***Studies included in Table 3***

**(i) Distance to any nearest health facility**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Sample** **selection** | **Affordability** | **Education** | **(Perceived) need** |
| De Allegri et al. 20111Burkina FasoNouna(Rural) | Multi-stage cluster random sample; first, clusters were defined according to the catchment area of each first-line HF. Second, one village where the HF was located, and another village randomly drawn from the list of all the villages in the HF catchment area were selected. In the third stage, 20 households in each village were randomly selected.N=435 women pregnant within a one-year recall period | ✓ | ✕ | Distance | Unclear | UnclearTOAny nearest HF | SR | Location | HF (first-line HF or hospital) | Others | Adjusted; negative;living <5km from a HF was associated with delivering in a HF – AOR=28.42, p-value<0.001 | Household asset index quintile | Maternal and paternal literacy | Parity |
| Johnson et al. 20152GhanaGhana(Rural) | Multi-stage cluster random sample from the 2003 and 2008 Ghana DHSs, rural clusters only. The births recorded in the two surveys cover the periods 1999-2003 and 2004-2008. Geo-referenced database of HFs, Community-based Health Planning and Services (CHPS) compounds and digitised topographic databased of national road network.N=4349 births from the two DHSs within each of the two five-year recall periods | ✕ | ✕ | Distance | Road | UnclearTOAny nearest HF for CHPS compound (where provision of skilled delivery care is not stated as a core activity) | Est. | Attendant | People with midwifery skills (e.g. doctors, midwives, nurses) | Others | Adjusted; negative;access to HF and CHPS (<8km) have a significant impact on the uptake of skilled birth care: the odds of skilled birth care increased by 35% (p<0.01) for those with access to HF, the odds of skilled care increased by 51% (p<0.05) for those with access to HF and CHPS. But living close to CHPS only showed no significant effect (p>0.05) | Household wealth status | Maternal education | Parity |
| Lwelamira and Safari 20123TanzaniaBahi(Rural) | Random selection of households from all households in the study area. Obstetric history of all women from sampled households were obtained. N=984 women given birth within the two-year recall period | ✕ | ✕ | Distance | Unclear | UnclearTOAny nearest HF | SR | Location | HF | Others | Adjusted; negative;Women >10km were 38% less likely to deliver in a HF compared to those <5km (AOR=0.62, 95%CI=0.47-0.81). But odds of facility delivery for those living 5-10km to the nearest HF were not significantly different from women <5km. | Annual household income | Maternal education | Perceived quality of maternity services |
| Nakua et al. 20154GhanaAmansie West(Rural) | The eligible study sample was respondents attending post-partum care identified by a sample of local health officials, and may not include mothers who were not engaged with the health system. N=400 women given birth within the one-year recall period | ✕ | ✓ | Distance | Unclear | UnclearTOAny nearest HF | SR | Attendant | Persons with midwifery skills(doctor, nurse, midwives and health officer) | Others | Adjusted; negative;compared to <5km, living 6-10km to the nearest HF was associated with reduced odds of delivering in a HF – AOR=0.32 (95%CI=0.13,0.74). Living 11-15km to the nearest HF, however, did not show any significant effect. | Average household income per day | Maternal education | Ever used unskilled care, knowledge about benefits of skilled delivery |
| Mageda et al. 20155TanzaniaBiharamula(Unclear) | Multi-stage cluster random sampleN=598 women given birth within the one-year recall period | ✕ | ✕ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear\_\_\_\_\_\_\_\_\_Walking | UnclearTOAny nearest HF | SR | Location | HF | Others | Adjusted; negative;women living <5km were more likely to have an institutional delivery than those living >10km, AOR=2. (95%CI=2.3-3.9). Odds for those living 5-10km were not significantly different from those living >10km.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_No result was presented. | Regularity of maternal and paternal sources of income | Maternal and paternal education | Parity |
