to have FBs.<sup>8,18,20–25,28–33,37–39,42–45,47</sup> Less time to reach facilities<sup>24,37,43,45</sup> and closer  
13 distance<sup>10,28,30</sup> were associated with FB, but associations between time to facility<sup>30,34,42</sup> and  
14 distance<sup>30,31,37,45,48</sup> with FB were not always significant. Transportation availability increased FB  
15 likelihood.<sup>30</sup>  
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24 Several weaknesses in research methodology limit interpretation of Ethiopian studies.  
25 First, research participants were almost exclusively women, yet male partners often make  
26 decisions about delivery location. Second, cultural practices identified in qualitative studies as  
27 barriers to FB have not been included in quantitative studies. Third, descriptive studies that base  
28 data collection on the Ethiopian Demographic and Health Survey (EDHS) limit new knowledge  
29 generation by asking the same questions in the same way. A discrete choice experiment (DCE)  
30 conducted in rural, southwest Ethiopia overcame this weakness. Women who had delivered in  
31 the last five years were asked to choose between two hypothetical facilities with varying distance,  
32 provider type, provider attitude, drug and medical equipment availability, transportation  
33 availability, and cost attributes,<sup>49</sup> thus identifying women's priorities in the context of multiple  
34 factors.  
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49 We collected data from both women and men and used DCE methodology to elicit  
50 preferences for delivery service attributes, specifically, allowing support persons in the delivery  
51 room, provider gender, distance, provider type, provider attitude, drug and medical equipment  
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3 availability, free transportation availability, and delivery cost. Our study aims were to determine:  
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5 (a) the combination of facility-based delivery care attributes preferred by women and men, (b)  
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7 whether gender differences exist in attribute preferences; and (c) whether poverty levels or  
8  
9 household decision-making involvement are associated with facility choice.  
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## 12 **Methods**

### 13 **Research Design**

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15 This cross-sectional DCE had three parts: household survey, individual surveys of men  
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17 and women, and DCE task set. Questions in household and individual surveys were drawn from  
18  
19 the EDHS.  
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### 23 **DCE Study Design**

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25 Respondents were shown pictures of two facilities (Figure 1) and asked to imagine they  
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27 were deciding where they would deliver their next baby. They were asked to choose between  
28  
29 Facility A, Facility B, or Neither Facility. Facility A and B were described using a script.  
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33 Table 1 lists attributes and levels included in the experimental design and were selected  
34  
35 to produce a reasonable number of scenarios to test with respondents.<sup>50-52</sup> Given that all  
36  
37 attributes had either two or five levels, ten tasks were required for attribute level balance. Pilot-  
38  
39 testing with local women and men indicated ten tasks did not cause respondent fatigue.  
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42 Quality of care was represented by medications and supplies' availability, provider  
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44 attitude, and provider type. Support persons and provider gender tested cultural preferences.  
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46 Perceived accessibility was represented by cost, distance to facility, and free ambulance  
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48 availability.  
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3       **Design decisions.** A d-efficient design (d-error = 0.3) that allows for smaller sample size,  
4 while still estimating attributes at a statistically significant level,<sup>52</sup> was produced based on prior  
5 probabilities using nGene software.<sup>53</sup>  
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10       **Sample Size.** A sample size of mean=36,820, median=314, ranging from minimum=8 to  
11 maximum=5,162,097 was calculated by nGene to detect statistically significant differences  
12 between women and men. The large sample size reflects the degree of uncertainty in the priors.<sup>54</sup>  
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15       Given the logistical impossibility of collecting a large sample for this pilot study, J. Rose  
16 (personal communication, May 20, 2015) recommended 100 respondents for each group (women  
17 and men) based on expected improved statistical properties of basing the design on prior  
18 parameters. Assuming a 20% non-response rate, 120 households were selected, representing 240  
19 respondents.  
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## 22       **Subjects and Setting**

23       The target population was women and their male partners in two rural *kebeles* defined by  
24 the most recent census (2007)<sup>55</sup> in Sidama zone, Southern Nations, Nationalities and People's  
25 region, Ethiopia. *Kebeles* are the smallest administrative unit in Ethiopia. Inclusion criteria were  
26 women and men who were expecting a child or had a child less than two years old. Eligible  
27 participants were excluded if unable to answer questions due to mental or physical disabilities.  
28 Informed consent and household interviews were conducted in participants' homes in October  
29 2015.  
30

## 31       **Sample plan**

32       Health Extension Workers (HEWs) from two *kebeles* listed eligible households using  
33 clinic and home visit records. Households were randomly selected by assigning each household a  
34 random number using the Excel random number generator and then sorting numerically.  
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## **Informed consent procedures**

Informed oral consent was obtained before the survey. Research ethics committees at Hawassa University in Ethiopia and University of California San Francisco gave approval. Common River, a local non-governmental organization, facilitated logistical arrangements with community participants.

### **Validity and reliability.**

**Validity.** EDHS questionnaires were adapted for this study, thus building upon EDHS' strong validity<sup>56-65</sup>. Demographic, health, education and living standard variables were collected. Additional EDHS questions were used to assess participation in decision-making, mass media exposure, danger signs knowledge, ANC use, and delivery history.

Attributes and levels for this DCE study were based on review of Ethiopian literature and the three delays model<sup>66</sup> and were refined during informant interviews and survey pilot testing to discern which attributes and levels were valid in this setting.<sup>51</sup> Pictures drawn by a local artist were used to ensure understanding in this low literacy population and were pre-tested with a local women's group and male staff at a local NGO.

**Reliability.** Experienced data collectors, fluent in both Amharic and Sidaminya (local language) were trained using a written protocol to ask questions in a standardized manner. Study materials were translated into Amharic and back-translated into English by local and professional translators. Questionnaires were pre-tested for clarity to ensure interviewers and participants easily understood questions. Questionnaires were reviewed daily for completeness; when errors were found, interviewers were asked for clarification.

To reduce socially desirable answers and response bias, interviewer and respondent genders were matched, interviewers were trained to be non-judgmental, privacy was ensured,

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3 and sensitive questions were asked later in the interview after respondent's trust had been gained.  
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5 To reduce non-response bias, households were revisited up to three times to contact eligible  
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7 participants.  
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10 **Multi-dimensional Poverty Index.** The Multi-dimensional Poverty Index (MPI)  
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12 attempts to capture in one number poverty aspects not captured by income-based poverty  
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14 measures.<sup>67</sup> The MPI combines deprivations at household level in education, health and living  
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16 standard.<sup>68</sup> The deprivation score is calculated by summing ten component weighted scores in  
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18 three indicator areas<sup>69</sup> (Table 2).  
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22 Health, education, and living standard indicators were collected to compare the sample  
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24 population to the national MPI. Malnutrition data could not be collected due to time and cost  
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26 restraints. In addition, sanitation questions were discarded due to misinterpretation. Therefore,  
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28 the sample MPI was not directly comparable to the reported national MPI. Instead, individual  
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30 indicators in the sample were compared to EDHS data. The sample MPI served as a poverty  
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32 indicator in the analysis.  
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35 **Household Decision-Making Score.** During the EDHS, women are asked about who  
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37 makes decisions around obtaining health care for themselves, large household purchases, and  
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39 visits to relatives. Women who make decisions on all three indicators, either solely or jointly  
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41 with their husbands, are considered to have the highest autonomy. Men are asked about their  
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43 participation in large household purchases and obtaining health care for themselves.<sup>1</sup> In this  
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45 study, both women and men were asked about their involvement in decisions regarding obtaining  
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47 health care for themselves, large household purchases, and visits to relatives.  
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## 51 **Data Management and Analysis**

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3 Study household characteristics were calculated and compared to the 2011 EDHS of  
4 rural households using chi-square and t-tests to determine statistically significant differences.  
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6 Similar analysis was conducted to describe and compare characteristics and reported pregnancy  
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8 and delivery care practices of female and male study participants.  
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12 We used multilevel mixed-effects logistic regression with QR decomposition. QR  
13 decomposition improves convergence when random-effects variance is small.<sup>70</sup> Unlike other  
14 models, which assume independence, multilevel models take dependency of multiple  
15 observations from single respondents into account.<sup>52</sup> Level 1 included choices made by each  
16 respondent; Level 2 included respondent's gender; and Level 3 included household  
17 characteristics.  
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21 Women's and men's responses were analyzed separately to determine the utility of  
22 specific Level 1 attributes for each group and attribute combinations that significantly  
23 contributed to facility choice. Adjusted odds ratios were calculated to provide a more intuitive  
24 presentation of strength and direction of utility coefficients ( $e^{\beta}$ ). Bonferroni method was used to  
25 control alpha for multiple comparisons.  
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29 A multilevel model was constructed by adding individual and random intercept terms.  
30 Level 2 interaction terms, combining attributes with gender, were introduced into the model one  
31 by one to test whether women and men differed significantly on preferences for facility  
32 characteristics. Predictor interactions with involvement in household decision-making (Level 3)  
33 were also tested.  
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37 Household poverty level (Level 3) main effect on facility choice was tested by creating a  
38 poverty variable. First, household deprivation percent was calculated using MPI deprivation  
39 indicators. Next, a dichotomous variable, poverty, was created to divide households into those  
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3 with percent deprivation greater than or equal to 33.3%, the definition for multidimensional  
4 poverty, and those who were not multidimensionally poor. In addition to adding poverty to the  
5 model to test the effect on facility choice, the interaction between poverty and gender was also  
6 tested to determine whether multidimensional poverty effected women and men differently.  
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11 Akaike's information criterion (AIC) was estimated and likelihood-ratio (LR) tests were  
12 conducted to test improvement in model fit. A decrease in AIC with a significant likelihood-ratio  
13 test indicates improvement in model fit.  
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19 Data were entered in RedCap using double-entry and analyzed using Stata 14.  
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## 23 24 **Results**

### 25 26 **Participant Eligibility**

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28 Households with children less than two years old (n=356) and households with  
29 pregnant women (n=136) were eligible to participate (Figure 2). For 20 households not  
30 located due to incomplete addresses, the next randomly selected household was approached.  
31 Participation rate for locatable, eligible households was 98%. Household and individual  
32 surveys took approximately 5 minutes and the DCE portion took approximately 10 minutes to  
33 complete.  
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### 42 43 **Study Participants' Characteristics**

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45 **Household Characteristics.** Study sample household characteristics were compared to household  
46 characteristics from the EDHS (Table 3). Study sample participants generally had better living  
47 conditions and more access to radios and mobile phones than those in the EDHS sample.  
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49 However, a significantly greater percent of study sample households lacked land and livestock.  
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3 **Female and Male Participants' Characteristics.** Ninety-seven percent of women and 99% of  
4 men were from Sidama (Table 4). All women and 96% of men were Protestant. Women were  
5 significantly younger and less educated than their husbands. Men had greater exposure to mass  
6 media and participated more in household decisions. Men were significantly more likely  
7 ( $p<0.001$ ) to believe their wife had received prenatal care during their pregnancy (89.8%) than  
8 women reported having done so (29.0%).  
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### 16 **DCE Results**

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19 **Women's preferences.** Women's odds of choosing to deliver at a facility were 3.08  
20 (2.03 to 4.67) times greater if medications and supplies were always available; 1.69 (1.37 to  
21 2.07) times greater if support persons were allowed in delivery room; 1.37 (1.09 to 1.70) times  
22 greater if a free ambulance was available; and 1.15 (1.12 to 1.18) times greater for every 50-birr  
23 (US \$2.50) reduction in cost (Table 5).  
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31 Provider type was significant using the Wald test ( $p<0.0001$ ) followed by Bonferroni-  
32 protected multiple comparisons. Women were 1.86 (1.23 to 2.80) times more likely to prefer  
33 delivery by HEWs than male nurses; 1.45 (1.09 to 1.93) times more likely to prefer male doctors  
34 to female doctors; 1.71 (1.27 to 2.29) times more likely to prefer female doctors to male nurses;  
35 1.95 (1.44 to 2.62) times more likely to prefer male doctors to female nurses; and 2.47 (1.84 to  
36 3.32) times more likely to prefer male doctors to male nurses.  
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44 **Men's preferences.** For men (Table 6), odds of choosing a facility were 2.68 (1.79 to 4.02)  
45 times greater when medications and supplies are always available; 1.74 (1.42 to 2.14) times  
46 greater when a support person is allowed in delivery room; 1.30 (1.03 to 1.64) times greater  
47 when provider smiles and listens well; 1.09 (1.06 to 1.13) times greater for each 15-minute  
48 reduction in walking distance; and 1.14 (1.11, to 1.17) times greater for every 50-birr reduction  
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3 in cost.  
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5 Provider type was significant overall using the Bonferroni Omnibus test ( $p < .0001$ ). Men  
6 were 1.89 (1.29 to 2.78) times more likely to prefer their wives be delivered by HEWs than  
7 female nurses; 1.95 (1.30 to 2.95) times as likely to prefer delivery by HEWs to male nurses;  
8 1.39 (1.02 to 1.89) times as likely to prefer female doctors to female nurses; 1.44 (1.07 to 1.92)  
9 times as likely to prefer female doctors to male nurses; 1.41 (1.05 to 1.90) times as likely to  
10 prefer male doctors to female nurses; and 1.46 (1.09 to 1.95) times as likely to prefer male  
11 doctors to male nurses.  
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### 21 **Significant differences between predictors of women and men's choices**

22 Only distance, provider type, and ambulance cost were significantly different between  
23 women and men. Women's odds of selecting a facility increased 1.08 times for every 15-  
24 minutes' increase in distance compared to men (1.03 to 1.14;  $p = .001$ ). Women were 1.70 (1.15  
25 to 2.52;  $p = 0.009$ ) times more likely than men to prefer male doctors to male nurses; and 1.36  
26 (1.05 to 1.75;  $p = 0.012$ ) times more likely to prefer a facility with free ambulance service. AIC  
27 decreased from the Level 1 model (5551) to a Level 2 model adding Gender at level 2 (5536) and  
28 the LR was significant ( $X^2(10) = 28.54$ ,  $p = 0.0002$ ) indicating improved model fit with the  
29 addition of significant cross-level interactions.  
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### 42 **Decision-making**

43 While Table 4 illustrated significant differences between women and men's involvement  
44 in decision-making, decision-making involvement did not significantly influence facility choice,  
45 whether measured as none vs. any ( $p = 0.496$ ); involved in healthcare decisions for self vs. not  
46 involved ( $p = 0.653$ ); involved in healthcare decisions for self vs. not involved, women vs. men  
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3 (p=0.189); number of decisions involved in (continuous) (p=0.930); or number of decisions  
4 involved in (categorical) (p=0.133).  
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### 7 **Poverty and facility choice**

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10 Multidimensionally poor and not multidimensionally poor households did not differ in  
11 facility choice (p=0.170), nor was percent household deprivation a significant indicator (p =  
12 0.055). In addition, facility choice did not differ between women and men based on household  
13 deprivation (p = 0.672).  
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## 19 **Discussion**

### 20 **DCE Preferences**

21  
22 In this study, both women and men placed the highest value on health facilities that  
23 always had medications and supplies available and allowed support persons into the delivery  
24 room. Women's facility choice was also influenced by free ambulance availability and low cost,  
25 while men were more likely to choose nearer, less expensive delivery services with friendly  
26 providers.  
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35 In contrast, in a DCE in rural Ethiopia, Kruk, Paczkowski, et al.<sup>49</sup> found women preferred  
36 high quality delivery services such as available drugs and medical equipment, doctors or nurses  
37 rather than HEWs, and friendly providers, with lower value placed on accessibility indicators  
38 when selecting facilities. Neither support person presence, nor provider gender, was included in  
39 their study.  
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46 In our study, preferences for provider type were complex. Women generally preferred  
47 doctors to nurses, although no significant difference in preference was found between delivery  
48 by female doctors or female nurses. Men preferred facilities with doctors to nurses regardless of  
49 gender. Nurse's gender did not affect women's facility preference, but male doctors were  
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3 selected over female doctors. While preference for more highly skilled providers noted by Kruk,  
4 Paczkowski, et al.<sup>49</sup> generally held between doctors and nurses; HEWs were either preferred or  
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6 chosen equally to doctors and nurses.  
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## 9 10 **Interpreting Findings within The Three Delays Model: Implications for Services and** 11 12 **Research**

13  
14 **Perceived quality of care.** In our study, reliable medications and supplies' availability  
15 was the strongest facility choice indicator for both women and men. This important element of  
16 the Three Delays model's perceived quality of care<sup>4,71</sup> has been reported by other  
17 researchers.<sup>6,15,17,49</sup> Government and facility administrators should prioritize supply chain  
18 management when making budget allocations. A study comparing actual and perceived stocks of  
19 medications and supplies' impact on FB rates and cost analysis of lives saved through improving  
20 supply chains would add further information on this intervention's effectiveness.  
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24 Provider attitude was a significant facility choice predictor for men, but not women.  
25  
26 However, no significant difference was found between women and men's facility choice based  
27 on provider attitude. Qualitative researchers have reported mistreatment by staff, ranging from  
28 yelling to physical abuse, made women distrustful of health facilities.<sup>6-8,11,14</sup> Roro et al.<sup>13</sup>  
29 reported this was true for men also. Lack of significance of provider attitude for women in this  
30 study may result from considering this aspect of care in the context of other variables, which  
31 were more important. It may also be that women in this area have had little experience with  
32 unfriendly providers, so they are not concerned with this attribute.  
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36 Both women and men valued doctors more than nurses, but preferred or were neutral on  
37 selecting facilities with HEWs compared to more skilled providers. While appreciation of skilled  
38 providers is not uncommon,<sup>8,9,11,14,16,30</sup> preference for HEWs is surprising as HEWs' ability to  
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3 perform safe deliveries has been questioned.<sup>7,13-15</sup> This preference may reflect the desire to be  
4 delivered by someone they know, or greater flexibility by HEWs in allowing support persons to  
5 be present in the delivery room. Our findings suggest inherent trust in providers, who understand  
6 the cultural context and needs, is more important than procedural skill and knowledge.  
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12 The apparent preference for HEWs and doctors over nurses is concerning. Nurses offer  
13 the lowest cost solution to providing skilled care in most developing countries. Research is  
14 needed to better understand why nurses were least preferred and how to address this issue, as it  
15 could have implications for women's health outcomes and workforce training.  
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22 **Cultural factors.** Cultural preference for being surrounded by family and friends during  
23 delivery<sup>7-12,14-16</sup> was voiced by both women and men. Excluding support persons from the  
24 delivery room is incompatible with cultural norms and is likely to decrease FB uptake.<sup>72</sup> A  
25 cluster-randomized controlled trial comparing facilities implementing family-centered delivery  
26 policies with those that are not could test this finding.  
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33 Preference for male over female providers contradicts reports in qualitative  
34 literature.<sup>7,8,15,23</sup> One explanation for this difference may lie in the study design. When asked  
35 directly about provider gender preferences, respondents may say they are ashamed to be  
36 delivered by a man.<sup>6,7,23</sup> However, when given more complex scenarios, underlying biases, such  
37 as sexism, may have greater influence on respondent choices, leading them to choose male  
38 providers as being more qualified.  
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47 **Perceived accessibility.** Both women and men preferred lower cost services. However,  
48 distance and free ambulance availability had mixed influences on facility choice with women  
49 preferring facilities with free ambulance service, while men were more influenced by distance.  
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53 Other Ethiopian research has shown either no effect<sup>31,34,35,42,48</sup> or increases in FB when facilities  
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3 are closer.<sup>10,21,24,30,37,43,45</sup> Women may prioritize free ambulance service due to greater concern  
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5 for their own comfort as other free transportation, such as riding in animal carts or being carried  
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7 on stretchers, are very uncomfortable.<sup>11,13,44</sup>  
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10 **Perceived Benefits and Needs.** We found men are primarily involved in making  
11  
12 household decisions, including decisions about whether their wives seek health care. Yet, 90% of  
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14 men believed their wives had attended ANC during their pregnancy, while only 29% of women  
15  
16 reported doing so. Educating men on home delivery's potential dangers and FB's benefits could  
17  
18 potentially increase families choosing FB. Barry, et al.<sup>45</sup> showed women who attended two or  
19  
20 more family education meetings on maternal health with family members were nearly twice as  
21  
22 likely to deliver with SBAs or HEWs compared to women who attended fewer than two  
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24 meetings, but no difference for women who attended alone. Intervention studies involving  
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26 partners or other family support in maternal education are needed.  
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### 30 **Limitations**

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32 **Generalizability.** Based on household characteristics, our study population appears  
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34 wealthier than the 2011 rural Ethiopian population. However, Ethiopia's economy has  
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36 experienced 10.8% average growth from 2003/04 to 2013/14.<sup>74</sup> Therefore, other rural areas in  
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38 Ethiopia may have also experienced similar improvements in living standards.  
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42 The household list used to select participants may have been incomplete and/or over-  
43  
44 represented families who lived near health posts or who attended clinic. This may limit  
45  
46 generalizability.  
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49 **Missing variables.** The ability to recognize emergencies may influence the decision of  
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51 where to deliver.<sup>71</sup> The original study plan included a DCE in which respondents were asked  
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53 where they would deliver if they believed the mother or baby's life was in danger. This portion  
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3 was dropped due to interview length. In addition, the perceived need measure, which the three  
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5 delays model predicts influences decisions to seek care, was not included in the analysis due to  
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7 discrepancies in interpreting the danger signs' questions.  
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## 10 **Conclusion**

11  
12 This study makes a unique contribution to the literature as the first known DCE to test  
13  
14 both women and men's preferences in choosing facility birth services. Including men  
15  
16 acknowledged the role men play in making decisions for their families either alone or in  
17  
18 collaboration with their partner. Women and men were found to agree on preferring facilities that  
19  
20 always had medications and supplies available and allowed support persons in the delivery room.  
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## 25 **Author Contributions**

26  
27 1. Substantial contributions to the conception or design of the work; or the acquisition, analysis,  
28  
29 or interpretation of data for the work; AND

30  
31 Nancy K. Beam, Gezahegn Bekele Dadi, Sally H. Rankin, Sandra Weiss, Bruce Cooper, and  
32  
33 Lisa Thompson participated in the conception of the study

34  
35 Nancy K. Beam and Gezahegn Bekele Dadi participated in the acquisition of the data.

36  
37 Nancy K. Beam designed the DCE

38  
39 Bruce Cooper and Nancy K. Beam participated in the analysis and interpretation of the data

40  
41 2. All authors participated in drafting the work or revising it critically for important intellectual  
42  
43 content; AND

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45 3. All authors gave final approval of the version to be published; AND

46  
47 4. All authors agreed to be accountable for all aspects of the work in ensuring that questions  
48  
49 related to the accuracy or integrity of any part of the work are appropriately investigated and  
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51 resolved.  
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59  
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For peer review only



## References

1. CSA [Ethiopia] and ICF International. Ethiopia demographic and health survey 2011. Addis Ababa, Ethiopia and Calverton, Maryland, USA; 2012.
2. WHO. Ethiopia | Maternal health [Internet]. 2015 [cited 2016 Sep 14]. Available from: <http://www.afro.who.int/en/ethiopia/country-programmes/topics/4459-maternal-health.html>
3. Campbell OMR, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. *Lancet* [Internet]. 2006 Oct 7 [cited 2014 May 26];368(9543):1284–99. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17027735>
4. Gabrysch S, Campbell OMR. Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth* [Internet]. 2009 Jan [cited 2013 May 22];9:34. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&rendertype=abstract>
5. Gabrysch S, Lema C, Bedriřana E, Bautista M a, Malca R, Campbell OM. Cultural adaptation of birthing services in rural Ayacucho, Peru. *Bull World Health Organ* [Internet]. 2009 Sep 1 [cited 2014 Feb 4];87(9):724–9. Available from: <http://www.who.int/bulletin/volumes/87/9/08-057794.pdf>
6. King R, Jackson R, Dietsch E, Hailemariam A. Barriers and facilitators to accessing skilled birth attendants in Afar region, Ethiopia. *Midwifery* [Internet]. 2015 May [cited 2016 Mar 2];31(5):540–6. Available from: <http://www.sciencedirect.com/science/article/pii/S0266613815000388>
7. Sipsma H, Thompson J, Maurer L, Bradley E, Curry L. Preferences for home delivery in

- 1  
2  
3 Ethiopia: provider perspectives. *Glob Public Health* [Internet]. Taylor & Francis; 2013  
4  
5 Oct [cited 2014 Mar 15];8(9):1014–26. Available from:  
6  
7 <http://www.ncbi.nlm.nih.gov/pubmed/24156727>  
8  
9
- 10 8. Abera M, Abebe G, Belachew T. Predictors of safe delivery service utilization in Arsi  
11  
12 zone, south-east Ethiopia. *Ethiop J Health Sci*. 2011;21(Special Issue):95–106.  
13  
14
- 15 9. Bedford J, Gandhi M, Admassu M, Girma A. “A normal delivery takes place at home”: a  
16  
17 qualitative study of the location of childbirth in rural Ethiopia. *Matern Child Health J*  
18  
19 [Internet]. 2013 Feb [cited 2013 Nov 12];17(2):230–9. Available from:  
20  
21 <http://www.ncbi.nlm.nih.gov/pubmed/22359241>  
22  
23
- 24 10. Birmeta K, Dibaba Y, Woldeyohannes D. Determinants of maternal health care utilization  
25  
26 in Holeta town, central Ethiopia. *BMC Health Serv Res* [Internet]. 2013 Jul 3 [cited 2013  
27  
28 Jul 8];13(1):256. Available from:  
29  
30 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&re  
31  
32 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&rendertype=abstract)  
33  
34
- 35 11. Gebrehiwot T, Goicolea I, Edin K, San Sebastian M. Making pragmatic choices: women’s  
36  
37 experiences of delivery care in Northern Ethiopia. *BMC Pregnancy Childbirth* [Internet].  
38  
39 2012 Jan [cited 2013 Nov 12];12:113. Available from:  
40  
41 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&re  
42  
43 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&rendertype=abstract)  
44  
45
- 46 12. Jackson R. The place of birth in Kafa Zone, Ethiopia. *Health Care Women Int* [Internet].  
47  
48 2014;35(7–9):728–42. Available from:  
49  
50 [http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&A  
51  
52 N=24786334](http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=24786334)  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 13. Roro MA, Hassen EM, Lemma AM, Gebreyesus SH, Afework MF. Why do women not  
4 deliver in health facilities: a qualitative study of the community perspectives in south  
5 central Ethiopia? BMC Res Notes [Internet]. BioMed Central; 2014 Jan 21 [cited 2016  
6 Feb 24];7(1):556. Available from:  
7  
8 <http://bmresnotes.biomedcentral.com/articles/10.1186/1756-0500-7-556>  
9  
10  
11  
12  
13  
14 14. Gebrehiwot T, San Sebastian M, Edin K, Goicolea I. Health workers' perceptions of  
15 facilitators of and barriers to institutional delivery in Tigray, Northern Ethiopia. BMC  
16 Pregnancy Childbirth [Internet]. 2014 Apr 10 [cited 2014 Apr 16];14(137). Available  
17 from: <http://www.ncbi.nlm.nih.gov/pubmed/24716750>  
18  
19  
20  
21  
22  
23  
24 15. Shiferaw S, Spigt M, Godefrooij M, Melkamu Y, Tekie M. Why do women prefer home  
25 births in Ethiopia? BMC Pregnancy Childbirth [Internet]. BMC Pregnancy and Childbirth;  
26 2013 Jan [cited 2013 Mar 2];13(1):5. Available from:  
27  
28 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&rendertype=abstract)  
29  
30  
31  
32  
33  
34  
35 16. Warren C. Care seeking for maternal health: challenges remain for poor women. Ethiop J  
36 Heal Dev [Internet]. 2010 Dec 16;24(Special Issue 1):100–4. Available from:  
37  
38 <http://www.ajol.info/index.php/ejhd/article/view/62950>  
39  
40  
41  
42 17. Bradley E, Thompson JW, Byam P, Webster TR, Zerihun A, Alpern R, et al. Access and  
43 quality of rural healthcare: Ethiopian Millennium Rural Initiative. Int J Qual Health Care  
44 [Internet]. 2011 Jun [cited 2013 Nov 11];23(3):222–30. Available from:  
45  
46  
47 <http://www.ncbi.nlm.nih.gov/pubmed/21467077>  
48  
49  
50  
51 18. Ethiopian Society of Population Studies. Maternal Health Care Seeking Behaviour in  
52 Ethiopia : Findings from EDHS 2005. 2008.  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
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46  
47  
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49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60
19. Dutamo Z, Assefa N, Egata G. Maternal health care use among married women in Hossaina, Ethiopia. *BMC Health Serv Res* [Internet]. BioMed Central; 2015 Jan 10 [cited 2016 Feb 24];15(1):365. Available from:  
<http://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-015-1047-1>
  20. Woldemicael G. Do women with higher autonomy seek more maternal health care? Evidence from Eritrea and Ethiopia. *Health Care Women Int* [Internet]. 2010 Jul [cited 2013 Nov 12];31(7):599–620. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/20526926>
  21. Wado YD, Afework MF, Hindin MJ. Unintended pregnancies and the use of maternal health services in southwestern Ethiopia. *BMC Int Health Hum Rights* [Internet]. 2013 Sep 8 [cited 2013 Nov 12];13(1):36. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24011335>
  22. Yebyo H, Alemayehu M, Kahsay A. Why do women deliver at home? Multilevel modeling of Ethiopian National Demographic and Health Survey data. *PLoS One* [Internet]. Public Library of Science; 2015 Jan 15 [cited 2016 Feb 24];10(4):e0124718. Available from: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124718>
  23. Hailu D, Berhe H. Determinants of institutional childbirth service utilisation among women of childbearing age in urban and rural areas of Tsegedie district, Ethiopia. *Midwifery* [Internet]. Elsevier; 2014 Mar 25 [cited 2014 Apr 21]; Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24726608>
  24. Wilunda C, Quaglio G, Putoto G, Takahashi R, Calia F, Abebe D, et al. Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reprod Health* [Internet]. BioMed Central; 2015

- 1  
2  
3 Jan 25 [cited 2016 Feb 24];12(1):74. Available from: [http://reproductive-health-](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-015-0067-y)  
4 journal.biomedcentral.com/articles/10.1186/s12978-015-0067-y  
5  
6  
7  
8 25. Nigussie M, Mariam DH, Mitike G. Assessment of safe delivery service utilization among  
9 women of childbearing age in north Gondar Zone , north west Ethiopia. *Ethiop J Heal Dev*  
10 [Internet]. 2004;18(3):145–52. Available from: <http://ejhd.uib.no/ejhdv18-no3/145.pdf>  
11  
12  
13  
14 26. Hagos S, Shaweno D, Assegid M, Mekonnen A, Afework MF, Ahmed S. Utilization of  
15 institutional delivery service at Wukro and Butajera districts in the Northern and South  
16 Central Ethiopia. *BMC Pregnancy Childbirth* [Internet]. 2014 Jan [cited 2016 Feb  
17 24];14:178. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24886375>  
18  
19  
20  
21  
22  
23 27. Tekelab T, Yadecha B, Melka AS. Antenatal care and women’s decision making power as  
24 determinants of institutional delivery in rural area of Western Ethiopia. *BMC Res Notes*  
25 [Internet]. BioMed Central; 2015 Jan 11 [cited 2016 Feb 24];8(1):769. Available from:  
26 <http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1708-5>  
27  
28  
29  
30  
31  
32 28. Mekonnen ZA, Lerebo WT, Gebrehiwot TG, Abadura SA. Multilevel analysis of  
33 individual and community level factors associated with institutional delivery in Ethiopia.  
34 *BMC Res Notes* [Internet]. BioMed Central; 2015 Jan 26 [cited 2016 Mar 2];8(1):376.  
35 Available from: [http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-](http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-1)  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45 29. Mengesha ZB, Biks GA, Ayele TA, Tessema GA, Koye DN. Determinants of skilled  
46 attendance for delivery in Northwest Ethiopia: a community based nested case control  
47 study. *BMC Public Health* [Internet]. BMC Public Health; 2013 Jan [cited 2013 Mar  
48 2];13(1):130. Available from:  
49  
50  
51  
52  
53  
54 <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3577480&tool=pmcentrez&re>  
55  
56  
57  
58  
59  
60

- ndertype=abstract
30. Feyissa TR, Genemo GA. Determinants of institutional delivery among childbearing age women in Western Ethiopia, 2013: unmatched case control study. PLoS One [Internet]. 2014 Jan [cited 2016 Feb 24];9(5):e97194. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24810609>
  31. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa Woreda, South East Ethiopia: a community based cross-sectional study. BMC Pregnancy Childbirth [Internet]. 2012 Jan [cited 2013 Nov 12];12:105. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&rendertype=abstract>
  32. Tarekegn SM, Lieberman LS, Giedraitis V. Determinants of maternal health service utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey. BMC Pregnancy Childbirth [Internet]. BioMed Central; 2014 Jan 7 [cited 2016 Feb 24];14(1):161. Available from: <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/1471-2393-14-161>
  33. Afework MF, Admassu K, Mekonen A, Hagos S, Asegid M, Ahmed S. Effect of an innovative community based health program on maternal health service utilization in north and south central Ethiopia: a community based cross sectional study. Reprod Health [Internet]. 2014 Apr 4 [cited 2014 Apr 14];11(28). Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24708848>
  34. Asres A, Davey G. Factors associated with safe delivery service utilization among women in Sheka zone, southwest Ethiopia. Matern Child Health J [Internet]. 2015 Apr [cited 2016 Mar 2];19(4):859–67. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25055761>

- 1  
2  
3 35. Bayou NB, Gacho YHM. Utilization of clean and safe delivery service package of health  
4 services extension program and associated factors in rural kebeles of Kafa Zone,  
5 Southwest Ethiopia. *Ethiop J Health Sci* [Internet]. 2013 Jul [cited 2013 Nov  
6 12];23(2):79–89. Available from:  
7  
8  
9  
10 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
11  
12 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
13  
14  
15  
16  
17 36. Bayu H, Adefris M, Amano A, Abuhay M. Pregnant women's preference and factors  
18 associated with institutional delivery service utilization in Debra Markos Town, North  
19 West Ethiopia: a community based follow up study. *BMC Pregnancy Childbirth*  
20  
21 [Internet]. 2015 Jan [cited 2016 Feb 24];15:15. Available from:  
22  
23  
24 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
25  
26 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
27  
28  
29  
30  
31 37. Kebede B, Gebeyehu A, Andargie G. Use of previous maternal health services has a  
32 limited role in reattendance for skilled institutional delivery: Cross-sectional survey in  
33 Northwest Ethiopia. *Int J Womens Health* [Internet]. 2013 Jan;5:79–85. Available from:  
34  
35  
36 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
37  
38 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
39  
40  
41  
42 38. Melaku YA, Weldearegawi B, Tesfay FH, Abera SF, Abraham L, Aregay A, et al. Poor  
43 linkages in maternal health care services-evidence on antenatal care and institutional  
44 delivery from a community-based longitudinal study in Tigray region, Ethiopia. *BMC*  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 39. Teferra AS, Alemu FM, Woldeyohannes SM. Institutional delivery service utilization and  
4 associated factors among mothers who gave birth in the last 12 months in Sekela District,  
5 north west of Ethiopia: A community-based cross sectional study. *BMC Pregnancy*  
6 *Childbirth* [Internet]. *BMC Pregnancy and Childbirth*; 2012 Jan [cited 2013 Mar  
7 11];12(74). Available from:  
8 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&rendertype=abstract)  
9 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&rendertype=abstract)  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19 40. Worku AG, Yalew AW, Afework MF. Maternal complications and women's behavior in  
20 seeking care from skilled providers in North Gondar, Ethiopia. *PLoS One* [Internet]. 2013  
21 Jan [cited 2013 Nov 12];8(3):e60171. Available from:  
22 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610646&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610646&tool=pmcentrez&rendertype=abstract)  
23 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610646&tool=pmcentrez&rendertype=abstract)  
24  
25  
26  
27  
28  
29  
30  
31 41. Worku AG, Yalew AW, Afework MF. Factors affecting utilization of skilled maternal  
32 care in Northwest Ethiopia: A multilevel analysis. *BMC Int Health Hum Rights* [Internet].  
33 2013 Jan [cited 2013 Nov 12];13(20). Available from:  
34 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3639034&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3639034&tool=pmcentrez&rendertype=abstract)  
35 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3639034&tool=pmcentrez&rendertype=abstract)  
36  
37  
38  
39  
40  
41  
42 42. Tsegay Y, Gebrehiwot T, Goicolea I, Edin K, Lemma H, Sebastian MS. Determinants of  
43 antenatal and delivery care utilization in Tigray region, Ethiopia: A cross-sectional study.  
44 *Int J Equity Health* [Internet]. 2013 Jan [cited 2013 May 27];12:30. Available from:  
45 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3658893&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3658893&tool=pmcentrez&rendertype=abstract)  
46 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3658893&tool=pmcentrez&rendertype=abstract)  
47  
48  
49  
50  
51  
52  
53  
54 43. Habte F, Demissie M. Magnitude and factors associated with institutional delivery service  
55  
56  
57  
58  
59  
60



- 1  
2  
3 utilization among childbearing mothers in Cheha district, Gurage zone, SNNPR, Ethiopia:  
4  
5 a community based cross sectional study. BMC Pregnancy Childbirth [Internet]. BioMed  
6  
7 Central; 2015 Jan 17 [cited 2016 Feb 24];15(1):299. Available from:  
8  
9 <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-015-0716-8>  
10  
11
- 12 44. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in  
13  
14 Dodota Woreda (district), Oromia regional state, Ethiopia. Reprod Health [Internet]. 2012  
15  
16 Jan [cited 2013 Jun 22];9:33. Available from:  
17  
18 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
19  
20  
21 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
22  
23
- 24 45. Tura G, Afework MF, Yalew AW. The effect of birth preparedness and complication  
25  
26 readiness on skilled care use: a prospective follow-up study in Southwest Ethiopia.  
27  
28 Reprod Health [Internet]. BioMed Central; 2014 Jan 5 [cited 2016 Feb 24];11(1):60.  
29  
30 Available from: [http://reproductive-health-](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
31  
32 [journal.biomedcentral.com/articles/10.1186/1742-4755-11-60](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
33  
34
- 35 46. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service  
36  
37 utilization among mothers in Bahir Dar City administration, Amhara region: a community  
38  
39 based cross sectional study. Reprod Health [Internet]. 2014 Jan [cited 2014 Apr 5];11(22).  
40  
41 Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24629278>  
42  
43
- 44 47. Abebe F, Berhane Y, Girma B. Factors associated with home delivery in Bahirdar,  
45  
46 Ethiopia: a case control study. BMC Res Notes [Internet]. 2012 Jan [cited 2013 Nov  
47  
48 12];5:653. Available from:  
49  
50 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
51  
52 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 48. Ballard K, Gari L, Mosisa H, Wright J. Provision of individualised obstetric risk advice to  
4 increase health facility usage by women at risk of a complicated delivery: a cohort study  
5 of women in the rural highlands of West Ethiopia. BJOG [Internet]. 2013 Jul [cited 2013  
6 Nov 12];120(8):971–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23464619>  
7  
8  
9  
10  
11  
12 49. Kruk ME, Paczkowski MM, Tegegn A, Tessema F, Hadley C, Asefa M, et al. Women’s  
13 preferences for obstetric care in rural Ethiopia: a population-based discrete choice  
14 experiment in a region with low rates of facility delivery. J Epidemiol Community Health.  
15 2010;64:984–8.  
16  
17  
18  
19  
20  
21 50. Ryan M, Scott DA, Reeves C, Bate A, van Teijlingen ER, Russell EM, et al. Eliciting  
22 Public Preferences for Healthcare: A systematic review of techniques. Health Technol  
23 Assess (Rockv). 2001;5(5).  
24  
25  
26  
27  
28 51. Bridges JFP, Hauber AB, Marshall D, Lloyd A, Prosser LA, Regier DA, et al. Conjoint  
29 analysis applications in health--a checklist: a report of the ISPOR Good Research  
30 Practices for Conjoint Analysis Task Force. Value Heal [Internet]. Elsevier Inc.; 2011 Jun  
31 [cited 2014 Jul 10];14(4):403–13. Available from:  
32  
33  
34  
35  
36  
37  
38  
39  
40 52. Rose JM, Bliemer MCJ. Sample size requirements for stated choice experiments.  
41 Transportation (Amst) [Internet]. 2013 Feb 1 [cited 2014 Nov 8];40(5):1021–41.  
42 Available from: <http://link.springer.com/10.1007/s11116-013-9451-z>  
43  
44  
45  
46 53. Rose JM, Collins AT, Bliemer MCJ, Hensher DA. Ngene [Internet]. ChoiceMetrics; 2014.  
47 Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
48  
49  
50  
51 54. ChoiceMetrics. Ngene 1.1.2 User Manual & Reference Guide [Internet]. 15/07/2014.  
52 ChoiceMetrics; 2014. Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 55. Population Census Commission. The Population and Housing Census of Ethiopia:  
4 SNNPR [Internet]. 2007. Available from: [phe-ethiopia.org/pdf/snnpr.pdf](http://phe-ethiopia.org/pdf/snnpr.pdf)  
5  
6
- 7 56. Bradley, Sarah E.K., Winfrey W and TNC. Contraceptive Use and Perinatal Mortality in  
8 the DHS: An Assessment of the Quality and Consistency of Calendars and Histories  
9  
10 [Internet]. DHS Methodological Reports No. 17. Rockville, Maryland, USA: ICF  
11  
12 International; 2015. Available from: [http://dhsprogram.com/publications/publication-](http://dhsprogram.com/publications/publication-MR17-Methodological-Reports.cfm)  
13  
14 MR17-Methodological-Reports.cfm  
15  
16
- 17 57. Assaf, Shireen, Monica T. Kothari and TP. An Assessment of the Quality of DHS  
18 Anthropometric Data, 2005-2014 [Internet]. DHS Methodological Reports No. 16.  
19  
20 Rockville, Maryland, USA: ICF International; 2015. Available from:  
21  
22 [http://dhsprogram.com/publications/publication-MR16-Methodological-](http://dhsprogram.com/publications/publication-MR16-Methodological-Reports.cfm#sthash.PLYVphzr.dpuf)  
23  
24 Reports.cfm#sthash.PLYVphzr.dpuf  
25  
26
- 27 58. Rutstein SO. Potential bias and selectivity in analyses of children born in the past five  
28 years using DHS data . DHS Methodol Reports No 14 [Internet]. 2014;(September).  
29  
30 Available from: <http://dhsprogram.com/pubs/pdf/MR14/MR14.pdf>  
31  
32
- 33 59. Ahmed S, Li Q, Scrafford C, Pullum TW. An assessment of DHS maternal mortality data  
34 and estimates [Internet]. DHS Methodological Reports No. 13 . 2014. Available from:  
35  
36 <http://dhsprogram.com/pubs/pdf/MR13/MR13.pdf>  
37  
38
- 39 60. Schoumaker B. Quality and consistency of DHS fertility estimates, 1990 to 2012 . DHS  
40 Methodol Reports No 12 [Internet]. 2014;(September). Available from:  
41  
42 <http://dhsprogram.com/pubs/pdf/MR12/MR12.pdf>  
43  
44
- 45 61. Pullum TW, Becker S. Evidence of omission and displacement in DHS birth histories .  
46  
47 DHS Methodol Reports No 11 [Internet]. 2014;(September). Available from:  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59

- 1  
2  
3 <http://dhsprogram.com/pubs/pdf/MR11/MR11.pdf>  
4
- 5 62. Pullum TW. An Assessment of the Quality of Data on Health and Nutrition in the DHS  
6  
7 Surveys, 1993-2003 [Internet]. DHS Methodological Reports No. 6. Calverton, Maryland,  
8  
9 USA: Macro International; 2008. p. 1–139. Available from:  
10  
11 <http://dhsprogram.com/publications/publication-MR6-Methodological-Reports.cfm>  
12  
13
- 14 63. Pullum TW. An assessment of age and date reporting in the DHS surveys, 1985-2003 .  
15  
16 DHS Methodol Reports No 5 [Internet]. 2006;4. Available from:  
17  
18 <http://dhsprogram.com/pubs/pdf/MR5/MR5.pdf>  
19  
20
- 21 64. Boerma, J. Ties, A. Elisabeth Sommerfelt, Jeroen K. Van Ginneken, George T. Bicego,  
22  
23 Kate M. Stewart and SOR-S more at: [http://dhsprogram.com/publications/publication-M-](http://dhsprogram.com/publications/publication-M-M-R.cfm#sthash.9SKwUnbk.dpu)  
24  
25 [M-R.cfm#sthash.9SKwUnbk.dpu](http://dhsprogram.com/publications/publication-M-M-R.cfm#sthash.9SKwUnbk.dpu). An Assessment of the Quality of Health Data in DHS-  
26  
27 I Surveys [Internet]. DHS Methodological Reports No. 2. Calverton, Maryland, USA:  
28  
29 Macro International; 1994. Available from:  
30  
31 [http://dhsprogram.com/publications/publication-MR2-Methodological-](http://dhsprogram.com/publications/publication-MR2-Methodological-Reports.cfm#sthash.9SKwUnbk.dpuf)  
32  
33 [Reports.cfm#sthash.9SKwUnbk.dpuf](http://dhsprogram.com/publications/publication-MR2-Methodological-Reports.cfm#sthash.9SKwUnbk.dpuf)  
34  
35
- 36 65. Rutstein SO, Bicego GT, Blanc AK, Rutenberg N, Arnold F, Sullivan J a. An assessment  
37  
38 of DHS-I data quality. DHS Methodological Reports No. 1. 1990.  
39  
40
- 41 66. Mangham L, Hanson K, McPake B. How to do (or not to do) ... Designing a discrete  
42  
43 choice experiment for application in a low-income country. Health Policy Plan [Internet].  
44  
45 2009 Mar [cited 2014 Jul 10];24(2):151–8. Available from:  
46  
47 <http://www.ncbi.nlm.nih.gov/pubmed/19112071>  
48  
49
- 50 67. Alkire S. The Missing Dimensions of Poverty Data: Introduction to the Special Issue.  
51  
52 Oxford Dev Stud [Internet]. TF; 2007 Dec 29 [cited 2016 Feb 26];35(4):347–59.  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Available from:  
4  
5 <http://www.tandfonline.com/doi/abs/10.1080/13600810701701863#.VtCzIBjVs3s>  
6  
7  
8 68. Alkire S, Foster J. Counting and multidimensional poverty measurement. *J Public Econ*  
9  
10 [Internet]. Elsevier B.V.; 2011;95(7–8):476–87. Available from:  
11  
12 <http://dx.doi.org/10.1016/j.jpubeco.2010.11.006>  
13  
14  
15 69. UNDP. Human development report 2015: Technical Notes [Internet]. 2015. Available  
16  
17 from: <http://hdr.undp.org/en/content/calculating-indices>  
18  
19  
20 70. StataCorp. Stata Multilevel mixed-effects reference manual. 13th ed. College Station, TX:  
21  
22 StataCorp LP; 2013.  
23  
24 71. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med*.  
25  
26 1994;38(8):1091–110.  
27  
28  
29 72. Rogers EM. Diffusion of innovations. Fifth. New York: Free Press; 2003.  
30  
31 73. Barry D, Frew AH, Mohammed H, Desta BF, Tadesse L, Aklilu Y, et al. The effect of  
32  
33 community maternal and newborn health family meetings on type of birth attendant and  
34  
35 completeness of maternal and newborn care received during birth and the early postnatal  
36  
37 period in rural Ethiopia. *J Midwifery Womens Health* [Internet]. 2014 Jan [cited 2014 Apr  
38  
39 5];59(Suppl 1):S44-54. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24588915>  
40  
41  
42 74. World Bank. Ethiopia Overview [Internet]. 2015. Available from:  
43  
44 <http://www.worldbank.org/>  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

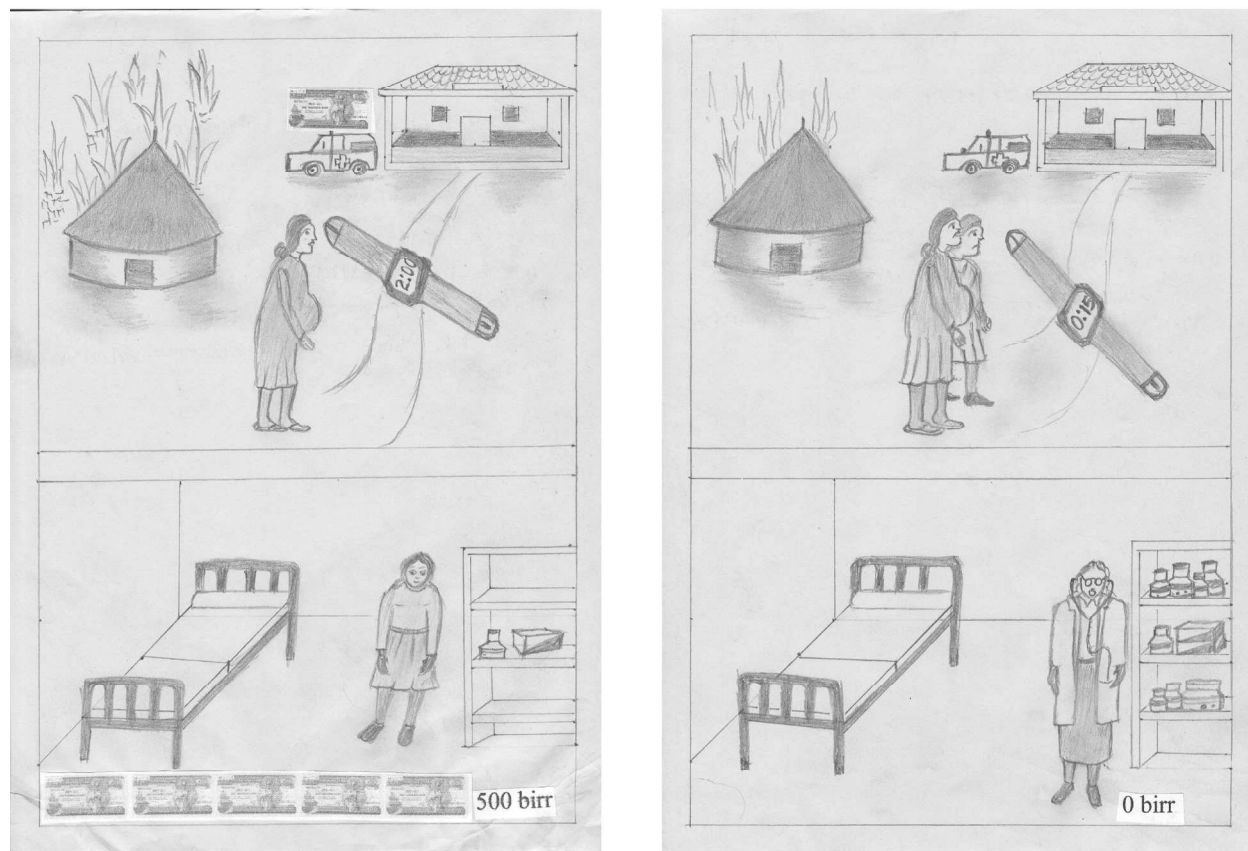


Figure 1: Sample Task Set for Discrete Choice Experiment

Table 1. *Attributes and Levels for Discrete Choice Experiment*

Attribute	Levels
<b>Distance to health facility</b>	30 minutes
	1 hour
	1½ hours
	2 hours
	3 hours
<b>Type of provider</b>	Female doctor
	Male doctor
	Female nurse
	Male nurse
	Health extension worker
<b>Provider attitude</b>	Provider smiles, is kind and respectful, speaks softly
	Provider does not smile, uses a harsh tone, harsh language
<b>Availability of medication and supplies</b>	Drugs and medical equipment always available
	Drugs and medical equipment not always available
<b>Availability of free transport</b>	Free ambulance available
	Free ambulance not available
<b>Support persons</b>	Family and friends allowed in delivery room
	Family and friends not allowed in delivery room
<b>Cost (Cost of user charges, labor-related supplies, and non-ambulance transportation)</b>	No cost
	50 Ethiopian birr <sup>a</sup>
	100 Ethiopian birr
	200 Ethiopian birr
	300 Ethiopian birr

<sup>a</sup>Approximately 20 birr/US\$1

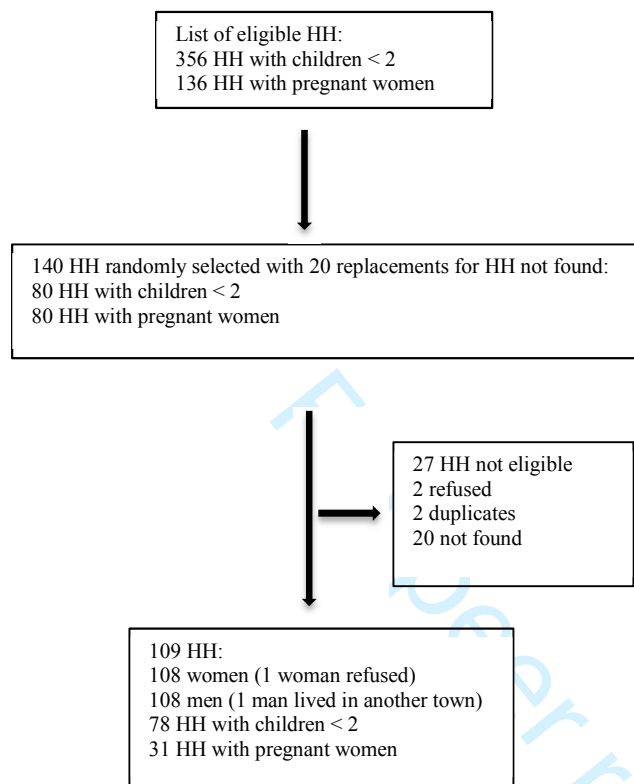


Figure 2: Study Flow Diagram



Table 2. *The Multi-dimensional Poverty Index (MPI) Deprivation Score Indicators*

<b>Definition</b>	<b>Weights (%)</b>
<b>Health</b>	
A household member is malnourished	16.7
A child has died in the last 5 years	16.7
<b>Education</b>	
No one in the household has completed at least 6 years of school	16.7
A school-age child (7-15) is not enrolled in school	16.7
<b>Living standard</b>	
No electricity	5.6
No access to clean drinking water or source of clean drinking water > 30 minute walk	5.6
Household lacks improved sanitation, or shares with other households	5.6
Dirty cooking fuel is used (dung, wood, or charcoal)	5.6
Household has a dirt, sand or dung floor	5.6
Household does not own a radio, TV, or telephone, and does not own a means of transportation (bike, motorbike, care, truck, animal cart, motorboat) or a means of livelihood (refrigerator, arable land, livestock)	5.6

Table 3. *Characteristics of households in Sidama Zone, SNNPR sample compared to EDHS rural subsample*

Variable	Study Sample <sup>a</sup> (n=109)	EDHS 2011 (n=11,590)	p-value
Household size, mean (SD)	5.4 (2.1)	4.9	p<.05
<b>Living Conditions</b>			
Use solid fuel for cooking <sup>b</sup>	109 (100)	11474 (99.0)	ns
Dirt or dung floor	81 (74.3)	11068 (95.5)	p<.001
Non-improved drinking water <sup>c</sup>	21 (19.27)	6734 (58.1)	p<.001
Walk ≥ 30 minutes to drinking water	61 (56.0)	7232 (62.4)	p<.001
No electricity	78 (71.6)	11034 (95.2)	p<.001
<b>Access to Information</b>			
No radio	50 (45.9)	7684 (66.3)	p<.001
No mobile phone	35 (32.1)	10,106 (87.2)	p<.001
No landline	109 (100)	11,567 (99.8)	ns
No television	107 (98.2)	11463 (98.9)	ns
<b>Access to Transportation</b>			
No bicycle	108 (99.1)	11428 (98.6)	ns
No motorcycle	107 (98.2)	11578 (99.9)	p<.001
No vehicle	109 (100)	11578 (99.9)	ns
No animal cart	108 (99.1)	11463 (98.9)	ns
<b>Means of Livelihood</b>			
No refrigerator	109 (100)	11520 (99.4)	ns
No agricultural land	25 (22.9)	1414 (12.2)	p<.001
No livestock	40 (36.7)	1217 (10.5)	p<.001

Note. Results presented as # (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Dirt or dung floor – 10 missing; owns land: 25 don't know. <sup>b</sup>Includes wood, charcoal, straw/shrubs/grass, agricultural crops, and animal dung. <sup>c</sup>Includes piped into dwelling, piped to yard/plot, public tap/standpipe, borehole, protected well, protected spring, rainwater, bottled water.