| O’Meara et al. 20146KenyaBunyala(Rural) | Multi-stage cluster random sample data were collected from four districts within the Academic Model Providing Access to Healthcare (AMPATH) PrimaryHealth Care catchment area and may not represent household located outside of any catchment area. GPS coordinates were captured for every household and HF. N=1987 women who delivered in the last five years | ✓ | ✕ | Distance | Straight | HomeTO1 Any nearest HF2 Hospital | Est. | Location | Hospital/Nursinghome, Health centre/Dispensary, and private clinics | Home | (Any nearest HF) Adjusted; mixed;effect of distance differed across the four districts – in Bunyala, Teso North and Bungamo East, distance was insignidicant but in Butula, distance was associated with delivery in a facility, AOR=1.33, 95%CI=1.00-1.69.(Hospital) Crude; mixed;significant only in Bunyala – COR=0.79, 95%CI=0.74-0.87. | Household SES index quartiles | Maternal education | Parity |
| Ndao-Brumblay et al. 20137TanzaniaKasulu(Rural) | Multi-stage cluster random sample; individual responses for distance to any nearest HF were aggregated at the village level and corresponding village estimates were assigned to individual respondents.N=1183 women given birth within a five-year recall period | ✕ | ✕ | Distance | Unclear | VillageTOAny nearest HF | SR | Location | Any government, mission or private HF | Friend’s home or own home | Adjusted; marginally negative;distance from had a marginal negative association with institutionalized delivery (AOR=0.89, p=0.085). | Household asset index quintile | Maternal education | Parity |

**(ii) Distance to one or more specified facilities**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Selection** | **Affordability** | **Education** | **(Perceived) need** |
| Mpembeni et al. 20078TanzaniaMtwara(Rural) | A random sample HF was first selected. For each of the selected HF, one village in its catchment area was selected randomly. In the selected village, a house to house survey was conducted and all women who had given birth within the previous one year were interviewed.N=974 women given birth within the one-year recall period | ✓ | ✕ | Distance | Unclear | UnclearTONearest HF with maternity care | SR | Attendant | Doctor, nurse, midwife, MCHA(TBA unclear) | Untrained relatives or friends(TBA unclear) | Adjusted; negative;distance to the HF providing maternity care (AOR=4.09, 95%CI=2.72–6.16) were significant associated with use of skilled care at birth. | Household asset index quintile | Maternal education | Advised where to deliver during ANC and knowledge of pregnancy danger signs |
| De Allegri et al. 20159Burkina FasoNouna(Rural) | Multi-stage cluster random sample with women who resided within the catchment areas of front-line health facilities only. N=420 women given birth within the one-year recall period | ✓ | ✕ | Distance | Unclear | VillageTOSpecified front-line HF equipped as BEmOC | Unclear | Location | Others | Home | Adjusted; negative;there were significant association between home delivery and greater distance to preassigned front-line HF (AOR=19.33, 95%CI=3.37-110.88).  | Household asset index quintile | Maternal and household head’s literacy | History of miscarriage |
| Moran et al. 200610Burkina FasoKoupela(Rural) | The study area comprised 145 villages in 13 health facility catchment areas. Within each catchment area, villages were stratified as further than or within the average distance to the HF. Villages from stratum were randomly selected, and women were then random selected from chosen villages.N=180 women given birth within the one-year recall period | ✓ | ✕ | Distance | Unclear | UnclearTOPreassigned health centre | Unclear but likely to be measured | Attendant | Doctor, nurse, midwife or auxiliary nurse | Others | Adjusted; negative;women living further away were 61% (95%CI=24.4-79.8) less likely to use a skilled provide at delivery. | Plan for saving money for emergency | Maternal education | Parity |