Table 4. *Characteristics of female and male study participants in Sidama Zone, SNNPR, Ethiopia*

Characteristic	Study Sample <sup>a</sup>		
	Women (n=108)	Men (n=108)	p-value
Age, mean (SD)	24.7 (4.6)	32.1 (8.5)	t= -7.85 (211), p<.001
Percent who never attended school	14 (13.0)	2 (1.9)	$X^2$ (1, N=215)= 9.72, p<.05
Years of education, mean (SD)	5.5 (3.5) (n= 93)	6.8 (3.3) (n= 106)	t = -2.75(197), p<.05
Mass media exposure			
Never reads paper	93 (86.1)	50 (46.3)	$X^2$ (1, N=216)= 38.26, p<.001
Never listens to radio	81 (75.0)	28 (25.9)	$X^2$ (1, N=216)= 52.02, p<.001
Never watches TV	99 (91.7)	36 (33.3)	$X^2$ (1, N=216)= 78.40, p<.001
No mass media exposure at least once/week	72 (66.7)	57 (52.8)	$X^2$ (1, N=216)= 4.33, p<.05
Involved in decisions about:			
Seeking health care for self <sup>b</sup>			
Respondent alone	48 (44.4)	99 (91.7)	$X^2$ (1, N=216)= 55.39, p<.001
Partner or someone else	4 (3.7)	23 (21.3)	
Jointly with spouse	60 (55.6)	9 (8.3)	
Major household purchases <sup>b</sup>			
Respondent alone	44 (40.7)	76 (70.4)	
Partner or someone else	66 (61.1)	106 (98.1)	$X^2$ (1, N=216)= 45.67, p<.001
Jointly with spouse	7 (6.5)	14 (13.0)	
Visiting friends and family <sup>b</sup>			
Respondent alone	42 (38.9)	2 (1.8)	
Partner or someone else	59 (54.6)	92 (85.2)	
Jointly with spouse	84 (77.8)	103 (95.4)	$X^2$ (1, N=216)= 14.38, p<.001
Full decision-making capacity <sup>c</sup>	26 (24.1)	22 (20.4)	
Participated in none of the 3 decisions	24 (22.2)	5 (4.7)	
Jointly with spouse	58 (53.7)	81 (75.0)	
Prenatal care during last or current pregnancy	35 (32.4)	96 (88.9)	$X^2$ (1, N=216)= 72.18, p<.001
Place of last delivery	18 (16.7)	1 (0.9)	$X^2$ (1, N=216)= 16.68, p<.001
Home <sup>c</sup>	31 (29.0)	97 (89.8)	$X^2$ (1, N=215)= 82.59, p<.001
Health facility	25 (23.2)	30 (27.8)	$X^2$ (1, N=155)= .53, p= ns
Delivered by a skilled birth attendant	27 (34.6)	31 (40.3)	$X^2$ (1, N=155)= .53, p= ns
Delivered by a skilled birth attendant	25 (23.2)	30 (27.8)	$X^2$ (1, N=216)= .61, p= ns

*Note.* Data is n (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Women: Age-2; Years of education-15; Prenatal-1; Men: Age-1; Years of education-2. <sup>b</sup>Alone or jointly with spouse. <sup>c</sup>Defined as participating in making decisions about healthcare, major household purchases, and visits to family or relatives alone or jointly with spouse. <sup>d</sup>Women and men were asked these questions separately. <sup>e</sup>Home includes participant's home or another home.

Table 5

*Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 women<sup>a</sup> from Sidama zone, SNNPR, Ethiopia*

Variable	Odds Ratio	p-value	95% CI	
Meds and supplies				
Always available	3.08	<b>0.000</b>	2.03	4.67
Support person				
Allowed in delivery room	1.69	<b>0.000</b>	1.37	2.07
Ambulance				
Free	1.37	<b>0.006</b>	1.09	1.70
Cost (per 50 birr decrease)	1.15	<b>0.000</b>	1.12	1.18
Provider				
Female doctor vs HEW	0.92	0.702	0.59	1.42
Male doctor vs HEW	1.33	0.169	0.89	1.99
Female nurse vs HEW	0.68	0.050	0.47	1.00
Male nurse vs HEW	0.54	<b>0.003</b>	0.36	0.81
Female doctor vs male doctor	0.69	<b>0.011</b>	0.52	0.92
Female doctor vs female nurse	1.34	0.064	0.98	1.84
Female doctor vs male nurse	1.71	<b>0.000</b>	1.27	2.29
Male doctor vs female nurse	1.95	<b>0.000</b>	1.44	2.62
Male doctor vs male nurse	2.47	<b>0.000</b>	1.84	3.32
Female nurse vs male nurse	0.68	0.120	0.94	1.71
Attitude				
Smiles, listens	1.24	0.075	0.98	1.56
Distance (per 15 minute decrease in walking time)	0.99	0.383	0.86	1.05

*Note.* AIC decreased from 2960 (null) to 2762 (Level1). Likelihood ratio (LR)  $\chi^2(10)=218.30$ ,  $p<0.0001$  <sup>a</sup>21 missing responses and 99 neither responses out of 3240 options

Table 6

*Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 men from Sidama zone, SNNPR, Ethiopia*

Variable	OR	p-value	95% CI	
Meds and supplies				
Always available	2.68	<b>0.000</b>	1.79	4.02
Support person				
Allowed in delivery room	1.74	<b>0.000</b>	1.42	2.14
Attitude				
Smiles, listens	1.30	<b>0.030</b>	1.03	1.64
Distance(per 15 minute decrease in walking time)	1.09	<b>0.000</b>	1.06	1.13
Cost (per 50 birr decrease)	1.14	<b>0.000</b>	1.11	1.17
Provider				
Female doctor vs HEW	0.74	0.169	0.47	1.14
Male doctor vs HEW	0.75	0.155	0.50	1.12
Female nurse vs HEW	0.53	<b>0.001</b>	0.36	0.78
Male nurse vs HEW	0.51	<b>0.001</b>	0.34	0.77
Female doctor vs male doctor	0.99	0.929	0.74	1.31
Female doctor vs female nurse	1.39	<b>0.035</b>	1.02	1.89
Female doctor vs male nurse	1.44	<b>0.014</b>	1.07	1.92
Male doctor vs female nurse	1.41	<b>0.022</b>	1.05	1.90
Male doctor vs male nurse	1.46	<b>0.012</b>	1.09	1.95
Female nurse vs male nurse	1.03	0.832	0.77	2.94
Ambulance				
Free	0.95	0.679	0.76	1.19

*Note.* AIC decreased from 2960 (null) to 2781 (Level 1). Likelihood ratio (LR)  $\chi^2(10)=234.49$ ,  $p<0.0001$  <sup>a</sup>No missing responses and 37 neither responses out of 3240 options

## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
<b>Title and abstract</b> pp. 1 and 3	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>		
p. 6 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
p. 9 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods – p. 9</b>		
Study design – p. 9	4	Present key elements of study design early in the paper
Setting – p. 10	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants – p. 10	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables – p.9	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement – p.9	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias – p. 11	9	Describe any efforts to address potential sources of bias
Study size – p. 10	10	Explain how the study size was arrived at
Quantitative variables – p. 13	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods – p. 13	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

**Results**

Participants – p. 14	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data – p. 14	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data – p. 15	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results – p. 15	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

**Discussion**

Key results – p. 17	18	Summarise key results with reference to study objectives
Limitations – p. 20	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation – p. 20	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability – p. 20	21	Discuss the generalisability (external validity) of the study results

**Other information**

Funding – p. 2	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## A discrete choice experiment to determine facility-based delivery services desired by women and men in rural Ethiopia

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3 **Title:** A discrete choice experiment to determine facility-based delivery services desired by  
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9

10 **Authors:**

11  
12 Nancy K. Beam<sup>a</sup>, Gezahegn Bekele Dadi<sup>b</sup>, Sally H. Rankin<sup>a</sup>, Sandra Weiss<sup>c</sup>, Bruce Cooper<sup>d</sup>, Lisa  
13  
14 Thompson<sup>a</sup>  
15  
16  
17  
18

19 <sup>a</sup>Family Health Care Nursing, School of Nursing, University of California, San Francisco, 2  
20  
21 Koret Way, Box 0606, San Francisco, CA 94143-0606  
22  
23

24 <sup>b</sup>School of Nursing and Midwifery, College of Medicine and Health Sciences, Hawassa  
25  
26 University, PO Box 1560, Hawassa, Ethiopia.  
27

28 <sup>c</sup>Dean's Office and Community Health Services, School of Nursing, University of California,  
29  
30 San Francisco, 2 Koret Way, Box 0608, San Francisco, CA 94143-0606  
31  
32

33 <sup>d</sup>Dean's Office, School of Nursing, University of California, San Francisco, 2 Koret Way, Box  
34  
35 0604, San Francisco, CA 94143-0606  
36  
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38  
39

40 **Corresponding Author:** Nancy Beam, Department of Family Health Care Nursing, School of  
41  
42 Nursing, University of California, San Francisco, 2 Koret Way, Box 0606, San Francisco, CA  
43  
44 94143-0606, USA. Phone: +011-510-593-0235. E-mail: docbeamphd@gmail.com  
45  
46

47 **Contributorship Statement**

48  
49 1. Substantial contributions to the conception or design of the work; or the acquisition, analysis,  
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51 or interpretation of data for the work; AND  
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3 Nancy K. Beam, Gezahegn Bekele Dadi, Sally H. Rankin, Sandra Weiss, Bruce Cooper, and  
4  
5 Lisa Thompson participated in the conception of the study  
6

7  
8 Nancy K. Beam and Gezahegn Bekele Dadi participated in the acquisition of the data.  
9

10 Nancy K. Beam designed the DCE  
11

12 Bruce Cooper and Nancy K. Beam participated in the analysis and interpretation of the data  
13

14  
15 2. All authors participated in drafting the work or revising it critically for important intellectual  
16  
17 content; AND  
18

19  
20 3. All authors gave final approval of the version to be published; AND  
21

22  
23 4. All authors agreed to be accountable for all aspects of the work in ensuring that questions  
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4 [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) and declare: no support from any organisation for the  
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## Abstract

**Objectives:** Despite global efforts to increase facility-based delivery (FBD), 90% of women in rural Ethiopia deliver at home without a skilled birth attendant. Men have an important role in increasing FBD due to their decision-making power, but this is largely unexplored. This study aimed to determine the FBD care attributes preferred by women and men, and whether poverty or household decision-making are associated with choice to deliver in a facility.

**Setting and Participants:** We conducted a cross-sectional discrete choice experiment in 109 randomly selected households in rural Ethiopia in September-October 2015. We interviewed women who were pregnant or who had a child < 2 years old and their male partners.

**Results:** Both women and men preferred health facilities where medications and supplies were available (OR=3.08; 95% CI, 2.03-4.67); (OR=2.68; 95% CI, 1.79-4.02), a support person was allowed in the delivery room (OR=1.69; 95% CI, 1.37-2.07); (OR=1.74; 95% CI, 1.42-2.14), and delivery cost was low (OR=1.15 95% CI, 1.12-1.18); OR=1.14 (95% CI, 1.11-1.17). Women valued free ambulance service (OR=1.37; 95% CI, 1.09-1.70), while men favored nearby facilities (OR=1.09; 95% CI, 1.06-1.13) with friendly providers (OR=1.30; 95% CI, 1.03-1.64). Provider preferences were complex. Neither women nor men preferred female doctors to health extension workers (HEW) (OR=0.92; 95% CI, 0.59-1.42); (OR=0.74; 95% CI, 0.47-1.14), male doctors to HEW (OR=1.33; 95% CI, 0.89-1.99); (OR=0.75; 95% CI, 0.50-1.12), or female over male nurses (OR=0.68; 95% CI, 0.94-1.71); (OR=1.03; 95% CI, 0.77-2.94). While both women and men preferred male nurses to HEW (OR=1.86; 95% CI, 1.23-2.80); (OR=1.95; 95% CI, 1.30-2.95), men (OR=1.89; 95% CI, 1.29-2.78), but not women (OR=1.47; 95% CI, 1.00-2.13) preferred HEW to female nurses. Both women and men preferred female doctors to male nurses

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3 (OR=1.71; 95% CI, 1.27-2.29); (OR=1.44; 95% CI, 1.07-1.92), male doctors to female nurses  
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5 (OR=1.95; 95% CI, 1.44-2.62); (OR=1.41; 95% CI, 1.05-1.90), and male doctors to male nurses  
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7 (OR=2.47; 95% CI, 1.84-3.32); (OR=1.46; 95% CI, 1.09-1.95), while only women preferred  
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9 male doctors to female doctors (OR=1.45; 95% CI, 1.09-1.93); (OR=1.01; 95% CI, 0.76-1.35)  
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11 and only men preferred female nurses to female doctors (OR=1.34; 95% CI, 0.98-1.84);  
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13 (OR=1.39; 95% CI, 1.02-1.89). Men are disproportionately involved in making household  
14  
15 decisions ( $X^2$  (1, N=216)=72.18,  $p<.001$ ), including decisions to seek health care ( $X^2$  (1,  
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17 N=216)= 55.39,  $p<.001$ ), yet men were often unaware of their partners' prenatal care attendance  
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19 ( $X^2$  (1, N=215)= 82.59,  $p<.001$ ).

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23 **Conclusion:** Women's and men's preferences may influence delivery service choices.

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26 Considering these choices is one way the Ethiopian government and health facilities may  
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28 encourage FBD in rural areas.  
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## Article Summary

### Strength and limitations of this study

- First known Discrete Choice Experiment to test preferences of both women and men around choice of facility-based delivery services.
- Acknowledges role men play in making delivery decisions for their families
- Tests preferences predicted by the Three Delays model and based on literature to influence use of delivery services
- Limited generalizability due to difference in wealth between study sample and general population

## Background/Rationale

Maternal mortality ratio in Ethiopia decreased from 871 deaths/100,000 live births in 2000 to 676/100,000 in 2011,<sup>1</sup> but still remains above the 75% Millennium Development Goal (MDG) target reduction (218).<sup>2</sup> Neonatal mortality rate has remained relatively unchanged since 2005 (39 deaths/1000 live births)<sup>1</sup> despite Ethiopia having achieved the MDG for infant mortality in 2013.<sup>2</sup> More than 90% of rural women deliver at home, a known barrier to reducing maternal and neonatal mortality.<sup>1</sup>

Recommendations for reducing maternal and neonatal mortality focus on skilled birth attendants (SBA) conducting delivery and referral care availability for emergencies.<sup>3</sup> While the SBA definition does not preclude home delivery<sup>4</sup>, conditions in many developing countries make skilled birth attendance synonymous with facility-based delivery (FBD). If women are not delivering at facilities, they do not have access to emergency interventions.<sup>5</sup>

Despite government efforts to improve FBD by increasing health facility numbers and training health staff in Emergency Obstetric and Neonatal Care services provision<sup>6</sup>, home delivery remains a strong tradition in Ethiopia.<sup>7,8</sup> In Peru, where home deliveries were similarly common, community members and providers identified FBD changes that would make FBD services more culturally acceptable and convenient to families. Changes that were both safe and acceptable to patients were instituted. Between 1999 and 2007, FBD increased from 6% to 83% in targeted rural communities.<sup>9</sup> Kenya's program to increase dialogue between communities and health services increased FBD in the rural community by 6.1%.<sup>10</sup> Community mobilization increased FBD by 30% in Burkina Faso.<sup>11</sup> No studies were found that tested community directed facility-based interventions to improve FBD in Ethiopia. An increased understanding of factors underlying delivery place choice may help Ethiopian health facilities to better respond to

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3 families' preferences.  
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5           The expanded three delays model<sup>12</sup> describes delays in receiving emergency and  
6 preventative FBD services: 1) Deciding to seek care; 2) Reaching the health facility; and 3)  
7 Receiving appropriate treatment. The decision to seek care may be influenced by sociocultural  
8 factors, perceived benefits and needs, perceived economic and physical accessibility, and  
9 perceived quality of care. A literature review including 54 studies examined factors associated  
10 with delivery location in Ethiopia's unique cultural context. Changeable FBD factors included  
11 cultural barriers, perceived benefits and barriers, economic accessibility, and physical  
12 accessibility. Cultural barriers to FBD identified in qualitative studies were examinations by  
13 male providers,<sup>13,14</sup> facility rules limiting support from family and friends during delivery,<sup>8,14-22</sup>  
14 and medical culture that allows mistreatment of pregnant women by providers.<sup>13-15,18,20</sup>  
15 Conversely, facilities offering delivery by higher level providers<sup>18,21-23</sup> and which were  
16 consistently stocked with medications and supplies were appreciated.<sup>18,23</sup> Quantitative measures  
17 of cultural factors include women's autonomy and involvement in deciding where to deliver.  
18 Women's autonomy was not generally found to be associated with FBD.<sup>24-28</sup> However, women  
19 involved in deciding where to deliver were more likely to have FBDs.<sup>15,17,29-33</sup>  
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40           Perceived benefits and need for FBD may be influenced by access to mass media,  
41 antenatal care (ANC) use, and previous FBD. FBD may be more common among families who  
42 own radios and/or TVs,<sup>17,34,35</sup> but more frequently no association was found.<sup>29,33-38</sup> ANC use,  
43 which may both increase knowledge of perceived benefits and need for FBD, and increase  
44 comfort with facility staff, was frequently,<sup>15,27,31,33,38-47</sup> but not always,<sup>25,29,48-50</sup> associated with  
45 FBD. Previous experience with FBD varied in its association with FBD from positive<sup>40,49</sup> to  
46 negative<sup>43</sup> to no association.<sup>29</sup>  
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3 Although the Three Delays model shows perceived, rather than actual, economic  
4 accessibility predicts care-seeking behavior, most Ethiopian studies measure economic  
5 accessibility as mother's occupation,<sup>17,24–26,33,36,37,42,44,45,51,52</sup> husband's  
6 occupation,<sup>31,33,35,37,45,48,51,52</sup> monthly income,<sup>17,25,29,31,36,40,45,53</sup> or wealth  
7 quintile.<sup>24,30,32,34,38,39,46,47,52</sup>  
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14 As with economic accessibility, physical accessibility to health facilities is most often  
15 measured as actual, rather than perceived, accessibility. Women living in urban areas are more  
16 likely to have FBDs.<sup>15,24,26–31,34–39,43–45,48–50,52,53</sup> Less time to reach facilities<sup>30,43,49,52</sup> and closer  
17 distance<sup>17,34,36</sup> were associated with FBD, but associations between time to facility<sup>36,40,48</sup> and  
18 distance<sup>36,37,43,52,54</sup> with FBD were not always significant. Transportation availability increased  
19 FBD likelihood.<sup>36</sup>  
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28 Several weaknesses in research methodology limit interpretation of Ethiopian studies.  
29 First, research participants were almost exclusively women, yet male partners often make  
30 household decisions<sup>55–57</sup> including delivery location.<sup>58</sup> Second, cultural practices identified in  
31 qualitative studies as barriers to FBD have not been included in quantitative studies. Third,  
32 descriptive studies that base data collection on the Ethiopian Demographic and Health Survey  
33 (EDHS) limit new knowledge generation by asking the same questions in the same way. A  
34 discrete choice experiment (DCE) conducted by Kruk, Paczkowski, et al. in rural Ethiopia  
35 overcame this weakness. Women who had delivered in the last five years were asked to choose  
36 between two hypothetical facilities with varying distance, provider type, provider attitude, drug  
37 and medical equipment availability, transportation availability, and cost attributes,<sup>59</sup> thus  
38 identifying women's priorities in the context of multiple factors.  
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53 We collected data from both women and men and used DCE methodology to elicit  
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3 preferences for delivery service attributes, specifically, allowing support persons in the delivery  
4 room, provider gender, distance, provider type, provider attitude, drug and medical equipment  
5 availability, free transportation availability, and delivery cost. Our study aims were to determine:  
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8 (a) the FBD care attributes preferred by women and men, (b) whether gender differences exist in  
9 attribute preferences; and (c) whether poverty levels or household decision-making involvement  
10 are associated with facility choice.  
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## 16 **Methods**

### 17 **Research Design**

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19 This cross-sectional DCE had three parts: household survey, individual surveys of men  
20 and women, and DCE task set. Questions in household and individual surveys were drawn from  
21 the EDHS.  
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### 28 **DCE Study Design**

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30 Respondents were shown pictures of two facilities (Figure 1) and asked to imagine they  
31 were deciding where they would deliver their next baby. They were asked to choose between  
32 Facility A, Facility B, or Neither Facility. Facility A and B were described using a script.  
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37  
38 Table 1 lists attributes and levels included in the experimental design and were selected  
39 to produce a reasonable number of scenarios to test with respondents.<sup>60-62</sup> Given that all  
40 attributes had either two or five levels, ten tasks were required for attribute level balance. Pilot-  
41 testing with local women and men indicated ten tasks did not cause respondent fatigue.  
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46  
47 Quality of care was represented by medications and supplies' availability, provider  
48 attitude, and provider type. Presence of support persons in the delivery room and provider gender  
49 tested cultural preferences. Perceived accessibility was represented by cost, distance to facility,  
50 and free ambulance availability.  
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3       **Design decisions.** A d-efficient design (d-error = 0.3) that allows for smaller sample size,  
4 while still estimating attributes at a statistically significant level,<sup>62</sup> was produced based on prior  
5 probabilities established through a review of the literature<sup>63</sup> using nGene software.<sup>64</sup>  
6  
7

8  
9  
10       **Sample Size.** A sample size of mean=36,820, median=314, ranging from minimum=8 to  
11 maximum=5,162,097 was calculated by nGene to detect statistically significant differences  
12 between women and men. Examining the equation for sample size provides an explanation for  
13 the wide range:  
14  
15

$$N_k = (T_{k2} * se_{k2}) / \beta_{k2}$$

16  
17 where  $N_k$  is the sample size,  $T_{k2}$  is the t-ratio required for significance,  $se_{k2}$  is the standard error  
18 for the prior parameter, and  $\beta_{k2}$  is the prior parameter. Therefore, as beta approaches zero, the  
19 sample size needed to detect statistical difference increases.  
20  
21

22  
23  
24       Several of the priors range from -1 to 1, reflecting the degree of uncertainty in the priors,  
25 which in turn results in a large sample size requirement (J. Rose, personal communication,  
26 August 18, 2015).<sup>65</sup>  
27

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30       Given the logistical impossibility of collecting a large sample for this pilot study, J. Rose  
31 (personal communication, May 20, 2015) recommended 100 respondents for each group (women  
32 and men) based on expected improved statistical properties of basing the design on prior  
33 parameters. Assuming a 20% non-response rate, 120 households were selected, representing 240  
34 respondents.  
35

### 36 37 38 **Subjects and Setting**

39  
40       The target population was women and their male partners in two rural *kebeles* defined by  
41 the most recent census (2007)<sup>66</sup> in Sidama zone, Southern Nations, Nationalities and People's  
42 region, Ethiopia. *Kebeles* are the smallest administrative unit in Ethiopia. Inclusion criteria were  
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3 women and men who were expecting a child or had a child less than two years old. Eligible  
4  
5 participants were excluded if unable to answer questions due to mental or physical disabilities.  
6  
7 Informed consent and household interviews were conducted in participants' homes in October  
8  
9  
10 2015.

### 11 12 **Sample plan**

13  
14 Health Extension Workers (HEWs) from two *kebeles* listed eligible households using  
15  
16 clinic and home visit records. Households were randomly selected by assigning each household a  
17  
18 random number using the Excel random number generator and then sorting numerically.  
19  
20

### 21 22 **Informed consent procedures**

23  
24 Informed oral consent was obtained before the survey. Research ethics committees at  
25  
26 Hawassa University in Ethiopia and University of California San Francisco gave approval.  
27  
28 Common River, a local non-governmental organization, facilitated logistical arrangements with  
29  
30 community participants.  
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### 33 34 **Validity and reliability.**

35  
36 **Validity.** Questions from the EDHS were used for this study, thus building upon EDHS'  
37  
38 strong validity<sup>67-76</sup>. Demographic, health, education and living standard variables were collected.  
39  
40 Additional EDHS questions were used to assess participation in decision-making, mass media  
41  
42 exposure, danger signs knowledge, ANC use, and delivery history.  
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45  
46 Attributes and levels for this DCE study were based on review of Ethiopian literature and  
47  
48 the three delays model<sup>77</sup> and were refined during informant interviews and survey pilot testing to  
49  
50 discern which attributes and levels were valid in this setting.<sup>61</sup> Pictures drawn by a local artist  
51  
52 were used to ensure understanding in this low literacy population and were pre-tested with a  
53  
54 local women's group and male staff at a local nonprofit.  
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3        **Reliability.** Experienced data collectors, fluent in both Amharic and Sidaminyä (local  
4 language) were trained using a written protocol to ask questions in a standardized manner. Study  
5 materials were translated into Amharic and Sidaminyä and back-translated into English by local  
6 and professional translators. Questionnaires were pre-tested for clarity to ensure interviewers and  
7 participants easily understood questions. In addition to pre-testing with male and female  
8 community members that took place during the translation and testing of the DCE pictures, the  
9 entire instrument was pre-tested during a day of field-testing. Pre-testing was conducted at  
10 households that had not been selected as part of the sample. Approximately twelve men and  
11 twelve women participated in pre-testing. Questionnaires were reviewed daily for completeness;  
12 when errors were found, interviewers were asked for clarification.  
13  
14

15        To reduce socially desirable answers and response bias, interviewer and respondent  
16 genders were matched, interviewers were trained to be non-judgmental, privacy was ensured,  
17 and sensitive questions were asked later in the interview after respondent's trust had been gained.  
18 To reduce non-response bias, households were revisited up to three times to contact eligible  
19 participants.  
20  
21

22        **Multi-dimensional Poverty Index.** The Multi-dimensional Poverty Index (MPI)  
23 attempts to capture in one number poverty aspects not captured by income-based poverty  
24 measures.<sup>78</sup> The MPI combines deprivations at household level in education, health and living  
25 standard.<sup>79</sup> The deprivation score is calculated by summing ten component weighted scores in  
26 three indicator areas<sup>80</sup> (Table 2).  
27  
28

29        Health, education, and living standard indicators were collected to compare the sample  
30 population to the national MPI. Malnutrition data could not be collected due to time and cost  
31 restraints. In addition, sanitation questions were discarded due to misinterpretation. Therefore,  
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3 the sample MPI was not directly comparable to the reported national MPI. Instead, individual  
4 indicators in the sample were compared to EDHS data. The sample MPI served as a poverty  
5 indicator in the analysis.  
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10 **Household Decision-Making Score.** During the EDHS, women are asked about who  
11 makes decisions around obtaining health care for themselves, large household purchases, and  
12 visits to relatives. Women who make decisions on all three indicators, either solely or jointly  
13 with their husbands, are considered to have the highest autonomy. Men are asked about their  
14 participation in large household purchases and obtaining health care for themselves.<sup>1</sup> In this  
15 study, both women and men were asked about their involvement in decisions regarding obtaining  
16 health care for themselves, large household purchases, and visits to relatives.  
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## 26 **Data Management and Analysis**

27  
28 Study household characteristics were calculated and compared to the 2011 EDHS of  
29 rural households using chi-square and t-tests to determine statistically significant differences.  
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31 Similar analysis was conducted to describe and compare characteristics and reported pregnancy  
32 and delivery care practices of female and male study participants.  
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38 We used multilevel mixed-effects logistic regression with QR decomposition. QR  
39 decomposition improves convergence when random-effects variance is small.<sup>81</sup> Unlike other  
40 models, which assume independence, multilevel models take dependency of multiple  
41 observations from single respondents into account.<sup>62</sup> Level 1 included choices made by each  
42 respondent; Level 2 included respondent's gender; and Level 3 included household  
43 characteristics.  
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51 The analysis was conducted in four parts, which are described in more detail below. First,  
52 separate multi-variate analyses of women's and men's data was conducted to determine their  
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3 preferences. Second, the data was combined, and gender was introduced as a Level 2 variable to  
4  
5 determine whether a statistical difference existed between women and men's preferences. Third,  
6  
7 a Level 2 analysis of various decision-making measures were tested to determine their effect on  
8  
9 facility choice. Finally, the effect of household poverty on preferences was tested in a Level 3  
10  
11 analysis.  
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15 Women's and men's responses were analyzed separately to determine the utility of  
16  
17 specific Level 1 attributes for each group that significantly contributed to facility choice.  
18  
19 Adjusted odds ratios were calculated to provide a more intuitive presentation of strength and  
20  
21 direction of utility coefficients ( $e^{\beta}$ ). Bonferroni method was used to control alpha for multiple  
22  
23 comparisons.  
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27 A multilevel model was constructed by adding individual and random intercept terms.  
28  
29 Level 2 interaction terms, combining attributes with gender, were introduced into the model one  
30  
31 by one to test whether women and men differed significantly on preferences for facility  
32  
33 characteristics. Predictor interactions with involvement in household decision-making (Level 2)  
34  
35 were also tested.  
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37

38  
39 Household poverty level (Level 3) main effect on facility choice was tested by creating a  
40  
41 poverty variable. First, household deprivation percent was calculated using MPI deprivation  
42  
43 indicators using reweighted variables to reflect use of fewer variables. Next, a dichotomous  
44  
45 variable, poverty, was created to divide households into those with percent deprivation greater  
46  
47 than or equal to 33.3%, the definition for multidimensional poverty, and those who were not  
48  
49 multidimensionally poor. In addition to adding poverty to the model to test the effect on facility  
50  
51 choice, the interaction between poverty and gender was also tested to determine whether  
52  
53 multidimensional poverty effected women and men differently.  
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3 Akaike's information criterion (AIC) was estimated and likelihood-ratio (LR) tests were  
4 conducted to test improvement in model fit. A decrease in AIC with a significant LR test  
5 indicates improvement in model fit.  
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10 Data were double-entered in REDCap (Research Electronic Data Capture), a secure web-  
11 based program for managing surveys and databases<sup>82</sup> and analyzed using Stata 14<sup>83</sup>.  
12  
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## 16 17 **Results**

### 18 19 **Participant Eligibility**

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21 Households with children less than two years old (n=356) and households with  
22 pregnant women (n=136) were eligible to participate (Figure 2). For 20 households not  
23 located due to incomplete addresses, the next randomly selected household was approached.  
24 Participation rate for locatable, eligible households was 98%. Household and individual  
25 surveys took approximately 5 minutes and the DCE portion took approximately 10 minutes to  
26 complete.  
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### 35 36 **Study Participants' Characteristics**

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38 **Household Characteristics.** Study sample household characteristics were compared to household  
39 characteristics from the EDHS (Table 3). Study sample participants generally had better living  
40 conditions and more access to radios and mobile phones than those in the EDHS sample.  
41  
42 However, a significantly greater percent of study sample households lacked land and livestock.  
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47 **Female and Male Participants' Characteristics.** Ninety-seven percent of women and 99% of  
48 men were from Sidama. All women and 96% of men were Protestant. Women were on average 7  
49 years younger and had one year less education than their husbands had. Men had two to three  
50 times more exposure to mass media and participated more in household decisions compared to  
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women. Men were more likely to believe their wife had received prenatal care during their pregnancy (89.8%) than women reported having done so (29.0%) (Table 4).

## DCE Results

**Women's preferences.** Women's odds of choosing to deliver at a facility were 3.08 (2.03 to 4.67) times greater if medications and supplies were always available; 1.69 (1.37 to 2.07) times greater if support persons were allowed in delivery room; 1.37 (1.09 to 1.70) times greater if a free ambulance was available; and 1.15 (1.12 to 1.18) times greater for every 50-birr (US \$2.50) reduction in cost (Table 5).

Provider type was significant using the Wald test ( $p < 0.0001$ ) followed by Bonferroni-protected multiple comparisons. Women were 1.86 (1.23 to 2.80) times more likely to prefer delivery by HEWs than male nurses; 1.45 (1.09 to 1.93) times more likely to prefer male doctors to female doctors; 1.71 (1.27 to 2.29) times more likely to prefer female doctors to male nurses; 1.95 (1.44 to 2.62) times more likely to prefer male doctors to female nurses; and 2.47 (1.84 to 3.32) times more likely to prefer male doctors to male nurses.

**Men's preferences.** For men (Table 6), odds of choosing a facility were 2.68 (1.79 to 4.02) times greater when medications and supplies are always available; 1.74 (1.42 to 2.14) times greater when a support person is allowed in delivery room; 1.30 (1.03 to 1.64) times greater when provider smiles and listens well; 1.09 (1.06 to 1.13) times greater for each 15-minute reduction in walking distance; and 1.14 (1.11, to 1.17) times greater for every 50-birr reduction in cost.

Provider type was significant overall using the Bonferroni Omnibus test ( $p < .0001$ ). Men were 1.89 (1.29 to 2.78) times more likely to prefer their wives be delivered by HEWs than female nurses; 1.95 (1.30 to 2.95) times as likely to prefer delivery by HEWs to male nurses;

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2  
3 1.39 (1.02 to 1.89) times as likely to prefer female doctors to female nurses; 1.44 (1.07 to 1.92)  
4  
5 times as likely to prefer female doctors to male nurses; 1.41 (1.05 to 1.90) times as likely to  
6  
7 prefer male doctors to female nurses; and 1.46 (1.09 to 1.95) times as likely to prefer male  
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9 doctors to male nurses.  
10

### 11 **Significant differences between predictors of women and men's choices**

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13  
14 Only distance, provider type, and ambulance cost were significantly different between  
15  
16 women and men. Women's odds of selecting a facility increased 1.08 times for every 15-  
17  
18 minutes' increase in distance compared to men (1.03 to 1.14). Women were 1.70 (1.15 to 2.52)  
19  
20 times more likely than men to prefer male doctors to male nurses; and 1.36 (1.05 to 1.75) times  
21  
22 more likely to prefer a facility with free ambulance service. AIC decreased from the Level 1  
23  
24 model (5551) to a Level 2 model adding Gender at level 2 (5536) and the LR was significant  
25  
26 ( $\chi^2(10) = 28.54, p = 0.0002$ ) indicating improved model fit with the addition of significant cross-  
27  
28 level interactions.  
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### 33 **Decision-making**

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35 While Table 4 illustrated significant differences between women and men's involvement  
36  
37 in decision-making, decision-making involvement did not significantly influence facility choice,  
38  
39 whether measured as none vs. any ( $p = 0.496$ ); involved in healthcare decisions for self vs. not  
40  
41 involved ( $p = 0.653$ ); involved in healthcare decisions for self vs. not involved, women vs. men  
42  
43 ( $p = 0.189$ ); number of decisions involved in (continuous) ( $p = 0.930$ ); or number of decisions  
44  
45 involved in (categorical) ( $p = 0.133$ ).  
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### 49 **Poverty and facility choice**

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51 Facility choice did not differ between multidimensionally poor and not  
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53 multidimensionally poor households ( $p = 0.170$ ), but facility choice was associated weakly with  
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3 percent household deprivation ( $p = 0.055$ ). In addition, facility choice did not differ between  
4  
5 women and men based on household deprivation ( $p = 0.672$ ).  
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## 7 8 **Discussion**

### 9 10 **DCE Preferences**

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12 In this study, both women and men placed the highest value on health facilities that  
13  
14 always had medications and supplies available and allowed support persons into the delivery  
15  
16 room. Women's facility choice was also influenced by free ambulance availability and low cost,  
17  
18 while men were more likely to choose nearer, less expensive delivery services with friendly  
19  
20 providers.  
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24 In contrast, in a DCE in rural Ethiopia, Kruk, Paczkowski, et al.<sup>59</sup> found women preferred  
25  
26 high quality delivery services such as available drugs and medical equipment, doctors or nurses  
27  
28 rather than HEWs, and friendly providers, with lower value placed on accessibility indicators  
29  
30 when selecting facilities. Neither support person presence, nor provider gender, was included in  
31  
32 their study.  
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35 In our study, preferences for provider type were complex. In order to have a reasonable  
36  
37 number of scenarios, provider type and gender were linked in the study design, making provider  
38  
39 preferences difficult to interpret. Women generally preferred doctors to nurses, although no  
40  
41 significant difference in preference was found between delivery by female doctors or female  
42  
43 nurses. Men preferred facilities with doctors to nurses regardless of gender. Nurse's gender did  
44  
45 not affect women's facility preference, but male doctors were selected over female doctors.  
46  
47 While preference for more highly skilled providers noted by Kruk, Paczkowski, et al.<sup>59</sup> generally  
48  
49 held between doctors and nurses; HEWs were either preferred or chosen equally to doctors and  
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51 nurses.  
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## Interpreting Findings within The Three Delays Model: Implications for Services and Research

**Perceived quality of care.** In our study, reliable medications and supplies' availability was the strongest facility choice indicator for both women and men. This important element of the Three Delays model's perceived quality of care<sup>12,84</sup> has been reported by other researchers.<sup>8,13,23,59</sup> Government and facility administrators should prioritize supply chain management when making budget allocations. A study comparing actual and perceived stocks of medications and supplies' impact on FBD rates and cost analysis of lives saved through improving supply chains would add further information on this intervention's effectiveness.

Provider attitude was a significant facility choice predictor for men, but not women. However, no significant difference was found between women and men's facility choice based on provider attitude. Qualitative researchers have reported mistreatment by staff, ranging from yelling to physical abuse, made women distrustful of health facilities.<sup>13-15,18,21</sup> Roro et al.<sup>20</sup> reported this was true for men also. Lack of significance of provider attitude for women in this study may result from considering this aspect of care in the context of other variables, which were more important. It may also be that women in this area have had little experience with unfriendly providers, so they are not concerned with this attribute.

Both women and men valued doctors more than nurses, but preferred or were neutral on selecting facilities with HEWs compared to more skilled providers. While appreciation of skilled providers is not uncommon,<sup>15,16,18,21,22,36</sup> preference for HEWs is surprising as HEWs' ability to perform safe deliveries has been questioned.<sup>8,14,20,21</sup> This preference may reflect the desire to be delivered by someone they know, or greater flexibility by HEWs in accommodating cultural birth practices<sup>85</sup> such as allowing support persons to be present in the delivery room. Both

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3 women and men may be more comfortable with HEWs who are local women,<sup>85,86</sup> and provide  
4 antenatal and postnatal services,<sup>86</sup> trusting them to refer mothers in emergencies.<sup>86</sup> Our findings  
5 suggest inherent trust in providers, who understand the cultural context and needs, is more  
6 important than procedural skill and knowledge.  
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11  
12 The apparent preference for HEWs and doctors over nurses is concerning. Nurses offer  
13 the lowest cost solution to providing skilled care in most developing countries. Research is  
14 needed to better understand why nurses were least preferred and how to address this issue, as it  
15 could have implications for women's health outcomes and workforce training.  
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21 **Cultural factors.** Cultural preference for being surrounded by family and friends during  
22 delivery<sup>8,14-19,21,22</sup> was voiced by both women and men. Excluding support persons from the  
23 delivery room is incompatible with cultural norms and is likely to decrease FBD uptake.<sup>87</sup> A  
24 cluster-randomized controlled trial comparing facilities implementing family-centered delivery  
25 policies with those that are not could test this finding.  
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33 Preference for male over female providers contradicts reports in qualitative  
34 literature.<sup>8,14,15,29</sup> One explanation for this difference may lie in the study design. When asked  
35 directly about provider gender preferences, respondents may say they are ashamed to be  
36 delivered by a man.<sup>13,14,29</sup> However, when given more complex scenarios, underlying biases,  
37 such as sexism, may have greater influence on respondent choices, leading them to choose male  
38 providers as being more qualified.  
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47 **Perceived accessibility.** Both women and men preferred lower cost services. However,  
48 distance and free ambulance availability had mixed influences on facility choice with women  
49 preferring facilities with free ambulance service, while men were more influenced by distance.  
50 Other Ethiopian research has shown either no effect<sup>37,40,41,48,54</sup> or increases in FBD when  
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3 facilities are closer.<sup>17,27,30,36,43,49,52</sup> Women may prioritize free ambulance service due to greater  
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5 concern for their own comfort as other free transportation, such as riding in animal carts or being  
6  
7 carried on stretchers, are very uncomfortable.<sup>18,20,50</sup> At the community meeting held at the  
8  
9 completion of the study, men complained that ambulances were unavailable for deliveries as has  
10  
11 been found in other areas of Ethiopia.<sup>85,88</sup>  
12  
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14  
15 **Perceived Benefits and Needs.** We found men are primarily responsible for making  
16  
17 household decisions, including decisions about whether their wives seek health care. Yet, 90% of  
18  
19 men believed their wives had attended ANC during their pregnancy, while only 29% of women  
20  
21 reported doing so. Educating men on home delivery's potential dangers and FBD's benefits  
22  
23 could potentially increase families choosing FBD. Barry, et al<sup>89</sup> showed women who attended  
24  
25 two or more family education meetings on maternal health with family members were nearly  
26  
27 twice as likely to deliver with SBAs or HEWs compared to women who attended fewer than two  
28  
29 meetings, but no difference for women who attended alone. Intervention studies involving  
30  
31 partners or other family support in maternal education are needed.  
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### 35 **Limitations**

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37 **Generalizability.** Based on household characteristics, our study population appears  
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39 wealthier than the 2011 rural Ethiopian population. However, Ethiopia's economy has  
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41 experienced 10.8% average growth from 2003/04 to 2013/14.<sup>90</sup> Therefore, other rural areas in  
42  
43 Ethiopia may have also experienced similar improvements in living standards. The high  
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45 percentage of Protestants in this study may limit generalizability to Orthodox or Moslem  
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47 communities. Also, much of Sidama has a much higher population density than other areas, such  
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49 as Afar Region, so distance may be less of a concern for women giving birth in Sidama.  
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3 The household list used to select participants came from paper-based registers and patient  
4 charts, which made identifying eligible participants difficult. Families who lived near health  
5 posts or attended clinic may have been over-represented. Although the health workers were  
6 expected to visit every home, staffing limitations make this difficult to accomplish. This may  
7 limit generalizability.  
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14 **Missing variables.** The ability to recognize emergencies may influence the decision of  
15 where to deliver.<sup>84</sup> The original study plan included a DCE in which respondents were asked  
16 where they would deliver if they believed the mother or baby's life was in danger. This portion  
17 was dropped due to interview length. In addition, the perceived need measure, which the three  
18 delays model predicts influences decisions to seek care, was not included in the analysis due to  
19 discrepancies in interpreting the danger signs' questions. Finally, while this study included men,  
20 mother-in-laws, traditional birth attendants, and other older women may also influence birth  
21 place decisions.<sup>18,19,58</sup>  
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### 32 33 **Conclusion**

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35 This study makes a unique contribution to the literature as the first known DCE to test  
36 both women and men's preferences in choosing FBD services. Including men acknowledged the  
37 role men play in making decisions for their families either alone or in collaboration with their  
38 partner. Women and men were found to agree on preferring facilities that always had  
39 medications and supplies available and allowed support persons in the delivery room.  
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## References

1. CSA [Ethiopia] and ICF International. Ethiopia demographic and health survey 2011. Addis Ababa, Ethiopia and Calverton, Maryland, USA; 2012.
2. WHO. Ethiopia | Maternal health [Internet]. 2015 [cited 2016 Sep 14]. Available from: <http://www.afro.who.int/en/ethiopia/country-programmes/topics/4459-maternal-health.html>
3. Campbell OMR, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. *Lancet* [Internet]. 2006 Oct 7 [cited 2014 May 26];368(9543):1284–99. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17027735>
4. WHO. Making pregnancy safer : the critical role of the skilled attendant: A joint statement by WHO , ICM and FIGO [Internet]. Geneva; 2004. Available from: [http://www.who.int/maternal\\_child\\_adolescent/documents/9241591692/en/](http://www.who.int/maternal_child_adolescent/documents/9241591692/en/)
5. Admasu K, Haile-Mariam A, Bailey P. Indicators for availability, utilization, and quality of emergency obstetric care in Ethiopia, 2008. *Int J Gynaecol Obstet* [Internet]. International Federation of Gynecology and Obstetrics; 2011 Oct [cited 2013 Feb 16];115(1):101–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21855065>
6. Ethiopian Federal Ministry of Health. Health Sector Transformation Plan (2015/16-2019/20). 2015.
7. Federal Ministry of Health, UNICEF, UNFPA, WHO A. National baseline assessment for emergency obstetric & newborn care: Ethiopia 2008. Addis Ababa; 2009.
8. Shiferaw S, Spigt M, Godefrooij M, Melkamu Y, Tekie M. Why do women prefer home births in Ethiopia? *BMC Pregnancy Childbirth* [Internet]. BMC Pregnancy and Childbirth; 2013 Jan [cited 2013 Mar 2];13(1):5. Available from:



- 1  
2  
3 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&rendertype=abstract)  
4  
5 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&rendertype=abstract)  
6  
7
- 8 9. Gabrysch S, Lema C, Bedriñana E, Bautista M a, Malca R, Campbell OM. Cultural  
9  
10 adaptation of birthing services in rural Ayacucho, Peru. Bull World Health Organ  
11  
12 [Internet]. 2009 Sep 1 [cited 2014 Feb 4];87(9):724–9. Available from:  
13  
14 <http://www.who.int/bulletin/volumes/87/9/08-057794.pdf>  
15  
16
- 17 10. Olayo R, Wafula C, Aseyo E, Loum C, Kaseje D. A quasi-experimental assessment of the  
18  
19 effectiveness of the Community Health Strategy on health outcomes in Kenya. BMC  
20  
21 Health Serv Res [Internet]. BioMed Central Ltd; 2014;14(SUPPL.1):S3. Available from:  
22  
23 <http://www.biomedcentral.com/bmchealthservres/content/14/S1/S3>  
24  
25
- 26 11. Hounton S, Byass P, Brahim B. Towards reduction of maternal and perinatal mortality in  
27  
28 rural Burkina Faso: Communities are not empty vessels. Glob Health Action. 2009;2(1).  
29  
30
- 31 12. Gabrysch S, Campbell OMR. Still too far to walk: Literature review of the determinants of  
32  
33 delivery service use. BMC Pregnancy Childbirth [Internet]. 2009 Jan [cited 2013 May  
34  
35 22];9:34. Available from:  
36  
37 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&rendertype=abstract)  
38  
39 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&rendertype=abstract)  
40  
41
- 42 13. King R, Jackson R, Dietsch E, Hailemariam A. Barriers and facilitators to accessing  
43  
44 skilled birth attendants in Afar region, Ethiopia. Midwifery [Internet]. 2015 May [cited  
45  
46 2016 Mar 2];31(5):540–6. Available from:  
47  
48 <http://www.sciencedirect.com/science/article/pii/S0266613815000388>  
49  
50
- 51 14. Sipsma H, Thompson J, Maurer L, Bradley E, Curry L. Preferences for home delivery in  
52  
53 Ethiopia: provider perspectives. Glob Public Health [Internet]. Taylor & Francis; 2013  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Oct [cited 2014 Mar 15];8(9):1014–26. Available from:  
4  
5 <http://www.ncbi.nlm.nih.gov/pubmed/24156727>  
6  
7  
8 15. Abera M, Abebe G, Belachew T. Predictors of safe delivery service utilization in Arsi  
9  
10 zone, south-east Ethiopia. *Ethiop J Health Sci*. 2011;21(Special Issue):95–106.  
11  
12 16. Bedford J, Gandhi M, Admassu M, Girma A. “A normal delivery takes place at home”: a  
13  
14 qualitative study of the location of childbirth in rural Ethiopia. *Matern Child Health J*  
15  
16 [Internet]. 2013 Feb [cited 2013 Nov 12];17(2):230–9. Available from:  
17  
18 <http://www.ncbi.nlm.nih.gov/pubmed/22359241>  
19  
20  
21 17. Birmeta K, Dibaba Y, Woldeyohannes D. Determinants of maternal health care utilization  
22  
23 in Holeta town, central Ethiopia. *BMC Health Serv Res* [Internet]. 2013 Jul 3 [cited 2013  
24  
25 Jul 8];13(1):256. Available from:  
26  
27 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&re  
28  
29 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&rendertype=abstract)  
30  
31  
32 18. Gebrehiwot T, Goicolea I, Edin K, San Sebastian M. Making pragmatic choices: women’s  
33  
34 experiences of delivery care in Northern Ethiopia. *BMC Pregnancy Childbirth* [Internet].  
35  
36 2012 Jan [cited 2013 Nov 12];12:113. Available from:  
37  
38 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&re  
39  
40 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&rendertype=abstract)  
41  
42  
43 19. Jackson R. The place of birth in Kafa Zone, Ethiopia. *Health Care Women Int* [Internet].  
44  
45 2014;35(7–9):728–42. Available from:  
46  
47 [http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&A  
48  
49 N=24786334](http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=24786334)  
50  
51  
52  
53 20. Roro MA, Hassen EM, Lemma AM, Gebreyesus SH, Afework MF. Why do women not  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 deliver in health facilities: a qualitative study of the community perspectives in south  
4 central Ethiopia? BMC Res Notes [Internet]. BioMed Central; 2014 Jan 21 [cited 2016  
5 Feb 24];7(1):556. Available from:  
6  
7  
8 <http://bmresnotes.biomedcentral.com/articles/10.1186/1756-0500-7-556>  
9  
10  
11  
12 21. Gebrehiwot T, San Sebastian M, Edin K, Goicolea I. Health workers' perceptions of  
13 facilitators of and barriers to institutional delivery in Tigray, Northern Ethiopia. BMC  
14 Pregnancy Childbirth [Internet]. 2014 Apr 10 [cited 2014 Apr 16];14(137). Available  
15 from: <http://www.ncbi.nlm.nih.gov/pubmed/24716750>  
16  
17  
18  
19  
20  
21 22. Warren C. Care seeking for maternal health: challenges remain for poor women. Ethiop J  
22 Heal Dev [Internet]. 2010 Dec 16;24(Special Issue 1):100–4. Available from:  
23  
24 <http://www.ajol.info/index.php/ejhd/article/view/62950>  
25  
26  
27  
28 23. Bradley E, Thompson JW, Byam P, Webster TR, Zerihun A, Alpern R, et al. Access and  
29 quality of rural healthcare: Ethiopian Millennium Rural Initiative. Int J Qual Health Care  
30 [Internet]. 2011 Jun [cited 2013 Nov 11];23(3):222–30. Available from:  
31  
32 <http://www.ncbi.nlm.nih.gov/pubmed/21467077>  
33  
34  
35  
36  
37 24. Ethiopian Society of Population Studies. Maternal Health Care Seeking Behaviour in  
38 Ethiopia : Findings from EDHS 2005. 2008.  
39  
40  
41  
42 25. Dutamo Z, Assefa N, Egata G. Maternal health care use among married women in  
43 Hossaina, Ethiopia. BMC Health Serv Res [Internet]. BioMed Central; 2015 Jan 10 [cited  
44 2016 Feb 24];15(1):365. Available from:  
45  
46  
47 <http://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-015-1047-1>  
48  
49  
50  
51 26. Woldemicael G. Do women with higher autonomy seek more maternal health care?  
52 Evidence from Eritrea and Ethiopia. Health Care Women Int [Internet]. 2010 Jul [cited  
53  
54  
55  
56  
57  
58  
59  
60

- 2013 Nov 12];31(7):599–620. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/20526926>
27. Wado YD, Afework MF, Hindin MJ. Unintended pregnancies and the use of maternal health services in southwestern Ethiopia. *BMC Int Health Hum Rights* [Internet]. 2013 Sep 8 [cited 2013 Nov 12];13(1):36. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24011335>
28. Yebyo H, Alemayehu M, Kahsay A. Why do women deliver at home? Multilevel modeling of Ethiopian National Demographic and Health Survey data. *PLoS One* [Internet]. Public Library of Science; 2015 Jan 15 [cited 2016 Feb 24];10(4):e0124718. Available from: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124718>
29. Hailu D, Berhe H. Determinants of institutional childbirth service utilisation among women of childbearing age in urban and rural areas of Tsegedie district, Ethiopia. *Midwifery* [Internet]. Elsevier; 2014 Mar 25 [cited 2014 Apr 21]; Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24726608>
30. Wilunda C, Quaglio G, Putoto G, Takahashi R, Calia F, Abebe D, et al. Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reprod Health* [Internet]. BioMed Central; 2015 Jan 25 [cited 2016 Feb 24];12(1):74. Available from: <http://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-015-0067-y>
31. Nigussie M, Mariam DH, Mitike G. Assessment of safe delivery service utilization among women of childbearing age in north Gondar Zone , north west Ethiopia. *Ethiop J Heal Dev* [Internet]. 2004;18(3):145–52. Available from: <http://ejhd.uib.no/ejhdv18-no3/145.pdf>
32. Hagos S, Shaweno D, Assegid M, Mekonnen A, Afework MF, Ahmed S. Utilization of