| Mills et al. 200811GhanaKassena-Nankana(Urban and rural) | All mothers with recorded birth in the local Health and Demographic Surveillance Site.The NDSS has a geographical information system with a geo-reference of roads, HFs rivers, and households/compounds.  | ✕ | ✓ | Distance | Road | ClusterTO1 Nearest HF2 District hospital | Est. | Attendant | Health professional (doctor, midwife or nurse) | Others | Adjusted; negative;distance to the district hospital showed significant association with use of health professionals at last delivery – AOR for >20km compared to <10 km was 0.31 (95%CI=0.33,0.43) and AOR for 10-19km compared to <10km was 0.54 (95%CI=0.34-0.79).Effect of distance to nearest HF was insignificant.  | Household asset index quintile | Maternal education | Parity |
| Magadi et al. 200012KenyaKenya(Urban and rural) | Multi-stage cluster random sample from the 1993 Kenya DHS N=5,290 births occurred within the five-year recall period | ✕ | ✕ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear\_\_\_\_\_\_\_\_\_Unclear | UnclearTONearest HF with maternity care | SR | Location | Others | Home | Adjusted; negative;for births occurring 5-10km or >10km away, the average odds of home births are more than double, compared to births occurring <5km from maternity care.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Adjusted; negative;the average odds of home births >2h from maternity care are almost double the odds of births <1h from a HF offering maternity care. | Household asset index tercile | Maternal education | Birth Order  |
| Gage 200713MaliMali(Rural) | Multi-stage cluster random sample from the 2001 Mali DHS, including a community questionnaire that collected data from key informants on the socioeconomic, and health and other infrastructure of enumeration areas selected for interview. N=6,178 most recent births within the five-year recall period | ✕ | ✕ | Distance | Unclear | UnclearTONearest HF with maternity care | SR (by community informants) | Attendant\_\_\_\_\_\_\_\_\_Location | Trained health worker(doctor, nurse, auxiliary nurse or midwife)\_\_\_\_\_\_\_\_\_HF | Others\_\_\_\_\_\_\_\_\_Others | Adjusted; negative;Distance had strong effects on the odds of both facility-based delivery and delivering with a trained health worker. | Household asset index | Maternal education | Mother told about pregnancy complications |
| Okafor 199114NigeriaUdi(Rural) | One-stage sample of town in part based on interviewers’ convenience and all women residing were interviewed.N=498 women given birth within the two-year recall period | ✓ | ✕ | Distance | Unclear | TownTONearest HF with maternity care | SR | Both | In a HF with at least a midwife or a trained and state licenced auxiliary/TBA | Others | Adjusted; negative;effect of distance was significant at p<0.05 level. | Husband’s occupation | Maternal education | Parity |
| Lohela et al. 201215MalawiMalawi(Rural)Note: We also included Gabrysch et al. 201116 which covered the analysis for Zambia in Lohela et al. 2012. | Multi-stage cluster random sample from the 2004 Malawi DHS, rural clusters only. Births that occurred before the mothers moving to the current location were excluded.Facility data on all public and semi-public and major private HFs were obtained from national Health Facility Censuses conducted in Malawi in 2002. N=8842 children born within the five-year recall period | ✕ | ✕ | Distance | Straight | ClusterTONearest HF with maternity care | Est. | location | HF | Others | Adjusted; negative;the odds of facility delivery decreased by65% for every 10 km increase in distance to the closest facility (AOR=0.35, p=0.001). | Household asset index quintile | Paternal education | Women’s modern attitudes (in cluster) |
| Kruk et al. 201517TanzaniaPwani(Rural) | The study population is women with deliveries in the past year who live in catchment areas of 24 study health facilities: government primary care clinics with at least one medically trained staff member who were trained in basic obstetric care and were actively providing delivery services. Enumerators collected locations of all HFs in the study area and sub-village centres using GPS receivers.N=3,019 women given birth between six weeks and one year before interview | ✓ | ✕ | Distance | Straight | VillageTO1 Primary clinic2 Health centre3 Hospital | Est. | Location | HF | Home (own or that of someone else) | Adjusted; negative;women’s distance from the nearest hospital was strongly associated with an increased likelihood of home delivery (AOR=2.49, 95%CI=1.60,3.88). Distance from the nearest health center and dispensary were not associated with likelihood of home delivery. | Household asset index quintile | Maternal education | Primipara |