- 1  
2  
3 institutional delivery service at Wukro and Butajera districts in the Northern and South  
4 Central Ethiopia. BMC Pregnancy Childbirth [Internet]. 2014 Jan [cited 2016 Feb  
5 24];14:178. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24886375>  
6  
7  
8  
9  
10 33. Tekelab T, Yadecha B, Melka AS. Antenatal care and women's decision making power as  
11 determinants of institutional delivery in rural area of Western Ethiopia. BMC Res Notes  
12 [Internet]. BioMed Central; 2015 Jan 11 [cited 2016 Feb 24];8(1):769. Available from:  
13 <http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1708-5>  
14  
15  
16  
17  
18  
19 34. Mekonnen ZA, Lerebo WT, Gebrehiwot TG, Abadura SA. Multilevel analysis of  
20 individual and community level factors associated with institutional delivery in Ethiopia.  
21 BMC Res Notes [Internet]. BioMed Central; 2015 Jan 26 [cited 2016 Mar 2];8(1):376.  
22 Available from: [http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-](http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-1)  
23  
24  
25  
26  
27  
28  
29  
30  
31 35. Mengesha ZB, Biks GA, Ayele TA, Tessema GA, Koye DN. Determinants of skilled  
32 attendance for delivery in Northwest Ethiopia: a community based nested case control  
33 study. BMC Public Health [Internet]. BMC Public Health; 2013 Jan [cited 2013 Mar  
34 2];13(1):130. Available from:  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45 36. Feyissa TR, Genemo GA. Determinants of institutional delivery among childbearing age  
46 women in Western Ethiopia, 2013: unmatched case control study. PLoS One [Internet].  
47 2014 Jan [cited 2016 Feb 24];9(5):e97194. Available from:  
48  
49  
50  
51  
52  
53  
54 37. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Woreda, South East Ethiopia: a community based cross-sectional study. *BMC Pregnancy*  
4 *Childbirth* [Internet]. 2012 Jan [cited 2013 Nov 12];12:105. Available from:  
5  
6 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&rendertype=abstract)  
7  
8 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&rendertype=abstract)  
9  
10  
11  
12 38. Tarekegn SM, Lieberman LS, Giedraitis V. Determinants of maternal health service  
13 utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey.  
14 *BMC Pregnancy Childbirth* [Internet]. BioMed Central; 2014 Jan 7 [cited 2016 Feb  
15 24];14(1):161. Available from:  
16  
17 <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/1471-2393-14-161>  
18  
19  
20  
21 39. Afework MF, Admassu K, Mekonen A, Hagos S, Asegid M, Ahmed S. Effect of an  
22 innovative community based health program on maternal health service utilization in  
23 north and south central Ethiopia: a community based cross sectional study. *Reprod Health*  
24 [Internet]. 2014 Apr 4 [cited 2014 Apr 14];11(28). Available from:  
25  
26 <http://www.ncbi.nlm.nih.gov/pubmed/24708848>  
27  
28  
29  
30  
31 40. Asres A, Davey G. Factors associated with safe delivery service utilization among women  
32 in Sheka zone, southwest Ethiopia. *Matern Child Health J* [Internet]. 2015 Apr [cited 2016  
33 Mar 2];19(4):859–67. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25055761>  
34  
35  
36  
37 41. Bayou NB, Gacho YHM. Utilization of clean and safe delivery service package of health  
38 services extension program and associated factors in rural kebeles of Kafa Zone,  
39 Southwest Ethiopia. *Ethiop J Health Sci* [Internet]. 2013 Jul [cited 2013 Nov  
40 12];23(2):79–89. Available from:  
41  
42 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
43  
44 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 42. Bayu H, Adefris M, Amano A, Abuhay M. Pregnant women's preference and factors  
4 associated with institutional delivery service utilization in Debra Markos Town, North  
5 West Ethiopia: a community based follow up study. *BMC Pregnancy Childbirth*  
6  
7 [Internet]. 2015 Jan [cited 2016 Feb 24];15:15. Available from:  
8  
9 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
10  
11 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
12  
13  
14  
15  
16 43. Kebede B, Gebeyehu A, Andargie G. Use of previous maternal health services has a  
17 limited role in reattendance for skilled institutional delivery: Cross-sectional survey in  
18 Northwest Ethiopia. *Int J Womens Health* [Internet]. 2013 Jan;5:79–85. Available from:  
19  
20 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
21  
22 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
23  
24  
25  
26  
27 44. Melaku YA, Weldearegawi B, Tesfay FH, Abera SF, Abraham L, Aregay A, et al. Poor  
28 linkages in maternal health care services-evidence on antenatal care and institutional  
29 delivery from a community-based longitudinal study in Tigray region, Ethiopia. *BMC*  
30  
31 *Pregnancy Childbirth* [Internet]. BioMed Central; 2014 Jan 19 [cited 2016 Feb  
32  
33 24];14(1):418. Available from:  
34  
35 <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-014-0418-7>  
36  
37  
38  
39  
40  
41 45. Teferra AS, Alemu FM, Woldeyohannes SM. Institutional delivery service utilization and  
42 associated factors among mothers who gave birth in the last 12 months in Sekela District,  
43 north west of Ethiopia: A community-based cross sectional study. *BMC Pregnancy*  
44  
45 *Childbirth* [Internet]. BMC Pregnancy and Childbirth; 2012 Jan [cited 2013 Mar  
46  
47 11];12(74). Available from:  
48  
49 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&rendertype=abstract)  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- ndertype=abstract
46. Worku AG, Yalew AW, Afework MF. Maternal complications and women's behavior in seeking care from skilled providers in North Gondar, Ethiopia. PLoS One [Internet]. 2013 Jan [cited 2013 Nov 12];8(3):e60171. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610646&tool=pmcentrez&rendertype=abstract>
47. Worku AG, Yalew AW, Afework MF. Factors affecting utilization of skilled maternal care in Northwest Ethiopia: A multilevel analysis. BMC Int Health Hum Rights [Internet]. 2013 Jan [cited 2013 Nov 12];13(20). Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3639034&tool=pmcentrez&rendertype=abstract>
48. Tsegay Y, Gebrehiwot T, Goicolea I, Edin K, Lemma H, Sebastian MS. Determinants of antenatal and delivery care utilization in Tigray region, Ethiopia: A cross-sectional study. Int J Equity Health [Internet]. 2013 Jan [cited 2013 May 27];12:30. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3658893&tool=pmcentrez&rendertype=abstract>
49. Habte F, Demissie M. Magnitude and factors associated with institutional delivery service utilization among childbearing mothers in Cheha district, Gurage zone, SNNPR, Ethiopia: a community based cross sectional study. BMC Pregnancy Childbirth [Internet]. BioMed Central; 2015 Jan 17 [cited 2016 Feb 24];15(1):299. Available from: <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-015-0716-8>
50. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. Reprod Health [Internet]. 2012



- 1  
2  
3 Jan [cited 2013 Jun 22];9:33. Available from:  
4  
5 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
6  
7 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
8  
9
- 10 51. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service  
11 utilization among mothers in Bahir Dar City administration, Amhara region: a community  
12 based cross sectional study. *Reprod Health* [Internet]. 2014 Jan [cited 2014 Apr 5];11(22).  
13  
14 Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24629278>  
15  
16
- 17 52. Tura G, Afework MF, Yalew AW. The effect of birth preparedness and complication  
18 readiness on skilled care use: a prospective follow-up study in Southwest Ethiopia.  
19  
20 *Reprod Health* [Internet]. *BioMed Central*; 2014 Jan 5 [cited 2016 Feb 24];11(1):60.  
21  
22 Available from: [http://reproductive-health-](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
23  
24 [journal.biomedcentral.com/articles/10.1186/1742-4755-11-60](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
25  
26
- 27 53. Abebe F, Berhane Y, Girma B. Factors associated with home delivery in Bahirdar,  
28 Ethiopia: a case control study. *BMC Res Notes* [Internet]. 2012 Jan [cited 2013 Nov  
29  
30 12];5:653. Available from:  
31  
32 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
33  
34 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
35  
36
- 37 54. Ballard K, Gari L, Mosisa H, Wright J. Provision of individualised obstetric risk advice to  
38 increase health facility usage by women at risk of a complicated delivery: a cohort study  
39  
40 of women in the rural highlands of West Ethiopia. *BJOG* [Internet]. 2013 Jul [cited 2013  
41  
42 Nov 12];120(8):971–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23464619>  
43  
44
- 45 55. Holden ST, Tefera T. From Being Property of Men to Becoming Equal Owners? Early  
46  
47 Impacts of Land Registration and Certification on Women. 2008;(July):1–110. Available  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 from: [http://www.unhsp.org/downloads/docs/10768\\_1\\_594333.pdf](http://www.unhsp.org/downloads/docs/10768_1_594333.pdf)  
4
- 5 56. Kumar N, Quisumbing AR. Policy Reform toward Gender Equality in Ethiopia: Little by  
6 Little the Egg Begins to Walk. *World Dev* [Internet]. Elsevier Ltd; 2015;67:406–23.  
7  
8 Available from: <http://dx.doi.org/10.1016/j.worlddev.2014.10.029>  
9
- 10 57. Biratu B, Lindstrom D. The influence of husbands' approval on women's use of prenatal  
11 care: Results from Yirgalem and Jimma towns, south west Ethiopia. *Ethiop J Heal Dev*  
12 [Internet]. 2007;20(2):84–92. Available from:  
13  
14 <http://www.ajol.info/index.php/ejhd/article/view/10017>  
15  
16
- 17 58. Jackson R, Tesfay FH, Godefay H, Gebrehiwot TG. Health Extension Workers' and  
18 Mothers' Attitudes to Maternal Health Service Utilization and Acceptance in Adwa  
19 Woreda, Tigray Region, Ethiopia. Roy JK, editor. *PLoS One* [Internet]. Public Library of  
20 Science; 2016 Mar 10 [cited 2017 Dec 14];11(3):e0150747. Available from:  
21  
22 <http://dx.plos.org/10.1371/journal.pone.0150747>  
23  
24
- 25 59. Kruk ME, Paczkowski MM, Tegegn A, Tessema F, Hadley C, Asefa M, et al. Women's  
26 preferences for obstetric care in rural Ethiopia: a population-based discrete choice  
27 experiment in a region with low rates of facility delivery. *J Epidemiol Community Health*.  
28 2010;64:984–8.  
29  
30
- 31 60. Ryan M, Scott DA, Reeves C, Bate A, van Teijlingen ER, Russell EM, et al. Eliciting  
32 Public Preferences for Healthcare: A systematic review of techniques. *Health Technol*  
33 *Assess (Rockv)*. 2001;5(5).  
34  
35
- 36 61. Bridges JFP, Hauber AB, Marshall D, Lloyd A, Prosser LA, Regier DA, et al. Conjoint  
37 analysis applications in health--a checklist: a report of the ISPOR Good Research  
38 Practices for Conjoint Analysis Task Force. *Value Heal* [Internet]. Elsevier Inc.; 2011 Jun  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 [cited 2014 Jul 10];14(4):403–13. Available from:  
4  
5 <http://www.ncbi.nlm.nih.gov/pubmed/21669364>  
6  
7
- 8 62. Rose JM, Bliemer MCJ. Sample size requirements for stated choice experiments.  
9  
10 Transportation (Amst) [Internet]. 2013 Feb 1 [cited 2014 Nov 8];40(5):1021–41.  
11  
12 Available from: <http://link.springer.com/10.1007/s11116-013-9451-z>  
13  
14
- 15 63. Beam NK. Women and men’s preferences for delivery services in rural Ethiopia (Doctoral  
16  
17 dissertation) [Internet]. University of California, San Francisco; 2016. Available from:  
18  
19 <https://pqdtopen.proquest.com/doc/1801982908.html?FMT=ABS>  
20  
21
- 22 64. Rose JM, Collins AT, Bliemer MCJ, Hensher DA. Ngene [Internet]. ChoiceMetrics; 2014.  
23  
24 Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
25
- 26 65. ChoiceMetrics. Ngene 1.1.2 User Manual & Reference Guide [Internet]. 15/07/2014.  
27  
28 ChoiceMetrics; 2014. Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
29  
30
- 31 66. Population Census Commission. The Population and Housing Census of Ethiopia:  
32  
33 SNNPR [Internet]. 2007. Available from: [phe-ethiopia.org/pdf/snnpr.pdf](http://phe-ethiopia.org/pdf/snnpr.pdf)  
34  
35
- 36 67. Bradley, Sarah E.K., Winfrey W and TNC. Contraceptive Use and Perinatal Mortality in  
37  
38 the DHS: An Assessment of the Quality and Consistency of Calendars and Histories  
39  
40 [Internet]. DHS Methodological Reports No. 17. Rockville, Maryland, USA: ICF  
41  
42 International; 2015. Available from: [http://dhsprogram.com/publications/publication-](http://dhsprogram.com/publications/publication-MR17-Methodological-Reports.cfm)  
43  
44 [MR17-Methodological-Reports.cfm](http://dhsprogram.com/publications/publication-MR17-Methodological-Reports.cfm)  
45  
46
- 47 68. Assaf, Shireen, Monica T. Kothari and TP. An Assessment of the Quality of DHS  
48  
49 Anthropometric Data, 2005-2014 [Internet]. DHS Methodological Reports No. 16.  
50  
51 Rockville, Maryland, USA: ICF International; 2015. Available from:  
52  
53 <http://dhsprogram.com/publications/publication-MR16-Methodological->  
54  
55  
56  
57  
58  
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60

- 1  
2  
3 Reports.cfm#sthash.PLYVphzr.dpuf  
4  
5  
6 69. Rutstein SO. Potential bias and selectivity in analyses of children born in the past five  
7 years using DHS data . DHS Methodol Reports No 14 [Internet]. 2014;(September).  
8 Available from: <http://dhsprogram.com/pubs/pdf/MR14/MR14.pdf>  
9  
10  
11  
12 70. Ahmed S, Li Q, Scrafford C, Pullum TW. An assessment of DHS maternal mortality data  
13 and estimates [Internet]. DHS Methodological Reports No. 13 . 2014. Available from:  
14 <http://dhsprogram.com/pubs/pdf/MR13/MR13.pdf>  
15  
16  
17  
18 71. Schoumaker B. Quality and consistency of DHS fertility estimates, 1990 to 2012 . DHS  
19 Methodol Reports No 12 [Internet]. 2014;(September). Available from:  
20 <http://dhsprogram.com/pubs/pdf/MR12/MR12.pdf>  
21  
22  
23  
24 72. Pullum TW, Becker S. Evidence of omission and displacement in DHS birth histories .  
25 DHS Methodol Reports No 11 [Internet]. 2014;(September). Available from:  
26 <http://dhsprogram.com/pubs/pdf/MR11/MR11.pdf>  
27  
28  
29  
30  
31  
32 73. Pullum TW. An Assessment of the Quality of Data on Health and Nutrition in the DHS  
33 Surveys, 1993-2003 [Internet]. DHS Methodological Reports No. 6. Calverton, Maryland,  
34 USA: Macro International; 2008. p. 1–139. Available from:  
35 <http://dhsprogram.com/publications/publication-MR6-Methodological-Reports.cfm>  
36  
37  
38  
39  
40  
41 74. Pullum TW. An assessment of age and date reporting in the DHS surveys, 1985-2003 .  
42 DHS Methodol Reports No 5 [Internet]. 2006;4. Available from:  
43 <http://dhsprogram.com/pubs/pdf/MR5/MR5.pdf>  
44  
45  
46  
47  
48 75. Boerma, J. Ties, A. Elisabeth Sommerfelt, Jeroen K. Van Ginneken, George T. Bicego,  
49 Kate M. Stewart and SOR-S more at: [http://dhsprogram.com/publications/publicatio.-M-](http://dhsprogram.com/publications/publicatio.-M-M-R.cfm#sthash.9SKwUnbk.dpu)  
50 [M-R.cfm#sthash.9SKwUnbk.dpu](http://dhsprogram.com/publications/publicatio.-M-M-R.cfm#sthash.9SKwUnbk.dpu). An Assessment of the Quality of Health Data in DHS-  
51  
52  
53  
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56  
57  
58  
59  
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- 1  
2  
3 I Surveys [Internet]. DHS Methodological Reports No. 2. Calverton, Maryland, USA:  
4  
5 Macro International; 1994. Available from:  
6  
7 <http://dhsprogram.com/publications/publication-MR2-Methodological->  
8  
9 [Reports.cfm#sthash.9SKwUnbk.dpuf](http://dhsprogram.com/publications/publication-MR2-Methodological-Reports.cfm#sthash.9SKwUnbk.dpuf)  
10  
11
- 12 76. Rutstein SO, Bicego GT, Blanc AK, Rutenberg N, Arnold F, Sullivan J a. An assessment  
13 of DHS-I data quality. DHS Methodological Reports No. 1. 1990.  
14
- 15 77. Mangham L, Hanson K, McPake B. How to do (or not to do) ... Designing a discrete  
16 choice experiment for application in a low-income country. Health Policy Plan [Internet].  
17 2009 Mar [cited 2014 Jul 10];24(2):151–8. Available from:  
18  
19 <http://www.ncbi.nlm.nih.gov/pubmed/19112071>  
20  
21
- 22 78. Alkire S. The Missing Dimensions of Poverty Data: Introduction to the Special Issue.  
23 Oxford Dev Stud [Internet]. TF; 2007 Dec 29 [cited 2016 Feb 26];35(4):347–59.  
24 Available from:  
25  
26 <http://www.tandfonline.com/doi/abs/10.1080/13600810701701863#.VtCzIbJVs3s>  
27  
28
- 29 79. Alkire S, Foster J. Counting and multidimensional poverty measurement. J Public Econ  
30 [Internet]. Elsevier B.V.; 2011;95(7–8):476–87. Available from:  
31  
32 <http://dx.doi.org/10.1016/j.jpubeco.2010.11.006>  
33  
34
- 35 80. UNDP. Human development report 2015: Technical Notes [Internet]. 2015. Available  
36 from: <http://hdr.undp.org/en/content/calculating-indices>  
37  
38
- 39 81. StataCorp. Stata Multilevel mixed-effects reference manual. 13th ed. College Station, TX:  
40 StataCorp LP; 2013.  
41  
42
- 43 82. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data  
44 capture (REDCap) - A metadata-driven methodology and workflow process for providing  
45  
46  
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- translational research informatics support. *J Biomed Inf.* 2009;42(2):377–81.
83. StataCorp. *Stata Statistical Software: Release 14.* College Station, TX: StataCorp LP; 2015.
84. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med.* 1994;38(8):1091–110.
85. Jackson R, Hailemariam A. The role of health extension workers in linking pregnant women with health facilities for delivery in rural and pastoralist areas of Ethiopia. *Ethiop J Health Sci [Internet].* 2016;26(5):471. Available from: <http://www.ajol.info/index.php/ejhs/article/view/144149>
86. Kok MC, Kea AZ, Datiko DG, Broerse JEW, Dieleman M, Taegtmeier M, et al. A qualitative assessment of health extension workers' relationships with the community and health sector in Ethiopia: opportunities for enhancing maternal health performance. *Hum Resour Health [Internet].* *Human Resources for Health;* 2015;13(1):80. Available from: <http://human-resources-health.biomedcentral.com/articles/10.1186/s12960-015-0077-4>
87. Rogers EM. *Diffusion of innovations.* Fifth. New York: Free Press; 2003.
88. Jackson R, Tesfay FH, Gebrehiwot TG, Godefay H. Factors that hinder or enable maternal health strategies to reduce delays in rural and pastoralist areas in Ethiopia. *Trop Med Int Heal.* 2017;22(2):148–60.
89. Barry D, Frew AH, Mohammed H, Desta BF, Tadesse L, Aklilu Y, et al. The effect of community maternal and newborn health family meetings on type of birth attendant and completeness of maternal and newborn care received during birth and the early postnatal period in rural Ethiopia. *J Midwifery Womens Health [Internet].* 2014 Jan [cited 2014 Apr 5];59(Suppl 1):S44-54. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24588915>

1  
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3 90. World Bank. Ethiopia Overview [Internet]. 2015. Available from:

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5 <http://www.worldbank.org/>  
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#### 10 Abbreviations

12 ANC	Antenatal care
13 DCE	Discrete choice experiment
14 EDHS	Ethiopian Demographic and Health Survey
15 FBD	Facility-based delivery
16 HEW	Health extension worker
17 MDG	Millenium Development Goal
18 MPI	Multi-dimensional Poverty Index
19 SBA	Skilled birth attendant

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10 Figure 1: Sample Task Set for Discrete Choice Experiment  
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12 Figure 2: Study Flow Diagram  
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Table 1. *Attributes and Levels for Discrete Choice Experiment*

Attribute	Levels
<b>Distance to health facility</b>	30 minutes
	1 hour
	1½ hours
	2 hours
	3 hours
<b>Type of provider<sup>a</sup></b>	Female doctor
	Male doctor
	Female nurse
	Male nurse
	Female Health extension worker
<b>Provider attitude</b>	Provider smiles, is kind and respectful, speaks softly
	Provider does not smile, uses a harsh tone, harsh language
<b>Availability of medication and supplies</b>	Drugs and medical equipment always available
	Drugs and medical equipment not always available
<b>Availability of free transport</b>	Free ambulance available
	Free ambulance not available
<b>Support persons</b>	Family and friends allowed in delivery room
	Family and friends not allowed in delivery room
<b>Cost (Cost of user charges, labor-related supplies, and non-ambulance transportation)</b>	No cost
	50 Ethiopian birr <sup>b</sup>
	100 Ethiopian birr
	200 Ethiopian birr
	300 Ethiopian birr

<sup>a</sup> Nurse was used to indicate both nurses and midwives on the advice of Ethiopian staff

<sup>b</sup> Approximately 20 birr/US\$1

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Table 2. *The Multi-dimensional Poverty Index Deprivation Score Indicators*

<b>Definition</b>	<b>Weights (%)</b>
<b>Health</b>	
A household member is malnourished	16.7
A child has died in the last 5 years	16.7
<b>Education</b>	
No one in the household has completed at least 6 years of school	16.7
A school-age child (7-15) is not enrolled in school	16.7
<b>Living standard</b>	
No electricity	5.6
No access to clean drinking water or source of clean drinking water > 30 minute walk	5.6
Household lacks improved sanitation, or shares with other households	5.6
Dirty cooking fuel is used (dung, wood, or charcoal)	5.6
Household has a dirt, sand or dung floor	5.6
Household does not own a radio, TV, or telephone, and does not own a means of transportation (bike, motorbike, care, truck, animal cart, motorboat) or a means of livelihood (refrigerator, arable land, livestock)	5.6

Table 3. *Characteristics of households in Sidama Zone, SNNPR sample compared to EDHS rural subsample*

Variable	Study Sample <sup>a</sup> (n=109)	EDHS 2011 (n=11,590)	p-value
Household size, mean (SD)	5.4 (2.1)	4.9	p<.05
<b>Living Conditions</b>			
Use solid fuel for cooking <sup>b</sup>	109 (100)	11474 (99.0)	ns
Dirt or dung floor	81 (74.3)	11068 (95.5)	p<.001
Non-improved drinking water <sup>c</sup>	21 (19.27)	6734 (58.1)	p<.001
Walk ≥ 30 minutes to drinking water	61 (56.0)	7232 (62.4)	p<.001
No electricity	78 (71.6)	11034 (95.2)	p<.001
<b>Access to Information</b>			
No radio	50 (45.9)	7684 (66.3)	p<.001
No mobile phone	35 (32.1)	10,106 (87.2)	p<.001
No landline	109 (100)	11,567 (99.8)	ns
No television	107 (98.2)	11463 (98.9)	ns
<b>Access to Transportation</b>			
No bicycle	108 (99.1)	11428 (98.6)	ns
No motorcycle	107 (98.2)	11578 (99.9)	p<.001
No vehicle	109 (100)	11578 (99.9)	ns
No animal cart	108 (99.1)	11463 (98.9)	ns
<b>Means of Livelihood</b>			
No refrigerator	109 (100)	11520 (99.4)	ns
No agricultural land	25 (22.9)	1414 (12.2)	p<.001
No livestock	40 (36.7)	1217 (10.5)	p<.001

Note. Results presented as # (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Dirt or dung floor – 10 missing; owns land: 25 don't know. <sup>b</sup>Includes wood, charcoal, straw/shrubs/grass, agricultural crops, and animal dung. <sup>c</sup>Includes piped into dwelling, piped to yard/plot, public tap/standpipe, borehole, protected well, protected spring, rainwater, bottled water.

Table 4. *Characteristics of female and male study participants in Sidama Zone, SNNPR, Ethiopia*

Characteristic	Study Sample <sup>a</sup>		
	Women (n=108)	Men (n=108)	p-value
Age, mean (SD)	24.7 (4.6)	32.1 (8.5)	t= -7.85 (211), p<.001
Percent who never attended school	14 (13.0)	2 (1.9)	$X^2$ (1, N=215)= 9.72, p<.05
Years of education, mean (SD)	5.5 (3.5) (n= 93)	6.8 (3.3) (n= 106)	t = -2.75(197), p<.05
Mass media exposure			
Never reads paper	93 (86.1)	50 (46.3)	$X^2$ (1, N=216)= 38.26, p<.001
Never listens to radio	81 (75.0)	28 (25.9)	$X^2$ (1, N=216)= 52.02, p<.001
Never watches TV	99 (91.7)	36 (33.3)	$X^2$ (1, N=216)= 78.40, p<.001
No mass media exposure at least once/week	72 (66.7)	57 (52.8)	$X^2$ (1, N=216)= 4.33, p<.05
Involvement in decisions about:			
Seeking health care for self <sup>b</sup>			
Respondent alone	48 (44.4)	99 (91.7)	$X^2$ (1, N=216)= 55.39, p<.001
Partner or someone else	4 (3.7)	23 (21.3)	
Jointly with spouse	60 (55.6)	9 (8.3)	
Major household purchases <sup>b</sup>			
Respondent alone	44 (40.7)	76 (70.4)	
Partner or someone else	66 (61.1)	106 (98.1)	$X^2$ (1, N=216)= 45.67, p<.001
Jointly with spouse	7 (6.5)	14 (13.0)	
Visiting friends and family <sup>b</sup>			
Respondent alone	42 (38.9)	2 (1.8)	
Partner or someone else	59 (54.6)	92 (85.2)	
Jointly with spouse	84 (77.8)	103 (95.4)	$X^2$ (1, N=216)= 14.38, p<.001
Full decision-making capacity <sup>c</sup>	26 (24.1)	22 (20.4)	
Participated in none of the 3 decisions	24 (22.2)	5 (4.7)	
Jointly with spouse	58 (53.7)	81 (75.0)	
Prenatal care during last or current pregnancy	35 (32.4)	96 (88.9)	$X^2$ (1, N=216)= 72.18, p<.001
Place of last delivery	18 (16.7)	1 (0.9)	$X^2$ (1, N=216)= 16.68, p<.001
Home <sup>c</sup>	31 (29.0)	97 (89.8)	$X^2$ (1, N=215)= 82.59, p<.001
Health facility	51 (65.4)	46 (59.7)	$X^2$ (1, N=155)= .53, p= ns
Delivered by a skilled birth attendant	27 (34.6)	31 (40.3)	$X^2$ (1, N=155)= .53, p= ns
	25 (23.2)	30 (27.8)	$X^2$ (1, N=216)= .61, p= ns

*Note.* Data is n (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Women: Age-2; Years of education-15; Prenatal-1; Men: Age-1; Years of education-2. <sup>b</sup>Alone or jointly with spouse. <sup>c</sup>Defined as participating in making decisions about healthcare, major household purchases, and visits to family or relatives alone or jointly with spouse. <sup>d</sup>Women and men were asked these questions separately. <sup>e</sup>Home includes participant's home or another home.

Table 5

Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 women<sup>a</sup> from Sidama zone, SNNPR, Ethiopia

Variable	Odds Ratio	p-value	95% CI	
Meds and supplies				
Always available	3.08	<b>0.000</b>	2.03	4.67
Support person				
Allowed in delivery room	1.69	<b>0.000</b>	1.37	2.07
Ambulance				
Free	1.37	<b>0.006</b>	1.09	1.70
Cost (per 50 birr decrease)	1.15	<b>0.000</b>	1.12	1.18
Provider				
Female doctor vs HEW	0.92	0.702	0.59	1.42
Male doctor vs HEW	1.33	0.169	0.89	1.99
Female nurse vs HEW	0.68	0.050	0.47	1.00
Male nurse vs HEW	0.54	<b>0.003</b>	0.36	0.81
Female doctor vs male doctor	0.69	<b>0.011</b>	0.52	0.92
Female doctor vs female nurse	1.34	0.064	0.98	1.84
Female doctor vs male nurse	1.71	<b>0.000</b>	1.27	2.29
Male doctor vs female nurse	1.95	<b>0.000</b>	1.44	2.62
Male doctor vs male nurse	2.47	<b>0.000</b>	1.84	3.32
Female nurse vs male nurse	0.68	0.120	0.94	1.71
Attitude				
Smiles, listens	1.24	0.075	0.98	1.56
Distance (per 15 minute decrease in walking time)	0.99	0.383	0.86	1.05

Note. AIC decreased from 2960 (null) to 2762 (Level1). Likelihood ratio (LR)  $\chi^2(10)=218.30$ ,  $p<0.0001$  <sup>a</sup>21 missing responses and 99 neither responses out of 3240 options

Table 6

*Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 men from Sidama zone, SNNPR, Ethiopia*

Variable	OR	p-value	95% CI	
Meds and supplies				
Always available	2.68	<b>0.000</b>	1.79	4.02
Support person				
Allowed in delivery room	1.74	<b>0.000</b>	1.42	2.14
Attitude				
Smiles, listens	1.30	<b>0.030</b>	1.03	1.64
Distance(per 15 minute decrease in walking time)	1.09	<b>0.000</b>	1.06	1.13
Cost (per 50 birr decrease)	1.14	<b>0.000</b>	1.11	1.17
Provider				
Female doctor vs HEW	0.74	0.169	0.47	1.14
Male doctor vs HEW	0.75	0.155	0.50	1.12
Female nurse vs HEW	0.53	<b>0.001</b>	0.36	0.78
Male nurse vs HEW	0.51	<b>0.001</b>	0.34	0.77
Female doctor vs male doctor	0.99	0.929	0.74	1.31
Female doctor vs female nurse	1.39	<b>0.035</b>	1.02	1.89
Female doctor vs male nurse	1.44	<b>0.014</b>	1.07	1.92
Male doctor vs female nurse	1.41	<b>0.022</b>	1.05	1.90
Male doctor vs male nurse	1.46	<b>0.012</b>	1.09	1.95
Female nurse vs male nurse	1.03	0.832	0.77	2.94
Ambulance				
Free	0.95	0.679	0.76	1.19

*Note.* AIC decreased from 2960 (null) to 2781 (Level 1). Likelihood ratio (LR)  $\chi^2(10)=234.49$ ,  $p<0.0001$  <sup>a</sup>No missing responses and 37 neither responses out of 3240 options



Figure 1: Sample Task Set for Discrete Choice Experiment!!

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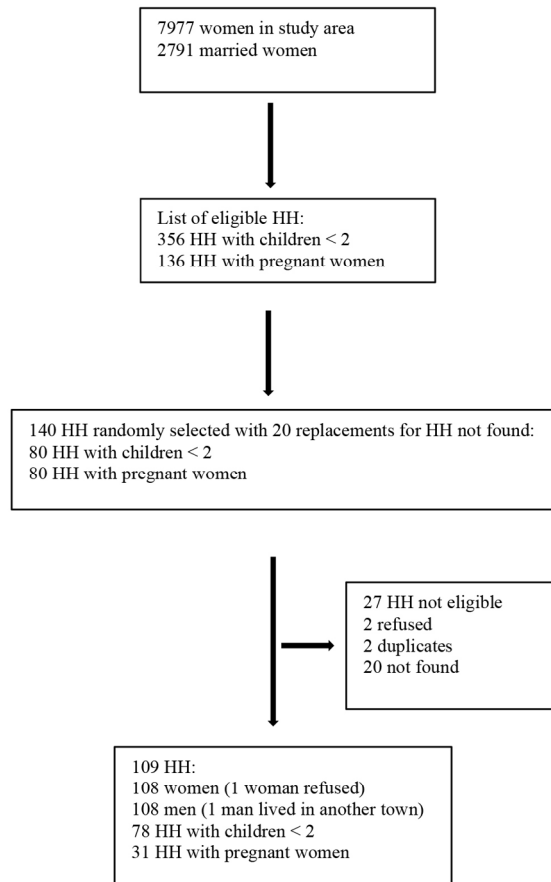


Figure 2: Study Flow Diagram

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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
<b>Title and abstract</b> pp. 1 and 3	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>		
p. 6 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
p. 9 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods – p. 9</b>		
Study design – p. 9	4	Present key elements of study design early in the paper
Setting – p. 10	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants – p. 10	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables – p.9	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement – p.9	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias – p. 11	9	Describe any efforts to address potential sources of bias
Study size – p. 10	10	Explain how the study size was arrived at
Quantitative variables – p. 13	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods – p. 13	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

**Results**

Participants – p. 14	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data – p. 14	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data – p. 15	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results – p. 15	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

**Discussion**

Key results – p. 17	18	Summarise key results with reference to study objectives
Limitations – p. 20	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation – p. 20	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability – p. 20	21	Discuss the generalisability (external validity) of the study results

**Other information**

Funding – p. 2	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## A discrete choice experiment to determine facility-based delivery services desired by women and men in rural Ethiopia

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Complete List of Authors:	Beam, Nancy Bekele Dadi, Gezehegn; Hawassa University College of Medicine and Health Sciences, School of Nursing and Midwifery Rankin, Sally; UCSF School of Nursing, Family Health Care Nursing Weiss, Sandra; UCSF School of Nursing, Dean's Office and Community Health Services Cooper, Bruce ; UCSF, Dean's Office Thompson, Lisa; UCSF School of Nursing, Family Health Care Nursing; Nell Hodgson Woodruff School of Nursing, Emory University
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3 **Title:** A discrete choice experiment to determine facility-based delivery services desired by  
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5 women and men in rural Ethiopia  
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9

10 **Authors:**

11  
12 Nancy K. Beam<sup>a</sup>, Gezahegn Bekele Dadi<sup>b</sup>, Sally H. Rankin<sup>a</sup>, Sandra Weiss<sup>c</sup>, Bruce Cooper<sup>d</sup>, Lisa  
13  
14 M. Thompson<sup>a,e</sup>  
15

16  
17 <sup>a</sup>Family Health Care Nursing, School of Nursing, University of California, San Francisco, 2  
18  
19 Koret Way, Box 0606, San Francisco, CA 94143-0606  
20

21  
22 <sup>b</sup>School of Nursing and Midwifery, College of Medicine and Health Sciences, Hawassa  
23  
24 University, PO Box 1560, Hawassa, Ethiopia.  
25

26  
27 <sup>c</sup>Dean's Office and Community Health Services, School of Nursing, University of California,  
28  
29 San Francisco, 2 Koret Way, Box 0608, San Francisco, CA 94143-0606  
30

31  
32 <sup>d</sup>Dean's Office, School of Nursing, University of California, San Francisco, 2 Koret Way, Box  
33  
34 0604, San Francisco, CA 94143-0606  
35

36  
37 <sup>e</sup>Nell Hodgson Woodruff School of Nursing, Emory University, 1520 Clifton Road, Suite 226 |  
38  
39 Atlanta, GA 30322  
40  
41

42 **Corresponding Author:** Nancy Beam, Department of Family Health Care Nursing, School of  
43  
44 Nursing, University of California, San Francisco, 2 Koret Way, Box 0606, San Francisco, CA  
45  
46 94143-0606, USA. Phone: +011-510-593-0235. E-mail: docbeamphd@gmail.com  
47  
48

49 **Contributorship Statement**

50  
51 1. Substantial contributions to the conception or design of the work; or the acquisition, analysis,  
52  
53 or interpretation of data for the work; AND  
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3 Nancy K. Beam, Gezahegn Bekele Dadi, Sally H. Rankin, Sandra Weiss, Bruce Cooper, and  
4  
5 Lisa M. Thompson participated in the conception of the study  
6

7  
8 Nancy K. Beam and Gezahegn Bekele Dadi participated in the acquisition of the data.  
9

10 Nancy K. Beam designed the DCE  
11

12 Bruce Cooper and Nancy K. Beam participated in the analysis and interpretation of the data  
13

14  
15 2. All authors participated in drafting the work or revising it critically for important intellectual  
16  
17 content; AND  
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19  
20 3. All authors gave final approval of the version to be published; AND  
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22  
23 4. All authors agreed to be accountable for all aspects of the work in ensuring that questions  
24  
25 related to the accuracy or integrity of any part of the work are appropriately investigated and  
26  
27 resolved.  
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3 **Conflicts of Interest:** All authors have completed the ICMJE uniform disclosure form at  
4 [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) and declare: no support from any organisation for the  
5 submitted work; no financial relationships with any organisations that might have an interest in  
6 the submitted work in the previous three years; no other relationships or activities that could  
7 appear to have influenced the submitted work.  
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## Abstract

**Objectives:** Despite global efforts to increase facility-based delivery (FBD), 90% of women in rural Ethiopia deliver at home without a skilled birth attendant. Men have an important role in increasing FBD due to their decision-making power, but this is largely unexplored. This study aimed to determine the FBD care attributes preferred by women and men, and whether poverty or household decision-making are associated with choice to deliver in a facility.

**Setting and Participants:** We conducted a cross-sectional discrete choice experiment in 109 randomly selected households in rural Ethiopia in September-October 2015. We interviewed women who were pregnant or who had a child < 2 years old and their male partners.

**Results:** Both women and men preferred health facilities where medications and supplies were available (OR=3.08; 95% CI, 2.03-4.67); (OR=2.68; 95% CI, 1.79-4.02), a support person was allowed in the delivery room (OR=1.69; 95% CI, 1.37-2.07); (OR=1.74; 95% CI, 1.42-2.14), and delivery cost was low (OR=1.15 95% CI, 1.12-1.18); OR=1.14 (95% CI, 1.11-1.17). Women valued free ambulance service (OR=1.37; 95% CI, 1.09-1.70), while men favored nearby facilities (OR=1.09; 95% CI, 1.06-1.13) with friendly providers (OR=1.30; 95% CI, 1.03-1.64). Provider preferences were complex. Neither women nor men preferred female doctors to health extension workers (HEW) (OR=0.92; 95% CI, 0.59-1.42); (OR=0.74; 95% CI, 0.47-1.14), male doctors to HEW (OR=1.33; 95% CI, 0.89-1.99); (OR=0.75; 95% CI, 0.50-1.12), or female over male nurses (OR=0.68; 95% CI, 0.94-1.71); (OR=1.03; 95% CI, 0.77-2.94). While both women and men preferred male nurses to HEW (OR=1.86; 95% CI, 1.23-2.80); (OR=1.95; 95% CI, 1.30-2.95), men (OR=1.89; 95% CI, 1.29-2.78), but not women (OR=1.47; 95% CI, 1.00-2.13) preferred HEW to female nurses. Both women and men preferred female doctors to male nurses



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3 (OR=1.71; 95% CI, 1.27-2.29); (OR=1.44; 95% CI, 1.07-1.92), male doctors to female nurses  
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5 (OR=1.95; 95% CI, 1.44-2.62); (OR=1.41; 95% CI, 1.05-1.90), and male doctors to male nurses  
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7 (OR=2.47; 95% CI, 1.84-3.32); (OR=1.46; 95% CI, 1.09-1.95), while only women preferred  
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9 male doctors to female doctors (OR=1.45; 95% CI, 1.09-1.93); (OR=1.01; 95% CI, 0.76-1.35)  
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11 and only men preferred female nurses to female doctors (OR=1.34; 95% CI, 0.98-1.84);  
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13 (OR=1.39; 95% CI, 1.02-1.89). Men are disproportionately involved in making household  
14  
15 decisions ( $X^2$  (1, N=216)=72.18,  $p<.001$ ), including decisions to seek health care ( $X^2$  (1,  
16  
17 N=216)= 55.39,  $p<.001$ ), yet men were often unaware of their partners' prenatal care attendance  
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19 ( $X^2$  (1, N=215)= 82.59,  $p<.001$ ).

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23 **Conclusion:** Women's and men's preferences may influence delivery service choices.

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26 Considering these choices is one way the Ethiopian government and health facilities may  
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28 encourage FBD in rural areas.  
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## Article Summary

### Strength and limitations of this study

- First known Discrete Choice Experiment to test preferences of both women and men around choice of facility-based delivery services.
- Acknowledges role men play in making delivery decisions for their families
- Tests preferences predicted by the Three Delays model and based on literature to influence use of delivery services
- Limited generalizability due to difference in wealth between study sample and general population

## Background/Rationale

Maternal mortality ratio in Ethiopia decreased from 871 deaths/100,000 live births in 2000 to 676/100,000 in 2011,<sup>1</sup> but still remains above the 75% Millennium Development Goal (MDG) target reduction (218).<sup>2</sup> Neonatal mortality rate has remained relatively unchanged since 2005 (39 deaths/1000 live births)<sup>1</sup> despite Ethiopia having achieved the MDG for infant mortality in 2013.<sup>2</sup> More than 90% of rural women deliver at home, a known barrier to reducing maternal and neonatal mortality.<sup>1</sup>

Recommendations for reducing maternal and neonatal mortality focus on skilled birth attendants (SBA) conducting delivery and referral care availability for emergencies.<sup>3</sup> While the SBA definition does not preclude home delivery<sup>4</sup>, conditions in many developing countries make skilled birth attendance synonymous with facility-based delivery (FBD). If women are not delivering at facilities, they do not have access to emergency interventions.<sup>5</sup>

Despite government efforts to improve FBD by increasing health facility numbers and training health staff in Emergency Obstetric and Neonatal Care services provision<sup>6</sup>, home delivery remains a strong tradition in Ethiopia.<sup>7,8</sup> In a setting where home deliveries were also common, community members and providers identified FBD changes that would make FBD services more culturally acceptable and convenient to families. Changes that were both safe and acceptable to patients were instituted. Between 1999 and 2007, FBD increased from 6% to 83% in targeted rural communities.<sup>9</sup> Kenya's program to increase dialogue between communities and health services increased FBD in the rural community by 6.1%.<sup>10</sup> Community mobilization increased FBD by 30% in Burkina Faso.<sup>11</sup> No studies were found that tested community directed facility-based interventions to improve FBD in Ethiopia. An increased understanding of factors underlying delivery place choice may help Ethiopian health facilities to better respond to

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3 families' preferences.  
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5 The expanded three delays model<sup>12</sup> describes delays in receiving emergency and  
6 preventative FBD services: 1) Deciding to seek care; 2) Reaching the health facility; and 3)  
7 Receiving appropriate treatment. The decision to seek care may be influenced by sociocultural  
8 factors, perceived benefits and needs, perceived economic and physical accessibility, and  
9 perceived quality of care. A literature review including 54 studies examined factors associated  
10 with delivery location in Ethiopia's unique cultural context. Changeable FBD factors included  
11 cultural barriers, perceived benefits and barriers, economic accessibility, and physical  
12 accessibility. Cultural barriers to FBD identified in qualitative studies were examinations by  
13 male providers,<sup>13,14</sup> facility rules limiting support from family and friends during delivery,<sup>8,14-22</sup>  
14 and medical culture that allows mistreatment of pregnant women by providers.<sup>13-15,18,20</sup>  
15 Conversely, facilities offering delivery by higher level providers<sup>18,21-23</sup> and which were  
16 consistently stocked with medications and supplies were appreciated.<sup>18,23</sup> Quantitative measures  
17 of cultural factors include women's autonomy and involvement in deciding where to deliver.  
18 Women's autonomy was not generally found to be associated with FBD.<sup>24-28</sup> However, women  
19 involved in deciding where to deliver were more likely to have FBDs.<sup>15,17,29-33</sup>  
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40 Perceived benefits and need for FBD may be influenced by access to mass media,  
41 antenatal care (ANC) use, and previous FBD. FBD may be more common among families who  
42 own radios and/or TVs,<sup>17,34,35</sup> but more frequently no association was found.<sup>29,33-38</sup> ANC use,  
43 which may both increase knowledge of perceived benefits and need for FBD, and increase  
44 comfort with facility staff, was frequently,<sup>15,27,31,33,38-47</sup> but not always,<sup>25,29,48-50</sup> associated with  
45 FBD. Previous experience with FBD varied in its association with FBD from positive<sup>40,49</sup> to  
46 negative<sup>43</sup> to no association.<sup>29</sup>  
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3 Although the Three Delays model shows perceived, rather than actual, economic  
4 accessibility predicts care-seeking behavior, most Ethiopian studies measure economic  
5 accessibility as mother's occupation,<sup>17,24–26,33,36,37,42,44,45,51,52</sup> husband's  
6 occupation,<sup>31,33,35,37,45,48,51,52</sup> monthly income,<sup>17,25,29,31,36,40,45,53</sup> or wealth  
7 quintile.<sup>24,30,32,34,38,39,46,47,52</sup>  
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14 As with economic accessibility, physical accessibility to health facilities is most often  
15 measured as actual, rather than perceived, accessibility. Women living in urban areas are more  
16 likely to have FBDs.<sup>15,24,26–31,34–39,43–45,48–50,52,53</sup> Less time to reach facilities<sup>30,43,49,52</sup> and closer  
17 distance<sup>17,34,36</sup> were associated with FBD, but associations between time to facility<sup>36,40,48</sup> and  
18 distance<sup>36,37,43,52,54</sup> with FBD were not always significant. Transportation availability increased  
19 FBD likelihood.<sup>36</sup>  
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28 Several weaknesses in research methodology limit interpretation of Ethiopian studies.  
29 First, research participants were almost exclusively women, yet male partners often make  
30 household decisions<sup>55–57</sup> including delivery location.<sup>58</sup> Second, cultural practices identified in  
31 qualitative studies as barriers to FBD have not been included in quantitative studies. Third,  
32 descriptive studies that base data collection on the Ethiopian Demographic and Health Survey  
33 (EDHS) limit new knowledge generation by asking the same questions in the same way. A  
34 discrete choice experiment (DCE) conducted by Kruk, Paczkowski, et al. in rural Ethiopia  
35 overcame this weakness. Women who had delivered in the last five years were asked to choose  
36 between two hypothetical facilities with varying distance, provider type, provider attitude, drug  
37 and medical equipment availability, transportation availability, and cost attributes,<sup>59</sup> thus  
38 identifying women's priorities in the context of multiple factors.  
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53 We collected data from both women and men and used DCE methodology to elicit  
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3 preferences for delivery service attributes, specifically, allowing support persons in the delivery  
4 room, provider gender, distance, provider type, provider attitude, drug and medical equipment  
5 availability, free transportation availability, and delivery cost. Our study aims were to determine:  
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8 (a) the FBD care attributes preferred by women and men, (b) whether gender differences exist in  
9 attribute preferences; and (c) whether poverty levels or household decision-making involvement  
10 are associated with facility choice.  
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## 16 **Methods**

### 17 **Research Design**

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19 This cross-sectional DCE had three parts: household survey, individual surveys of men  
20 and women, and DCE task set. Questions in household and individual surveys were drawn from  
21 the EDHS.  
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### 28 **DCE Study Design**

29 Respondents were shown pictures of two facilities (Figure 1) and asked to imagine they  
30 were deciding where they would deliver their next baby. They were asked to choose between  
31 Facility A, Facility B, or Neither Facility. Facility A and B were described using a script.  
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37 Table 1 lists attributes and levels included in the experimental design and were selected  
38 to produce a reasonable number of scenarios to test with respondents.<sup>60-62</sup> Given that all  
39 attributes had either two or five levels, ten tasks were required for attribute level balance. Pilot-  
40 testing with local women and men indicated ten tasks did not cause respondent fatigue.  
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46 Quality of care was represented by medications and supplies' availability, provider  
47 attitude, and provider type. Presence of support persons in the delivery room and provider gender  
48 tested cultural preferences. Perceived accessibility was represented by cost, distance to facility,  
49 and free ambulance availability.  
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3       **Design decisions.** A d-efficient design (d-error = 0.3) that allows for smaller sample size,  
4 while still estimating attributes at a statistically significant level,<sup>62</sup> was produced based on prior  
5 probabilities established through a review of the literature<sup>63</sup> using nGene software.<sup>64</sup>  
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10       **Sample Size.** A sample size of mean=36,820, median=314, ranging from minimum=8 to  
11 maximum=5,162,097 was calculated by nGene to detect statistically significant differences  
12 between women and men. Examining the equation for sample size provides an explanation for  
13 the wide range:  
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$$N_k = (T_{k2} * se_{k2}) / \beta_{k2}$$

16  
17 where  $N_k$  is the sample size,  $T_{k2}$  is the t-ratio required for significance,  $se_{k2}$  is the standard error  
18 for the prior parameter, and  $\beta_{k2}$  is the prior parameter. Therefore, as beta approaches zero, the  
19 sample size needed to detect statistical difference increases.  
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23       Several of the priors range from -1 to 1, reflecting the degree of uncertainty in the priors,  
24 which in turn results in a large sample size requirement (J. Rose, personal communication,  
25 August 18, 2015).<sup>65</sup>  
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29       Given the logistical impossibility of collecting a large sample for this pilot study, J. Rose  
30 (personal communication, May 20, 2015) recommended 100 respondents for each group (women  
31 and men) based on expected improved statistical properties of basing the design on prior  
32 parameters. Assuming a 20% non-response rate, 120 households were selected, representing 240  
33 respondents.  
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### 36       **Subjects and Setting**

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38       The target population was women and their male partners in two rural *kebeles* defined by  
39 the most recent census (2007)<sup>66</sup> in Sidama zone, Southern Nations, Nationalities and People's  
40 region, Ethiopia. *Kebeles* are the smallest administrative unit in Ethiopia. Inclusion criteria were  
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3 women and men who were expecting a child or had a child less than two years old. Eligible  
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5 participants were excluded if unable to answer questions due to mental or physical disabilities.  
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7 Informed consent and household interviews were conducted in participants' homes in October  
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9  
10 2015.

### 11 12 **Sample plan**

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14 Health Extension Workers (HEWs) from two *kebeles* listed eligible households using  
15  
16 clinic and home visit records. Households were randomly selected by assigning each household a  
17  
18 random number using the Excel random number generator and then sorting numerically.  
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### 21 22 **Informed consent procedures**

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24 Informed oral consent was obtained before the survey. Research ethics committees at  
25  
26 Hawassa University in Ethiopia and University of California San Francisco gave approval.  
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28 Common River, a local non-governmental organization, facilitated logistical arrangements with  
29  
30 community participants.  
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### 33 34 **Validity and reliability.**

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36 **Validity.** Questions from the EDHS were used for this study, thus building upon EDHS'  
37  
38 strong validity<sup>67-76</sup>. Demographic, health, education and living standard variables were collected.  
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40 Additional EDHS questions were used to assess participation in decision-making, mass media  
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42 exposure, danger signs knowledge, ANC use, and delivery history.  
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46 Attributes and levels for this DCE study were based on review of Ethiopian literature and  
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48 the three delays model<sup>77</sup> and were refined during informant interviews and survey pilot testing to  
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50 discern which attributes and levels were valid in this setting.<sup>61</sup> Pictures drawn by a local artist  
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52 were used to ensure understanding in this low literacy population and were pre-tested with a  
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54 local women's group and male staff at a local nonprofit.  
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3       **Reliability.** Experienced data collectors, fluent in both Amharic and Sidaminyä (local  
4 language) were trained using a written protocol to ask questions in a standardized manner. Study  
5 materials were translated into Amharic and Sidaminyä and back-translated into English by local  
6 and professional translators. Questionnaires were pre-tested for clarity to ensure interviewers and  
7 participants easily understood questions. In addition to pre-testing with male and female  
8 community members that took place during the translation and testing of the DCE pictures, the  
9 entire instrument was pre-tested during a day of field-testing. Pre-testing was conducted at  
10 households that had not been selected as part of the sample. Approximately twelve men and  
11 twelve women participated in pre-testing. Questionnaires were reviewed daily for completeness;  
12 when errors were found, interviewers were asked for clarification.  
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15       To reduce socially desirable answers and response bias, interviewer and respondent  
16 genders were matched, interviewers were trained to be non-judgmental, privacy was ensured,  
17 and sensitive questions were asked later in the interview after respondent's trust had been gained.  
18 To reduce non-response bias, households were revisited up to three times to contact eligible  
19 participants.  
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22       **Multi-dimensional Poverty Index.** The Multi-dimensional Poverty Index (MPI)  
23 attempts to capture in one number poverty aspects not captured by income-based poverty  
24 measures.<sup>78</sup> The MPI combines deprivations at household level in education, health and living  
25 standard.<sup>79</sup> The deprivation score is calculated by summing ten component weighted scores in  
26 three indicator areas<sup>80</sup> (Table 2).  
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29       Health, education, and living standard indicators were collected to compare the sample  
30 population to the national MPI. Malnutrition data could not be collected due to time and cost  
31 restraints. In addition, sanitation questions were discarded due to misinterpretation. Therefore,  
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3 the sample MPI was not directly comparable to the reported national MPI. Instead, individual  
4 indicators in the sample were compared to EDHS data. The sample MPI served as a poverty  
5 indicator in the analysis.  
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10 **Household Decision-Making Score.** During the EDHS, women are asked about who  
11 makes decisions around obtaining health care for themselves, large household purchases, and  
12 visits to relatives. Women who make decisions on all three indicators, either solely or jointly  
13 with their husbands, are considered to have the highest autonomy. Men are asked about their  
14 participation in large household purchases and obtaining health care for themselves.<sup>1</sup> In this  
15 study, both women and men were asked about their involvement in decisions regarding obtaining  
16 health care for themselves, large household purchases, and visits to relatives.  
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## 26 **Data Management and Analysis**

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28 Study household characteristics were calculated and compared to the 2011 EDHS of  
29 rural households using chi-square and t-tests to determine statistically significant differences.  
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31 Similar analysis was conducted to describe and compare characteristics and reported pregnancy  
32 and delivery care practices of female and male study participants.  
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38 We used multilevel mixed-effects logistic regression with QR decomposition. QR  
39 decomposition improves convergence when random-effects variance is small.<sup>81</sup> Unlike other  
40 models, which assume independence, multilevel models take dependency of multiple  
41 observations from single respondents into account.<sup>62</sup> Level 1 included choices made by each  
42 respondent; Level 2 included respondent's gender; and Level 3 included household  
43 characteristics.  
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51 The analysis was conducted in four parts, which are described in more detail below. First,  
52 separate multi-variate analyses of women's and men's data was conducted to determine their  
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3 preferences. Second, the data was combined, and gender was introduced as a Level 2 variable to  
4  
5 determine whether a statistical difference existed between women and men's preferences. Third,  
6  
7 a Level 2 analysis of various decision-making measures were tested to determine their effect on  
8  
9 facility choice. Finally, the effect of household poverty on preferences was tested in a Level 3  
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11 analysis.  
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15 Women's and men's responses were analyzed separately to determine the utility of  
16  
17 specific Level 1 attributes for each group that significantly contributed to facility choice.  
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19 Adjusted odds ratios were calculated to provide a more intuitive presentation of strength and  
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21 direction of utility coefficients ( $e^{\beta}$ ). Bonferroni method was used to control alpha for multiple  
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23 comparisons.  
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27 A multilevel model was constructed by adding individual and random intercept terms.  
28  
29 Level 2 interaction terms, combining attributes with gender, were introduced into the model one  
30  
31 by one to test whether women and men differed significantly on preferences for facility  
32  
33 characteristics. Predictor interactions with involvement in household decision-making (Level 2)  
34  
35 were also tested.  
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39 Household poverty level (Level 3) main effect on facility choice was tested by creating a  
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41 poverty variable. First, household deprivation percent was calculated using MPI deprivation  
42  
43 indicators using reweighted variables to reflect use of fewer variables. Next, a dichotomous  
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45 variable, poverty, was created to divide households into those with percent deprivation greater  
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47 than or equal to 33.3%, the definition for multidimensional poverty, and those who were not  
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49 multidimensionally poor. In addition to adding poverty to the model to test the effect on facility  
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51 choice, the interaction between poverty and gender was also tested to determine whether  
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53 multidimensional poverty effected women and men differently.  
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3 Akaike's information criterion (AIC) was estimated and likelihood-ratio (LR) tests were  
4 conducted to test improvement in model fit. A decrease in AIC with a significant LR test  
5 indicates improvement in model fit.  
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10 Data were double-entered in REDCap (Research Electronic Data Capture), a secure web-  
11 based program for managing surveys and databases<sup>82</sup> and analyzed using Stata 14<sup>83</sup>.  
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## 16 17 **Results**

### 18 19 **Participant Eligibility**

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21 Households with children less than two years old (n=356) and households with  
22 pregnant women (n=136) were eligible to participate (Figure 2). For 20 households not  
23 located due to incomplete addresses, the next randomly selected household was approached.  
24 Participation rate for locatable, eligible households was 98%. Household and individual  
25 surveys took approximately 5 minutes and the DCE portion took approximately 10 minutes to  
26 complete.  
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### 35 36 **Study Participants' Characteristics**

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38 **Household Characteristics.** Study sample household characteristics were compared to household  
39 characteristics from the EDHS (Table 3). Study sample participants generally had better living  
40 conditions and more access to radios and mobile phones than those in the EDHS sample.  
41  
42 However, a significantly greater percent of study sample households lacked land and livestock.  
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47 **Female and Male Participants' Characteristics.** Ninety-seven percent of women and 99% of  
48 men were from Sidama. All women and 96% of men were Protestant. Women were on average 7  
49 years younger and had one year less education than their husbands had. Men had two to three  
50 times more exposure to mass media and participated more in household decisions compared to  
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women. Men were more likely to believe their wife had received prenatal care during their pregnancy (89.8%) than women reported having done so (29.0%) (Table 4).