| Hounton et al. 200818Burkina FasoOuargaye(Rural) | A census was conducted to cover the total population in the study area.All 43 health facilities in the two districts were surveyed, each of which typically led by a nurse and maternity care typically provided by an auxiliary midwife, except for in remote centres where TBA are the main givers of maternity care.N=81,539 women given birth within the five-year recall period. | ✕ | ✕ | Distance | Unclear | UnclearTO1 Preassigned health centre (typically led by a nurse)2 Preassigned hospital | Unclear | Location | Health centre or hospital | Others | Adjusted; negative;the effect of distance to the health centre was very pronounced up to about 7 km from the health centre (AOR 0.77⁄km, 95%CI=0.75-0.79), levelling off beyond that (AOR 0.97⁄km, 95%CI=0.95-0.98). Distance to the district hospital remained an important predictor of institutional birth – AOR 0.83/10km, 95%CI=0.77-0.91) | Household asset index quintile | Maternal education | Parity |
| Joharifard et al. 201219RwandaBugesera(Mostly rural) | From each selected villages, 40 women were to be interviewed. Enumerators stood from the main road at the edge of each village, approached the closest households consecutively until they had either approached all households or interviewed 40 women.N=959 women given birth within the three-year recall period | ✓ | ✕ | Distance | Road | VillageTO1 Each village’s designed health centre (staffed exclusively by nurse)2 Nyamata District Hospital(result not presented) | Est. | Location | Health centre, hospital | Others | Adjusted; negative;Greater distance between the respondents’’ village and her designated HC was negatively associated with facility delivery – AOR=0.909 (95%CI=0.846-0.976) per additional kilometre. | Covered by health insurance | Maternal education | Next-to-last delivery at HF, past intra/post-partum problems |
| Kitul et al. 201320KenyaKenya(Urban and rural) | Multi-stage cluster random sample of the 2008-2009 Kenya DHS; HF data from the 2008 Kenya Health Facility DatabaseN=5857 live births within a five-year recall period | ✕ | ✕ | Distance | Straight | ClusterTONearest HF with maternity care | Est. | Location | Any HF | Home or on the way | Adjusted; insignificant;results not presented. | Household asset index quintile | Maternal education | Parity |
| Anyait et al. 201221UgandaBusia(Mostly rural) | The study population was restricted to women residing within 5km of a HF providing delivery services.N=500 women given birth within a twp-year recall period | ✓ | ✕ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear**\_\_\_\_\_\_\_\_\_**Unclear | UnclearTONearest HF with maternity care | SR | Location | Public and private HF | Others | Crude; negative;living <3km of a HF offering maternity care increased the likelihood of HF delivery (COR=1.9, 95%CI=1.2-3.1)Adjusted; insignificant;result not presented\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Crude; insignificant;Time taken to reach maternity HF did not influence the place of delivery (COR=0.8, 95%CI=0.5-1.3). |  |  |  |
| Nuwaha and Amooti-kaguna 199922UgandaRakai(Mostly rural) | Villages were selected proportional to population size, then standing in the centre of each village. In addition, about 80% of the study population lived <5km from a HF N=211 women given birth within the one-year recall period | ✕ | ✕ | Distance | Unclear | UnclearTO1 Nearest HF with maternity care2 Nearest HF offering caesarean section (CS) | SR | Location | TBA’s place or HF | Home | Crude; negative;39% of mothers <5km to a maternity centre delivered at home, compared with 66% who lived >5km (COR=0.35, 95%CI=0.17-0.71).26% of the mothers who were <5km to a health unit that could do CS delivered at home, compared to 65% who were >5km (COR=0.21, 95%CI=0.11-0.40)Adjusted; insignificant,result not presented. |  |  |  |