## DCE Results

**Women's preferences.** Women's odds of choosing to deliver at a facility were 3.08 (2.03 to 4.67) times greater if medications and supplies were always available; 1.69 (1.37 to 2.07) times greater if support persons were allowed in delivery room; 1.37 (1.09 to 1.70) times greater if a free ambulance was available; and 1.15 (1.12 to 1.18) times greater for every 50-birr (US \$2.50) reduction in cost (Table 5).

Provider type was significant using the Wald test ( $p < 0.0001$ ) followed by Bonferroni-protected multiple comparisons. Women were 1.86 (1.23 to 2.80) times more likely to prefer delivery by HEWs than male nurses; 1.45 (1.09 to 1.93) times more likely to prefer male doctors to female doctors; 1.71 (1.27 to 2.29) times more likely to prefer female doctors to male nurses; 1.95 (1.44 to 2.62) times more likely to prefer male doctors to female nurses; and 2.47 (1.84 to 3.32) times more likely to prefer male doctors to male nurses.

**Men's preferences.** For men (Table 6), odds of choosing a facility were 2.68 (1.79 to 4.02) times greater when medications and supplies are always available; 1.74 (1.42 to 2.14) times greater when a support person is allowed in delivery room; 1.30 (1.03 to 1.64) times greater when provider smiles and listens well; 1.09 (1.06 to 1.13) times greater for each 15-minute reduction in walking distance; and 1.14 (1.11, to 1.17) times greater for every 50-birr reduction in cost.

Provider type was significant overall using the Bonferroni Omnibus test ( $p < .0001$ ). Men were 1.89 (1.29 to 2.78) times more likely to prefer their wives be delivered by HEWs than female nurses; 1.95 (1.30 to 2.95) times as likely to prefer delivery by HEWs to male nurses;

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3 1.39 (1.02 to 1.89) times as likely to prefer female doctors to female nurses; 1.44 (1.07 to 1.92)  
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5 times as likely to prefer female doctors to male nurses; 1.41 (1.05 to 1.90) times as likely to  
6  
7 prefer male doctors to female nurses; and 1.46 (1.09 to 1.95) times as likely to prefer male  
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9 doctors to male nurses.  
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### 11 **Significant differences between predictors of women and men's choices**

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14 Only distance, provider type, and ambulance cost were significantly different between  
15  
16 women and men. Women's odds of selecting a facility increased 1.08 times for every 15-  
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18 minutes' increase in distance compared to men (1.03 to 1.14). Women were 1.70 (1.15 to 2.52)  
19  
20 times more likely than men to prefer male doctors to male nurses; and 1.36 (1.05 to 1.75) times  
21  
22 more likely to prefer a facility with free ambulance service. AIC decreased from the Level 1  
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24 model (5551) to a Level 2 model adding Gender at level 2 (5536) and the LR was significant  
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26 ( $\chi^2(10) = 28.54, p = 0.0002$ ) indicating improved model fit with the addition of significant cross-  
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28 level interactions.  
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### 33 **Decision-making**

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35 While Table 4 illustrated significant differences between women and men's involvement  
36  
37 in decision-making, decision-making involvement did not significantly influence facility choice,  
38  
39 whether measured as none vs. any ( $p = 0.496$ ); involved in healthcare decisions for self vs. not  
40  
41 involved ( $p = 0.653$ ); involved in healthcare decisions for self vs. not involved, women vs. men  
42  
43 ( $p = 0.189$ ); number of decisions involved in (continuous) ( $p = 0.930$ ); or number of decisions  
44  
45 involved in (categorical) ( $p = 0.133$ ).  
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### 49 **Poverty and facility choice**

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51 Facility choice did not differ between multidimensionally poor and not  
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53 multidimensionally poor households ( $p = 0.170$ ), but facility choice was associated weakly with  
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3 percent household deprivation ( $p = 0.055$ ). In addition, facility choice did not differ between  
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5 women and men based on household deprivation ( $p = 0.672$ ).  
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## 8 **Discussion**

### 9 **DCE Preferences**

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11 In this study, both women and men placed the highest value on health facilities that  
12  
13 always had medications and supplies available and allowed support persons into the delivery  
14  
15 room. Women's facility choice was also influenced by free ambulance availability and low cost,  
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17 while men were more likely to choose nearer, less expensive delivery services with friendly  
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19 providers.  
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24 In contrast, in a DCE in rural Ethiopia, Kruk, Paczkowski, et al.<sup>59</sup> found women preferred  
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26 high quality delivery services such as available drugs and medical equipment, doctors or nurses  
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28 rather than HEWs, and friendly providers, with lower value placed on accessibility indicators  
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30 when selecting facilities. Neither support person presence, nor provider gender, was included in  
31  
32 their study.  
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36 In our study, preferences for provider type were complex. In order to have a reasonable  
37  
38 number of scenarios, provider type and gender were linked in the study design, making provider  
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40 preferences difficult to interpret. Women generally preferred doctors to nurses, although no  
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42 significant difference in preference was found between delivery by female doctors or female  
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44 nurses. Men preferred facilities with doctors to nurses regardless of gender. Nurse's gender did  
45  
46 not affect women's facility preference, but male doctors were selected over female doctors.  
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48 While preference for more highly skilled providers noted by Kruk, Paczkowski, et al.<sup>59</sup> generally  
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50 held between doctors and nurses; HEWs were either preferred or chosen equally to doctors and  
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52 nurses.  
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## Interpreting Findings within The Three Delays Model: Implications for Services and Research

**Perceived quality of care.** In our study, reliable medications and supplies' availability was the strongest facility choice indicator for both women and men. This important element of the Three Delays model's perceived quality of care<sup>12,84</sup> has been reported by other researchers.<sup>8,13,23,59</sup> Government and facility administrators should prioritize supply chain management when making budget allocations. A study comparing actual and perceived stocks of medications and supplies' impact on FBD rates and cost analysis of lives saved through improving supply chains would add further information on this intervention's effectiveness.

Provider attitude was a significant facility choice predictor for men, but not women. However, no significant difference was found between women and men's facility choice based on provider attitude. Qualitative researchers have reported mistreatment by staff, ranging from yelling to physical abuse, made women distrustful of health facilities.<sup>13-15,18,21</sup> Roro et al.<sup>20</sup> reported this was true for men also. Lack of significance of provider attitude for women in this study may result from considering this aspect of care in the context of other variables, which were more important. It may also be that women in this area have had little experience with unfriendly providers, so they are not concerned with this attribute.

Both women and men valued doctors more than nurses, but preferred or were neutral on selecting facilities with HEWs compared to more skilled providers. While appreciation of skilled providers is not uncommon,<sup>15,16,18,21,22,36</sup> HEWs' ability to perform safe deliveries has been questioned.<sup>8,14,20,21</sup> Preference for HEWs may reflect the desire to be delivered by someone they know, or greater flexibility by HEWs in accommodating cultural birth practices<sup>85</sup> such as allowing support persons to be present in the delivery room. Both women and men may be more



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3 comfortable with HEWs who are local women,<sup>85,86</sup> and provide antenatal and postnatal  
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5 services,<sup>86</sup> trusting them to refer mothers in emergencies.<sup>86</sup> Our findings suggest inherent trust in  
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7 providers, who understand the cultural context and needs, is more important than procedural skill  
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9 and knowledge.  
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12 The apparent preference for HEWs and doctors over nurses is concerning. Nurses offer  
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14 the lowest cost solution to providing skilled care in most developing countries. Research is  
15  
16 needed to better understand why nurses were least preferred and how to address this issue, as it  
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18 could have implications for women's health outcomes and workforce training.  
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22 **Cultural factors.** Cultural preference for being surrounded by family and friends during  
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24 delivery<sup>8,14-19,21,22</sup> was voiced by both women and men. Excluding support persons from the  
25  
26 delivery room is incompatible with cultural norms and is likely to decrease FBD uptake.<sup>87</sup> A  
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28 cluster-randomized controlled trial comparing facilities implementing family-centered delivery  
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30 policies with those that are not could test this finding.  
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34 Preference for male over female providers contradicts reports in qualitative  
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36 literature.<sup>8,14,15,29</sup> One explanation for this difference may lie in the study design. When asked  
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38 directly about provider gender preferences, respondents may say they are ashamed to be  
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40 delivered by a man.<sup>13,14,29</sup> However, when given more complex scenarios, underlying biases,  
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42 such as sexism, may have greater influence on respondent choices, leading them to choose male  
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44 providers as being more qualified.  
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48 **Perceived accessibility.** Both women and men preferred lower cost services. However,  
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50 distance and free ambulance availability had mixed influences on facility choice with women  
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52 preferring facilities with free ambulance service, while men were more influenced by distance.  
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54 Other Ethiopian research has shown either no effect<sup>37,40,41,48,54</sup> or increases in FBD when  
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3 facilities are closer.<sup>17,27,30,36,43,49,52</sup> Women may prioritize free ambulance service due to greater  
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5 concern for their own comfort as other free transportation, such as riding in animal carts or being  
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7 carried on stretchers, are very uncomfortable.<sup>18,20,50</sup> At the community meeting held at the  
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9 completion of the study, men complained that ambulances were unavailable for deliveries as has  
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11 been found in other areas of Ethiopia.<sup>85,88</sup>  
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15 **Perceived Benefits and Needs.** We found men are primarily responsible for making  
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17 household decisions, including decisions about whether their wives seek health care. Yet, 90% of  
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19 men believed their wives had attended ANC during their pregnancy, while only 29% of women  
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21 reported doing so. Educating men on home delivery's potential dangers and FBD's benefits  
22  
23 could potentially increase families choosing FBD. Barry, et al<sup>89</sup> showed women who attended  
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25 two or more family education meetings on maternal health with family members were nearly  
26  
27 twice as likely to deliver with SBAs or HEWs compared to women who attended fewer than two  
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29 meetings, but no difference for women who attended alone. Intervention studies involving  
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31 partners or other family support in maternal education are needed.  
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### 34 35 **Limitations**

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37 **Generalizability.** Based on household characteristics, our study population appears  
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39 wealthier than the 2011 rural Ethiopian population. However, Ethiopia's economy has  
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41 experienced 10.8% average growth from 2003/04 to 2013/14.<sup>90</sup> Therefore, other rural areas in  
42  
43 Ethiopia may have also experienced similar improvements in living standards. The high  
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45 percentage of Protestants in this study may limit generalizability to Orthodox or Moslem  
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47 communities. Also, much of Sidama has a much higher population density than other areas, such  
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49 as Afar Region, so distance may be less of a concern for women giving birth in Sidama.  
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3 The household list used to select participants came from paper-based registers and patient  
4 charts, which made identifying eligible participants difficult. Families who lived near health  
5 posts or attended clinic may have been over-represented. Although the health workers were  
6 expected to visit every home, staffing limitations make this difficult to accomplish. This may  
7 limit generalizability.  
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14 **Missing variables.** The ability to recognize emergencies may influence the decision of  
15 where to deliver.<sup>84</sup> The original study plan included a DCE in which respondents were asked  
16 where they would deliver if they believed the mother or baby's life was in danger. This portion  
17 was dropped due to interview length. In addition, the perceived need measure, which the three  
18 delays model predicts influences decisions to seek care, was not included in the analysis due to  
19 discrepancies in interpreting the danger signs' questions. Finally, while this study included men,  
20 mother-in-laws, traditional birth attendants, and other older women may also influence birth  
21 place decisions.<sup>18,19,58</sup>  
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### 33 **Conclusion**

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35 This study makes a unique contribution to the literature as the first known DCE to test  
36 both women and men's preferences in choosing FBD services. Including men acknowledged the  
37 role men play in making decisions for their families either alone or in collaboration with their  
38 partner. Women and men were found to agree on preferring facilities that always had  
39 medications and supplies available and allowed support persons in the delivery room. Facilities  
40 that respond to these preferences for higher quality and culturally appropriate care may increase  
41 FBD uptake.  
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58  
59  
60

## References

1. CSA [Ethiopia] and ICF International. Ethiopia demographic and health survey 2011. Addis Ababa, Ethiopia and Calverton, Maryland, USA; 2012.
2. WHO. Ethiopia | Maternal health [Internet]. 2015 [cited 2016 Sep 14]. Available from: <http://www.afro.who.int/en/ethiopia/country-programmes/topics/4459-maternal-health.html>
3. Campbell OMR, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. *Lancet* [Internet]. 2006 Oct 7 [cited 2014 May 26];368(9543):1284–99. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17027735>
4. WHO. Making pregnancy safer : the critical role of the skilled attendant: A joint statement by WHO , ICM and FIGO [Internet]. Geneva; 2004. Available from: [http://www.who.int/maternal\\_child\\_adolescent/documents/9241591692/en/](http://www.who.int/maternal_child_adolescent/documents/9241591692/en/)
5. Admasu K, Haile-Mariam A, Bailey P. Indicators for availability, utilization, and quality of emergency obstetric care in Ethiopia, 2008. *Int J Gynaecol Obstet* [Internet]. International Federation of Gynecology and Obstetrics; 2011 Oct [cited 2013 Feb 16];115(1):101–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21855065>
6. Ethiopian Federal Ministry of Health. Health Sector Transformation Plan (2015/16-2019/20). 2015.
7. Federal Ministry of Health, UNICEF, UNFPA, WHO A. National baseline assessment for emergency obstetric & newborn care: Ethiopia 2008. Addis Ababa; 2009.
8. Shiferaw S, Spigt M, Godefrooij M, Melkamu Y, Tekie M. Why do women prefer home births in Ethiopia? *BMC Pregnancy Childbirth* [Internet]. BMC Pregnancy and Childbirth; 2013 Jan [cited 2013 Mar 2];13(1):5. Available from:

- 1  
2  
3 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3562506&tool=pmcentrez&rendertype=abstract)  
4  
5 <ndertype=abstract>  
6  
7
- 8 9. Gabrysch S, Lema C, Bedriñana E, Bautista M a, Malca R, Campbell OM. Cultural  
9  
10 adaptation of birthing services in rural Ayacucho, Peru. *Bull World Health Organ*  
11  
12 [Internet]. 2009 Sep 1 [cited 2014 Feb 4];87(9):724–9. Available from:  
13  
14 <http://www.who.int/bulletin/volumes/87/9/08-057794.pdf>  
15  
16
- 17 10. Olayo R, Wafula C, Aseyo E, Loum C, Kaseje D. A quasi-experimental assessment of the  
18  
19 effectiveness of the Community Health Strategy on health outcomes in Kenya. *BMC*  
20  
21 *Health Serv Res* [Internet]. BioMed Central Ltd; 2014;14(SUPPL.1):S3. Available from:  
22  
23 <http://www.biomedcentral.com/bmchealthservres/content/14/S1/S3>  
24  
25
- 26 11. Hounton S, Byass P, Brahim B. Towards reduction of maternal and perinatal mortality in  
27  
28 rural Burkina Faso: Communities are not empty vessels. *Glob Health Action*. 2009;2(1).  
29  
30
- 31 12. Gabrysch S, Campbell OMR. Still too far to walk: Literature review of the determinants of  
32  
33 delivery service use. *BMC Pregnancy Childbirth* [Internet]. 2009 Jan [cited 2013 May  
34  
35 22];9:34. Available from:  
36  
37 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2744662&tool=pmcentrez&rendertype=abstract)  
38  
39 <ndertype=abstract>  
40  
41
- 42 13. King R, Jackson R, Dietsch E, Hailemariam A. Barriers and facilitators to accessing  
43  
44 skilled birth attendants in Afar region, Ethiopia. *Midwifery* [Internet]. 2015 May [cited  
45  
46 2016 Mar 2];31(5):540–6. Available from:  
47  
48 <http://www.sciencedirect.com/science/article/pii/S0266613815000388>  
49  
50
- 51 14. Sipsma H, Thompson J, Maurer L, Bradley E, Curry L. Preferences for home delivery in  
52  
53 Ethiopia: provider perspectives. *Glob Public Health* [Internet]. Taylor & Francis; 2013  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Oct [cited 2014 Mar 15];8(9):1014–26. Available from:  
4  
5 <http://www.ncbi.nlm.nih.gov/pubmed/24156727>  
6  
7
- 8 15. Abera M, Abebe G, Belachew T. Predictors of safe delivery service utilization in Arsi  
9  
10 zone, south-east Ethiopia. *Ethiop J Health Sci*. 2011;21(Special Issue):95–106.  
11
- 12 16. Bedford J, Gandhi M, Admassu M, Girma A. “A normal delivery takes place at home”: a  
13  
14 qualitative study of the location of childbirth in rural Ethiopia. *Matern Child Health J*  
15  
16 [Internet]. 2013 Feb [cited 2013 Nov 12];17(2):230–9. Available from:  
17  
18 <http://www.ncbi.nlm.nih.gov/pubmed/22359241>  
19  
20
- 21 17. Birmeta K, Dibaba Y, Woldeyohannes D. Determinants of maternal health care utilization  
22  
23 in Holeta town, central Ethiopia. *BMC Health Serv Res* [Internet]. 2013 Jul 3 [cited 2013  
24  
25 Jul 8];13(1):256. Available from:  
26  
27 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&re  
28  
29 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3710264&tool=pmcentrez&rendertype=abstract)  
30  
31
- 32 18. Gebrehiwot T, Goicolea I, Edin K, San Sebastian M. Making pragmatic choices: women’s  
33  
34 experiences of delivery care in Northern Ethiopia. *BMC Pregnancy Childbirth* [Internet].  
35  
36 2012 Jan [cited 2013 Nov 12];12:113. Available from:  
37  
38 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&re  
39  
40 ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542090&tool=pmcentrez&rendertype=abstract)  
41  
42
- 43 19. Jackson R. The place of birth in Kafa Zone, Ethiopia. *Health Care Women Int* [Internet].  
44  
45 2014;35(7–9):728–42. Available from:  
46  
47 [http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&A  
48  
49 N=24786334](http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=24786334)  
50  
51
- 52 20. Roro MA, Hassen EM, Lemma AM, Gebreyesus SH, Afework MF. Why do women not  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 deliver in health facilities: a qualitative study of the community perspectives in south  
4 central Ethiopia? BMC Res Notes [Internet]. BioMed Central; 2014 Jan 21 [cited 2016  
5 Feb 24];7(1):556. Available from:  
6  
7  
8  
9  
10 <http://bmresnotes.biomedcentral.com/articles/10.1186/1756-0500-7-556>  
11
- 12 21. Gebrehiwot T, San Sebastian M, Edin K, Goicolea I. Health workers' perceptions of  
13 facilitators of and barriers to institutional delivery in Tigray, Northern Ethiopia. BMC  
14 Pregnancy Childbirth [Internet]. 2014 Apr 10 [cited 2014 Apr 16];14(137). Available  
15 from: <http://www.ncbi.nlm.nih.gov/pubmed/24716750>  
16  
17  
18
- 19 22. Warren C. Care seeking for maternal health: challenges remain for poor women. Ethiop J  
20 Heal Dev [Internet]. 2010 Dec 16;24(Special Issue 1):100–4. Available from:  
21  
22 <http://www.ajol.info/index.php/ejhd/article/view/62950>  
23  
24  
25
- 26 23. Bradley E, Thompson JW, Byam P, Webster TR, Zerihun A, Alpern R, et al. Access and  
27 quality of rural healthcare: Ethiopian Millennium Rural Initiative. Int J Qual Health Care  
28 [Internet]. 2011 Jun [cited 2013 Nov 11];23(3):222–30. Available from:  
29  
30  
31 <http://www.ncbi.nlm.nih.gov/pubmed/21467077>  
32  
33  
34
- 35 24. Ethiopian Society of Population Studies. Maternal Health Care Seeking Behaviour in  
36 Ethiopia : Findings from EDHS 2005. 2008.  
37  
38  
39
- 40 25. Dutamo Z, Assefa N, Egata G. Maternal health care use among married women in  
41 Hossaina, Ethiopia. BMC Health Serv Res [Internet]. BioMed Central; 2015 Jan 10 [cited  
42 2016 Feb 24];15(1):365. Available from:  
43  
44  
45  
46  
47  
48  
49 <http://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-015-1047-1>  
50
- 51 26. Woldemicael G. Do women with higher autonomy seek more maternal health care?  
52 Evidence from Eritrea and Ethiopia. Health Care Women Int [Internet]. 2010 Jul [cited  
53  
54  
55  
56  
57  
58  
59  
60

- 2013 Nov 12];31(7):599–620. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/20526926>
27. Wado YD, Afework MF, Hindin MJ. Unintended pregnancies and the use of maternal health services in southwestern Ethiopia. *BMC Int Health Hum Rights* [Internet]. 2013 Sep 8 [cited 2013 Nov 12];13(1):36. Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24011335>
28. Yebyo H, Alemayehu M, Kahsay A. Why do women deliver at home? Multilevel modeling of Ethiopian National Demographic and Health Survey data. *PLoS One* [Internet]. Public Library of Science; 2015 Jan 15 [cited 2016 Feb 24];10(4):e0124718. Available from: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0124718>
29. Hailu D, Berhe H. Determinants of institutional childbirth service utilisation among women of childbearing age in urban and rural areas of Tsegedie district, Ethiopia. *Midwifery* [Internet]. Elsevier; 2014 Mar 25 [cited 2014 Apr 21]; Available from:  
<http://www.ncbi.nlm.nih.gov/pubmed/24726608>
30. Wilunda C, Quaglio G, Putoto G, Takahashi R, Calia F, Abebe D, et al. Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reprod Health* [Internet]. BioMed Central; 2015 Jan 25 [cited 2016 Feb 24];12(1):74. Available from: <http://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-015-0067-y>
31. Nigussie M, Mariam DH, Mitike G. Assessment of safe delivery service utilization among women of childbearing age in north Gondar Zone , north west Ethiopia. *Ethiop J Heal Dev* [Internet]. 2004;18(3):145–52. Available from: <http://ejhd.uib.no/ejhdv18-no3/145.pdf>
32. Hagos S, Shaweno D, Assegid M, Mekonnen A, Afework MF, Ahmed S. Utilization of



- 1  
2  
3 institutional delivery service at Wukro and Butajera districts in the Northern and South  
4 Central Ethiopia. *BMC Pregnancy Childbirth* [Internet]. 2014 Jan [cited 2016 Feb  
5 24];14:178. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24886375>  
6  
7  
8  
9  
10 33. Tekelab T, Yadecha B, Melka AS. Antenatal care and women's decision making power as  
11 determinants of institutional delivery in rural area of Western Ethiopia. *BMC Res Notes*  
12 [Internet]. BioMed Central; 2015 Jan 11 [cited 2016 Feb 24];8(1):769. Available from:  
13 <http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1708-5>  
14  
15  
16  
17  
18  
19 34. Mekonnen ZA, Lerebo WT, Gebrehiwot TG, Abadura SA. Multilevel analysis of  
20 individual and community level factors associated with institutional delivery in Ethiopia.  
21 *BMC Res Notes* [Internet]. BioMed Central; 2015 Jan 26 [cited 2016 Mar 2];8(1):376.  
22 Available from: [http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-](http://bmresnotes.biomedcentral.com/articles/10.1186/s13104-015-1343-1)  
23  
24  
25  
26  
27  
28  
29  
30  
31 35. Mengesha ZB, Biks GA, Ayele TA, Tessema GA, Koye DN. Determinants of skilled  
32 attendance for delivery in Northwest Ethiopia: a community based nested case control  
33 study. *BMC Public Health* [Internet]. BMC Public Health; 2013 Jan [cited 2013 Mar  
34 2];13(1):130. Available from:  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45 36. Feyissa TR, Genemo GA. Determinants of institutional delivery among childbearing age  
46 women in Western Ethiopia, 2013: unmatched case control study. *PLoS One* [Internet].  
47 2014 Jan [cited 2016 Feb 24];9(5):e97194. Available from:  
48  
49  
50  
51  
52  
53  
54 37. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Woreda, South East Ethiopia: a community based cross-sectional study. *BMC Pregnancy*  
4 *Childbirth* [Internet]. 2012 Jan [cited 2013 Nov 12];12:105. Available from:  
5  
6 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&rendertype=abstract)  
7  
8 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3506545&tool=pmcentrez&rendertype=abstract)  
9  
10  
11  
12 38. Tarekegn SM, Lieberman LS, Giedraitis V. Determinants of maternal health service  
13 utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey.  
14 *BMC Pregnancy Childbirth* [Internet]. BioMed Central; 2014 Jan 7 [cited 2016 Feb  
15 24];14(1):161. Available from:  
16  
17 <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/1471-2393-14-161>  
18  
19  
20  
21 39. Afework MF, Admassu K, Mekonen A, Hagos S, Asegid M, Ahmed S. Effect of an  
22 innovative community based health program on maternal health service utilization in  
23 north and south central Ethiopia: a community based cross sectional study. *Reprod Health*  
24 [Internet]. 2014 Apr 4 [cited 2014 Apr 14];11(28). Available from:  
25  
26 <http://www.ncbi.nlm.nih.gov/pubmed/24708848>  
27  
28  
29  
30  
31 40. Asres A, Davey G. Factors associated with safe delivery service utilization among women  
32 in Sheka zone, southwest Ethiopia. *Matern Child Health J* [Internet]. 2015 Apr [cited 2016  
33 Mar 2];19(4):859–67. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25055761>  
34  
35  
36  
37 41. Bayou NB, Gacho YHM. Utilization of clean and safe delivery service package of health  
38 services extension program and associated factors in rural kebeles of Kafa Zone,  
39 Southwest Ethiopia. *Ethiop J Health Sci* [Internet]. 2013 Jul [cited 2013 Nov  
40 12];23(2):79–89. Available from:  
41  
42 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
43  
44 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3742885&tool=pmcentrez&rendertype=abstract)  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 42. Bayu H, Adefris M, Amano A, Abuhay M. Pregnant women's preference and factors  
4 associated with institutional delivery service utilization in Debra Markos Town, North  
5 West Ethiopia: a community based follow up study. *BMC Pregnancy Childbirth*  
6  
7 [Internet]. 2015 Jan [cited 2016 Feb 24];15:15. Available from:  
8  
9 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
10  
11 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4324647&tool=pmcentrez&rendertype=abstract)  
12  
13  
14  
15  
16  
17 43. Kebede B, Gebeyehu A, Andargie G. Use of previous maternal health services has a  
18 limited role in reattendance for skilled institutional delivery: Cross-sectional survey in  
19 Northwest Ethiopia. *Int J Womens Health* [Internet]. 2013 Jan;5:79–85. Available from:  
20  
21 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
22  
23 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3583437&tool=pmcentrez&rendertype=abstract)  
24  
25  
26  
27  
28 44. Melaku YA, Weldearegawi B, Tesfay FH, Abera SF, Abraham L, Aregay A, et al. Poor  
29 linkages in maternal health care services-evidence on antenatal care and institutional  
30 delivery from a community-based longitudinal study in Tigray region, Ethiopia. *BMC*  
31 *Pregnancy Childbirth* [Internet]. BioMed Central; 2014 Jan 19 [cited 2016 Feb  
32  
33 24];14(1):418. Available from:  
34  
35 <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-014-0418-7>  
36  
37  
38  
39  
40  
41  
42 45. Teferra AS, Alemu FM, Woldeyohannes SM. Institutional delivery service utilization and  
43 associated factors among mothers who gave birth in the last 12 months in Sekela District,  
44 north west of Ethiopia: A community-based cross sectional study. *BMC Pregnancy*  
45 *Childbirth* [Internet]. BMC Pregnancy and Childbirth; 2012 Jan [cited 2013 Mar  
46  
47 11];12(74). Available from:  
48  
49 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3449175&tool=pmcentrez&rendertype=abstract)  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- ndertype=abstract
46. Worku AG, Yalew AW, Afework MF. Maternal complications and women's behavior in seeking care from skilled providers in North Gondar, Ethiopia. PLoS One [Internet]. 2013 Jan [cited 2013 Nov 12];8(3):e60171. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3610646&tool=pmcentrez&rendertype=abstract>
47. Worku AG, Yalew AW, Afework MF. Factors affecting utilization of skilled maternal care in Northwest Ethiopia: A multilevel analysis. BMC Int Health Hum Rights [Internet]. 2013 Jan [cited 2013 Nov 12];13(20). Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3639034&tool=pmcentrez&rendertype=abstract>
48. Tsegay Y, Gebrehiwot T, Goicolea I, Edin K, Lemma H, Sebastian MS. Determinants of antenatal and delivery care utilization in Tigray region, Ethiopia: A cross-sectional study. Int J Equity Health [Internet]. 2013 Jan [cited 2013 May 27];12:30. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3658893&tool=pmcentrez&rendertype=abstract>
49. Habte F, Demissie M. Magnitude and factors associated with institutional delivery service utilization among childbearing mothers in Cheha district, Gurage zone, SNNPR, Ethiopia: a community based cross sectional study. BMC Pregnancy Childbirth [Internet]. BioMed Central; 2015 Jan 17 [cited 2016 Feb 24];15(1):299. Available from: <http://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-015-0716-8>
50. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. Reprod Health [Internet]. 2012

- 1  
2  
3 Jan [cited 2013 Jun 22];9:33. Available from:  
4  
5 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
6  
7 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3546055&tool=pmcentrez&rendertype=abstract)  
8  
9
- 10 51. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service  
11 utilization among mothers in Bahir Dar City administration, Amhara region: a community  
12 based cross sectional study. *Reprod Health* [Internet]. 2014 Jan [cited 2014 Apr 5];11(22).  
13  
14 Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24629278>  
15  
16
- 17 52. Tura G, Afework MF, Yalew AW. The effect of birth preparedness and complication  
18 readiness on skilled care use: a prospective follow-up study in Southwest Ethiopia.  
19  
20 *Reprod Health* [Internet]. *BioMed Central*; 2014 Jan 5 [cited 2016 Feb 24];11(1):60.  
21  
22 Available from: [http://reproductive-health-](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
23  
24 [journal.biomedcentral.com/articles/10.1186/1742-4755-11-60](http://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-11-60)  
25  
26
- 27 53. Abebe F, Berhane Y, Girma B. Factors associated with home delivery in Bahirdar,  
28 Ethiopia: a case control study. *BMC Res Notes* [Internet]. 2012 Jan [cited 2013 Nov  
29  
30 12];5:653. Available from:  
31  
32 [http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&re](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
33  
34 [ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3554461&tool=pmcentrez&rendertype=abstract)  
35  
36
- 37 54. Ballard K, Gari L, Mosisa H, Wright J. Provision of individualised obstetric risk advice to  
38 increase health facility usage by women at risk of a complicated delivery: a cohort study  
39  
40 of women in the rural highlands of West Ethiopia. *BJOG* [Internet]. 2013 Jul [cited 2013  
41  
42 Nov 12];120(8):971–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23464619>  
43  
44
- 45 55. Holden ST, Tefera T. From Being Property of Men to Becoming Equal Owners? Early  
46  
47 Impacts of Land Registration and Certification on Women. 2008;(July):1–110. Available  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 from: [http://www.unhsp.org/downloads/docs/10768\\_1\\_594333.pdf](http://www.unhsp.org/downloads/docs/10768_1_594333.pdf)  
4
- 5 56. Kumar N, Quisumbing AR. Policy Reform toward Gender Equality in Ethiopia: Little by  
6 Little the Egg Begins to Walk. *World Dev* [Internet]. Elsevier Ltd; 2015;67:406–23.  
7  
8 Available from: <http://dx.doi.org/10.1016/j.worlddev.2014.10.029>  
9
- 10 57. Biratu B, Lindstrom D. The influence of husbands' approval on women's use of prenatal  
11 care: Results from Yirgalem and Jimma towns, south west Ethiopia. *Ethiop J Heal Dev*  
12 [Internet]. 2007;20(2):84–92. Available from:  
13  
14 <http://www.ajol.info/index.php/ejhd/article/view/10017>  
15  
16
- 17 58. Jackson R, Tesfay FH, Godefay H, Gebrehiwot TG. Health Extension Workers' and  
18 Mothers' Attitudes to Maternal Health Service Utilization and Acceptance in Adwa  
19 Woreda, Tigray Region, Ethiopia. Roy JK, editor. *PLoS One* [Internet]. Public Library of  
20 Science; 2016 Mar 10 [cited 2017 Dec 14];11(3):e0150747. Available from:  
21  
22 <http://dx.plos.org/10.1371/journal.pone.0150747>  
23  
24
- 25 59. Kruk ME, Paczkowski MM, Tegegn A, Tessema F, Hadley C, Asefa M, et al. Women's  
26 preferences for obstetric care in rural Ethiopia: a population-based discrete choice  
27 experiment in a region with low rates of facility delivery. *J Epidemiol Community Health*.  
28 2010;64:984–8.  
29  
30
- 31 60. Ryan M, Scott DA, Reeves C, Bate A, van Teijlingen ER, Russell EM, et al. Eliciting  
32 Public Preferences for Healthcare: A systematic review of techniques. *Health Technol*  
33 *Assess (Rockv)*. 2001;5(5).  
34  
35
- 36 61. Bridges JFP, Hauber AB, Marshall D, Lloyd A, Prosser LA, Regier DA, et al. Conjoint  
37 analysis applications in health--a checklist: a report of the ISPOR Good Research  
38 Practices for Conjoint Analysis Task Force. *Value Heal* [Internet]. Elsevier Inc.; 2011 Jun  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 [cited 2014 Jul 10];14(4):403–13. Available from:  
4  
5 <http://www.ncbi.nlm.nih.gov/pubmed/21669364>  
6  
7
- 8 62. Rose JM, Bliemer MCJ. Sample size requirements for stated choice experiments.  
9  
10 Transportation (Amst) [Internet]. 2013 Feb 1 [cited 2014 Nov 8];40(5):1021–41.  
11  
12 Available from: <http://link.springer.com/10.1007/s11116-013-9451-z>  
13  
14
- 15 63. Beam NK. Women and men’s preferences for delivery services in rural Ethiopia (Doctoral  
16  
17 dissertation) [Internet]. University of California, San Francisco; 2016. Available from:  
18  
19 <https://pqdopen.proquest.com/doc/1801982908.html?FMT=ABS>  
20  
21
- 22 64. Rose JM, Collins AT, Bliemer MCJ, Hensher DA. Ngene [Internet]. ChoiceMetrics; 2014.  
23  
24 Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
25
- 26 65. ChoiceMetrics. Ngene 1.1.2 User Manual & Reference Guide [Internet]. 15/07/2014.  
27  
28 ChoiceMetrics; 2014. Available from: [www.choice-metrics.com](http://www.choice-metrics.com)  
29  
30
- 31 66. Population Census Commission. The Population and Housing Census of Ethiopia:  
32  
33 SNNPR [Internet]. 2007. Available from: [phe-ethiopia.org/pdf/snnpr.pdf](http://phe-ethiopia.org/pdf/snnpr.pdf)  
34  
35
- 36 67. Bradley, Sarah E.K., Winfrey W and TNC. Contraceptive Use and Perinatal Mortality in  
37  
38 the DHS: An Assessment of the Quality and Consistency of Calendars and Histories  
39  
40 [Internet]. DHS Methodological Reports No. 17. Rockville, Maryland, USA: ICF  
41  
42 International; 2015. Available from: [http://dhsprogram.com/publications/publication-](http://dhsprogram.com/publications/publication-MR17-Methodological-Reports.cfm)  
43  
44 [MR17-Methodological-Reports.cfm](http://dhsprogram.com/publications/publication-MR17-Methodological-Reports.cfm)  
45  
46
- 47 68. Assaf, Shireen, Monica T. Kothari and TP. An Assessment of the Quality of DHS  
48  
49 Anthropometric Data, 2005-2014 [Internet]. DHS Methodological Reports No. 16.  
50  
51 Rockville, Maryland, USA: ICF International; 2015. Available from:  
52  
53 <http://dhsprogram.com/publications/publication-MR16-Methodological->  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Reports.cfm#sthash.PLYVphzr.dpuf  
4  
5  
6 69. Rutstein SO. Potential bias and selectivity in analyses of children born in the past five  
7 years using DHS data . DHS Methodol Reports No 14 [Internet]. 2014;(September).  
8 Available from: <http://dhsprogram.com/pubs/pdf/MR14/MR14.pdf>  
9  
10  
11  
12 70. Ahmed S, Li Q, Scrafford C, Pullum TW. An assessment of DHS maternal mortality data  
13 and estimates [Internet]. DHS Methodological Reports No. 13 . 2014. Available from:  
14 <http://dhsprogram.com/pubs/pdf/MR13/MR13.pdf>  
15  
16  
17  
18 71. Schoumaker B. Quality and consistency of DHS fertility estimates, 1990 to 2012 . DHS  
19 Methodol Reports No 12 [Internet]. 2014;(September). Available from:  
20 <http://dhsprogram.com/pubs/pdf/MR12/MR12.pdf>  
21  
22  
23  
24 72. Pullum TW, Becker S. Evidence of omission and displacement in DHS birth histories .  
25 DHS Methodol Reports No 11 [Internet]. 2014;(September). Available from:  
26 <http://dhsprogram.com/pubs/pdf/MR11/MR11.pdf>  
27  
28  
29  
30  
31  
32 73. Pullum TW. An Assessment of the Quality of Data on Health and Nutrition in the DHS  
33 Surveys, 1993-2003 [Internet]. DHS Methodological Reports No. 6. Calverton, Maryland,  
34 USA: Macro International; 2008. p. 1–139. Available from:  
35 <http://dhsprogram.com/publications/publication-MR6-Methodological-Reports.cfm>  
36  
37  
38  
39  
40  
41 74. Pullum TW. An assessment of age and date reporting in the DHS surveys, 1985-2003 .  
42 DHS Methodol Reports No 5 [Internet]. 2006;4. Available from:  
43 <http://dhsprogram.com/pubs/pdf/MR5/MR5.pdf>  
44  
45  
46  
47  
48 75. Boerma, J. Ties, A. Elisabeth Sommerfelt, Jeroen K. Van Ginneken, George T. Bicego,  
49 Kate M. Stewart and SOR-S more at: [http://dhsprogram.com/publications/publicatio.-M-](http://dhsprogram.com/publications/publicatio.-M-M-R.cfm#sthash.9SKwUnbk.dpu)  
50 [M-R.cfm#sthash.9SKwUnbk.dpu](http://dhsprogram.com/publications/publicatio.-M-M-R.cfm#sthash.9SKwUnbk.dpu). An Assessment of the Quality of Health Data in DHS-  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 I Surveys [Internet]. DHS Methodological Reports No. 2. Calverton, Maryland, USA:  
4  
5 Macro International; 1994. Available from:  
6  
7 <http://dhsprogram.com/publications/publication-MR2-Methodological->  
8  
9 [Reports.cfm#sthash.9SKwUnbk.dpuf](http://dhsprogram.com/publications/publication-MR2-Methodological-Reports.cfm#sthash.9SKwUnbk.dpuf)  
10  
11
- 12 76. Rutstein SO, Bicego GT, Blanc AK, Rutenberg N, Arnold F, Sullivan J a. An assessment  
13 of DHS-I data quality. DHS Methodological Reports No. 1. 1990.  
14
- 15 77. Mangham L, Hanson K, McPake B. How to do (or not to do) ... Designing a discrete  
16 choice experiment for application in a low-income country. Health Policy Plan [Internet].  
17 2009 Mar [cited 2014 Jul 10];24(2):151–8. Available from:  
18  
19 <http://www.ncbi.nlm.nih.gov/pubmed/19112071>  
20  
21
- 22 78. Alkire S. The Missing Dimensions of Poverty Data: Introduction to the Special Issue.  
23 Oxford Dev Stud [Internet]. TF; 2007 Dec 29 [cited 2016 Feb 26];35(4):347–59.  
24 Available from:  
25  
26 <http://www.tandfonline.com/doi/abs/10.1080/13600810701701863#.VtCzlBjVs3s>  
27  
28
- 29 79. Alkire S, Foster J. Counting and multidimensional poverty measurement. J Public Econ  
30 [Internet]. Elsevier B.V.; 2011;95(7–8):476–87. Available from:  
31  
32 <http://dx.doi.org/10.1016/j.jpubeco.2010.11.006>  
33  
34
- 35 80. UNDP. Human development report 2015: Technical Notes [Internet]. 2015. Available  
36 from: <http://hdr.undp.org/en/content/calculating-indices>  
37  
38
- 39 81. StataCorp. Stata Multilevel mixed-effects reference manual. 13th ed. College Station, TX:  
40 StataCorp LP; 2013.  
41  
42
- 43 82. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data  
44 capture (REDCap) - A metadata-driven methodology and workflow process for providing  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- translational research informatics support. *J Biomed Inf.* 2009;42(2):377–81.
83. StataCorp. *Stata Statistical Software: Release 14.* College Station, TX: StataCorp LP; 2015.
84. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med.* 1994;38(8):1091–110.
85. Jackson R, Hailemariam A. The role of health extension workers in linking pregnant women with health facilities for delivery in rural and pastoralist areas of Ethiopia. *Ethiop J Health Sci [Internet].* 2016;26(5):471. Available from: <http://www.ajol.info/index.php/ejhs/article/view/144149>
86. Kok MC, Kea AZ, Datiko DG, Broerse JEW, Dieleman M, Taegtmeier M, et al. A qualitative assessment of health extension workers' relationships with the community and health sector in Ethiopia: opportunities for enhancing maternal health performance. *Hum Resour Health [Internet].* *Human Resources for Health;* 2015;13(1):80. Available from: <http://human-resources-health.biomedcentral.com/articles/10.1186/s12960-015-0077-4>
87. Rogers EM. *Diffusion of innovations.* Fifth. New York: Free Press; 2003.
88. Jackson R, Tesfay FH, Gebrehiwot TG, Godefay H. Factors that hinder or enable maternal health strategies to reduce delays in rural and pastoralist areas in Ethiopia. *Trop Med Int Heal.* 2017;22(2):148–60.
89. Barry D, Frew AH, Mohammed H, Desta BF, Tadesse L, Aklilu Y, et al. The effect of community maternal and newborn health family meetings on type of birth attendant and completeness of maternal and newborn care received during birth and the early postnatal period in rural Ethiopia. *J Midwifery Womens Health [Internet].* 2014 Jan [cited 2014 Apr 5];59(Suppl 1):S44-54. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24588915>

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10 Abbreviations  
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12 ANC	Antenatal care
13 DCE	Discrete choice experiment
14 EDHS	Ethiopian Demographic and Health Survey
15 FBD	Facility-based delivery
16 HEW	Health extension worker
17 MDG	Millenium Development Goal
18 MPI	Multi-dimensional Poverty Index
19 SBA	Skilled birth attendant

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10 Figure 1: Sample Task Set for Discrete Choice Experiment  
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12 Figure 2: Study Flow Diagram  
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Table 1. *Attributes and Levels for Discrete Choice Experiment*

Attribute	Levels
<b>Distance to health facility</b>	30 minutes
	1 hour
	1½ hours
	2 hours
	3 hours
<b>Type of provider<sup>a</sup></b>	Female doctor
	Male doctor
	Female nurse
	Male nurse
	Female Health extension worker
<b>Provider attitude</b>	Provider smiles, is kind and respectful, speaks softly
	Provider does not smile, uses a harsh tone, harsh language
<b>Availability of medication and supplies</b>	Drugs and medical equipment always available
	Drugs and medical equipment not always available
<b>Availability of free transport</b>	Free ambulance available
	Free ambulance not available
<b>Support persons</b>	Family and friends allowed in delivery room
	Family and friends not allowed in delivery room
<b>Cost (Cost of user charges, labor-related supplies, and non-ambulance transportation)</b>	No cost
	50 Ethiopian birr <sup>b</sup>
	100 Ethiopian birr
	200 Ethiopian birr
	300 Ethiopian birr

<sup>a</sup> Nurse was used to indicate both nurses and midwives on the advice of Ethiopian staff as patients generally did not understand the difference between nurses and midwives.

<sup>b</sup> Approximately 20 birr/US\$1

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Table 2. *The Multi-dimensional Poverty Index Deprivation Score Indicators*

<b>Definition</b>	<b>Weights (%)</b>
<b>Health</b>	
A household member is malnourished	16.7
A child has died in the last 5 years	16.7
<b>Education</b>	
No one in the household has completed at least 6 years of school	16.7
A school-age child (7-15) is not enrolled in school	16.7
<b>Living standard</b>	
No electricity	5.6
No access to clean drinking water or source of clean drinking water > 30 minute walk	5.6
Household lacks improved sanitation, or shares with other households	5.6
Dirty cooking fuel is used (dung, wood, or charcoal)	5.6
Household has a dirt, sand or dung floor	5.6
Household does not own a radio, TV, or telephone, and does not own a means of transportation (bike, motorbike, care, truck, animal cart, motorboat) or a means of livelihood (refrigerator, arable land, livestock)	5.6

Table 3. *Characteristics of households in Sidama Zone, SNNPR sample compared to EDHS rural subsample*

Variable	Study Sample <sup>a</sup> (n=109)	EDHS 2011 (n=11,590)	p-value
Household size, mean (SD)	5.4 (2.1)	4.9	p<.05
<b>Living Conditions</b>			
Use solid fuel for cooking <sup>b</sup>	109 (100)	11474 (99.0)	ns
Dirt or dung floor	81 (74.3)	11068 (95.5)	p<.001
Non-improved drinking water <sup>c</sup>	21 (19.27)	6734 (58.1)	p<.001
Walk ≥ 30 minutes to drinking water	61 (56.0)	7232 (62.4)	p<.001
No electricity	78 (71.6)	11034 (95.2)	p<.001
<b>Access to Information</b>			
No radio	50 (45.9)	7684 (66.3)	p<.001
No mobile phone	35 (32.1)	10,106 (87.2)	p<.001
No landline	109 (100)	11,567 (99.8)	ns
No television	107 (98.2)	11463 (98.9)	ns
<b>Access to Transportation</b>			
No bicycle	108 (99.1)	11428 (98.6)	ns
No motorcycle	107 (98.2)	11578 (99.9)	p<.001
No vehicle	109 (100)	11578 (99.9)	ns
No animal cart	108 (99.1)	11463 (98.9)	ns
<b>Means of Livelihood</b>			
No refrigerator	109 (100)	11520 (99.4)	ns
No agricultural land	25 (22.9)	1414 (12.2)	p<.001
No livestock	40 (36.7)	1217 (10.5)	p<.001

Note. Results presented as # (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Dirt or dung floor – 10 missing; owns land: 25 don't know. <sup>b</sup>Includes wood, charcoal, straw/shrubs/grass, agricultural crops, and animal dung. <sup>c</sup>Includes piped into dwelling, piped to yard/plot, public tap/standpipe, borehole, protected well, protected spring, rainwater, bottled water.



Table 4. *Characteristics of female and male study participants in Sidama Zone, SNNPR, Ethiopia*

Characteristic	Study Sample <sup>a</sup>		
	Women (n=108)	Men (n=108)	p-value
Age, mean (SD)	24.7 (4.6)	32.1 (8.5)	t= -7.85 (211), p<.001
Percent who never attended school	14 (13.0)	2 (1.9)	$X^2$ (1, N=215)= 9.72, p<.05
Years of education, mean (SD)	5.5 (3.5) (n= 93)	6.8 (3.3) (n= 106)	t = -2.75(197), p<.05
Mass media exposure			
Never reads paper	93 (86.1)	50 (46.3)	$X^2$ (1, N=216)= 38.26, p<.001
Never listens to radio	81 (75.0)	28 (25.9)	$X^2$ (1, N=216)= 52.02, p<.001
Never watches TV	99 (91.7)	36 (33.3)	$X^2$ (1, N=216)= 78.40, p<.001
No mass media exposure at least once/week	72 (66.7)	57 (52.8)	$X^2$ (1, N=216)= 4.33, p<.05
Involvement in decisions about:			
Seeking health care for self <sup>b</sup>			
Respondent alone	48 (44.4)	99 (91.7)	$X^2$ (1, N=216)= 55.39, p<.001
Partner or someone else	4 (3.7)	23 (21.3)	
Jointly with spouse	60 (55.6)	9 (8.3)	
Major household purchases <sup>b</sup>			
Respondent alone	44 (40.7)	76 (70.4)	
Partner or someone else	66 (61.1)	106 (98.1)	$X^2$ (1, N=216)= 45.67, p<.001
Jointly with spouse	7 (6.5)	14 (13.0)	
Visiting friends and family <sup>b</sup>			
Respondent alone	42 (38.9)	2 (1.8)	
Partner or someone else	59 (54.6)	92 (85.2)	
Jointly with spouse	84 (77.8)	103 (95.4)	$X^2$ (1, N=216)= 14.38, p<.001
Full decision-making capacity <sup>c</sup>	26 (24.1)	22 (20.4)	
Participated in none of the 3 decisions	24 (22.2)	5 (4.7)	
Jointly with spouse	58 (53.7)	81 (75.0)	
Pregnancy and Delivery Care Characteristics <sup>d</sup>			
Prenatal care during last or current pregnancy	35 (32.4)	96 (88.9)	$X^2$ (1, N=216)= 72.18, p<.001
Place of last delivery	18 (16.7)	1 (0.9)	$X^2$ (1, N=216)= 16.68, p<.001
Home <sup>e</sup>	31 (29.0)	97 (89.8)	$X^2$ (1, N=215)= 82.59, p<.001
Health facility	51 (65.4)	46 (59.7)	$X^2$ (1, N=155)= .53, p= ns
Delivered by a skilled birth attendant	27 (34.6)	31 (40.3)	$X^2$ (1, N=155)= .53, p= ns
	25 (23.2)	30 (27.8)	$X^2$ (1, N=216)= .61, p= ns

*Note.* Data is n (%) unless otherwise specified. <sup>a</sup>Study sample had no missing data except: Women: Age-2; Years of education-15; Prenatal-1; Men: Age-1; Years of education-2. <sup>b</sup>Alone or jointly with spouse. <sup>c</sup>Defined as participating in making decisions about healthcare, major household purchases, and visits to family or relatives alone or jointly with spouse. <sup>d</sup>Women and men were asked these questions separately. <sup>e</sup>Home includes participant's home or another home.

Table 5

Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 women<sup>a</sup> from Sidama zone, SNNPR, Ethiopia

Variable	Odds Ratio	p-value	95% CI	
Meds and supplies				
Always available	3.08	<b>0.000</b>	2.03	4.67
Support person				
Allowed in delivery room	1.69	<b>0.000</b>	1.37	2.07
Ambulance				
Free	1.37	<b>0.006</b>	1.09	1.70
Cost (per 50 birr decrease)	1.15	<b>0.000</b>	1.12	1.18
Provider				
Female doctor vs HEW	0.92	0.702	0.59	1.42
Male doctor vs HEW	1.33	0.169	0.89	1.99
Female nurse vs HEW	0.68	0.050	0.47	1.00
Male nurse vs HEW	0.54	<b>0.003</b>	0.36	0.81
Female doctor vs male doctor	0.69	<b>0.011</b>	0.52	0.92
Female doctor vs female nurse	1.34	0.064	0.98	1.84
Female doctor vs male nurse	1.71	<b>0.000</b>	1.27	2.29
Male doctor vs female nurse	1.95	<b>0.000</b>	1.44	2.62
Male doctor vs male nurse	2.47	<b>0.000</b>	1.84	3.32
Female nurse vs male nurse	0.68	0.120	0.94	1.71
Attitude				
Smiles, listens	1.24	0.075	0.98	1.56
Distance (per 15 minute decrease in walking time)	0.99	0.383	0.86	1.05

Note. AIC decreased from 2960 (null) to 2762 (Level1). Likelihood ratio (LR)  $\chi^2(10)=218.30$ ,  $p<0.0001$  <sup>a</sup>21 missing responses and 99 neither responses out of 3240 options

Table 6

*Results from mixed-effects logistic regression model for utility of attributes of health facilities for delivery, reported for 108 men from Sidama zone, SNNPR, Ethiopia*

Variable	OR	p-value	95% CI	
Meds and supplies				
Always available	2.68	<b>0.000</b>	1.79	4.02
Support person				
Allowed in delivery room	1.74	<b>0.000</b>	1.42	2.14
Attitude				
Smiles, listens	1.30	<b>0.030</b>	1.03	1.64
Distance(per 15 minute decrease in walking time)	1.09	<b>0.000</b>	1.06	1.13
Cost (per 50 birr decrease)	1.14	<b>0.000</b>	1.11	1.17
Provider				
Female doctor vs HEW	0.74	0.169	0.47	1.14
Male doctor vs HEW	0.75	0.155	0.50	1.12
Female nurse vs HEW	0.53	<b>0.001</b>	0.36	0.78
Male nurse vs HEW	0.51	<b>0.001</b>	0.34	0.77
Female doctor vs male doctor	0.99	0.929	0.74	1.31
Female doctor vs female nurse	1.39	<b>0.035</b>	1.02	1.89
Female doctor vs male nurse	1.44	<b>0.014</b>	1.07	1.92
Male doctor vs female nurse	1.41	<b>0.022</b>	1.05	1.90
Male doctor vs male nurse	1.46	<b>0.012</b>	1.09	1.95
Female nurse vs male nurse	1.03	0.832	0.77	2.94
Ambulance				
Free	0.95	0.679	0.76	1.19

*Note.* AIC decreased from 2960 (null) to 2781 (Level 1). Likelihood ratio (LR)  $\chi^2(10)=234.49$ ,  $p<0.0001$  <sup>a</sup>No missing responses and 37 neither responses out of 3240 options



Figure 1: Sample Task Set for Discrete Choice Experiment!!

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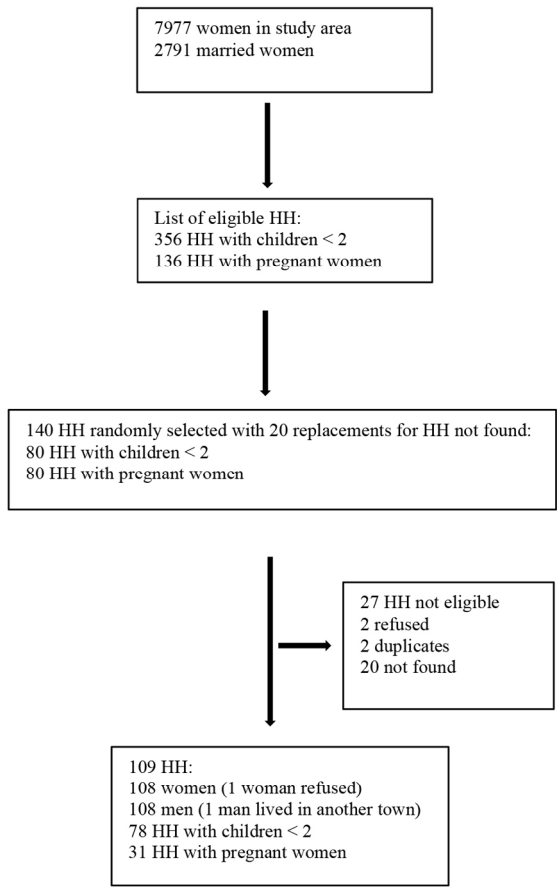


Figure 2: Study Flow Diagram

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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
<b>Title and abstract</b> pp. 1 and 3	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>		
p. 6 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
p. 9 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods – p. 9</b>		
Study design – p. 9	4	Present key elements of study design early in the paper
Setting – p. 10	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants – p. 10	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables – p.9	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement – p.9	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias – p. 11	9	Describe any efforts to address potential sources of bias
Study size – p. 10	10	Explain how the study size was arrived at
Quantitative variables – p. 13	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods – p. 13	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

**Results**

Participants – p. 14	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data – p. 14	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data – p. 15	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results – p. 15	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

**Discussion**

Key results – p. 17	18	Summarise key results with reference to study objectives
Limitations – p. 20	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation – p. 20	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability – p. 20	21	Discuss the generalisability (external validity) of the study results

**Other information**

Funding – p. 2	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).