**(iii) Walking or motorized travel time to any end location**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Selection** | **Affordability** | **Education** | **(Perceived) need** |
| Wado et al. 201323EthiopiaGilgel Gibe(Urban and rural) | Multi-stage cluster random sample of women taken from mothers with recorded birth in the Gilgel Gibe Health and Demographic Surveillance Site.N=1,456 women given birth within the two-year recall period | ✕ | ✓ | Time | Walking | HomeTONearest HF with maternity care | SR | Location | HF | Others | Adjusted; negative;women living >1h walking time from a health HF offering maternity care were 45% less likely to delivery in a HF (AOR=0.55, 95%CI=0.34-0.89). | Household asset index tercile | Maternal education | Parity; pregnancy related morbidity |
| Hailu et al. 201424EthiopiaTsegedie(Urban and rural) | Multi-stage cluster random sampleN=485 women given birth within a two-year recall period | ✕ | ✕ | Time | Walking | UnclearTOAny nearest HF | SR | Location | HF (health centres and hospitals) | Home | Adjusted; negative;women living <1h from the nearest HF were three times (AOR=3.3, 95%CI=1.15-9.52) more likely to deliver in a HF compared to women living <1h from the nearest HF. | Household monthly income | Maternal education | Parity |
| Gebru et al. 201425EthiopiaTigrey(Urban and rural) | Facility-based study, all women who visited the selected HFs for child immunization services during the study period were includedN=911 women who gave birth within a one-year recall period | ✕ | ✕ | Time | Walking | UnclearTOAny nearest HF | SR | Attendant | Skilled birth attendant (no other specifications given) | Others | Adjusted; negative;women living <1 hour to HF were more likelyto utilize SBA – AOR=4.017, 95%CI=2.302-7.009) | Family monthly income | Maternal education | Parity |
| Abikar et al. 201326KenyaGarissa(Unclear) | Multistage cluster method wasused to identify respondent for the study. Quantitative data was generated through the dministration of semi structured questionnaire in a face to face interview.N=334 women who gave birth at least once | ✕ | ✕ | Time | Walking | Unclear to TOAny nearest HF | SR | Attendant | Nurse and doctor | Others | Adjusted; negativeresidence of <1h from the nearest HF was significantly associated with skilled delivery service (AOR=3.91, 95%CI=1.24-12.34) | Cost of delivery tested  | Maternal education tested | Previous delivery complication |
| Van Eijk et al. 200627KenyaAsembo and Gem(Rural) | Multi-stage cluster random sample of women taken from mothers with recorded birth in the local Health and Demographic Surveillance Site.N=730 women given birth within the  | ✕ | ✓ | Time | Walking | UnclearTOAny nearest HF | SR | Location | HF | Others (own house, TBA’s house, on the way to a HF) | Adjusted; negative;women who delivered outside of a HF were more likely to delivery outside of a HF than women <1h walking time to antenatal care (AOR=2.75, 95%CI=1.33-5.68). But living exactly 1h from, or used bus/bicycle instead showed no difference compared to walking <1h. | Household asset index status  | Maternal education | Parity |
| Spangler and Bloom 201028TanzaniaKilombero and Ulanga(Rural) | All mothers with recorded birth in the local Health and Demographic Surveillance Site.N=1,150 women given birth within the 42-60 days recall period | ✕ | ✓ | Time | Walking | HomeTOAny nearest HF | SR | Location | In a HF, on the way to a HF | Others | Adjusted; negative;compared to women <30min of a HF,those living 30-60 min away were much less likely to use obstetric care (AOR=0.45, 95%CI=0.31-0.64), as were those >60min(AOR=0.26, 95%CI=0.18-0.38). | Household head’s occupation and household asset/ possession | Maternal education | Perceived problems with labour |
| Kawakatsu et al. 201429KenyaNyanza(Rural) | A total of 11,906 mothers who had children aged 12–23 months were identified by community health workers in 64 sub-locations in the study area; 40 mothers in each sub-location were selected using random-sampling methods.N=2,560 mothers of children aged 12-23 months | ✕ | ✓ | Time | Walking | UnclearTOAny nearest HF | SR | Location | Any HF(dispensary/ health centre/ hospital or higher-level) | Others | Adjusted; negative;using >60min as the reference category, women living near a health facility (<20min walk) have 2.482 times higher odds of giving birth in a HF (95%CI=1.735-3.549). Odds of skilled care for women living 21-40 min and 41-60 min were insignificant. | Household asset index quintile | Maternal education | Parity |
| Masters et al. 201330GhanaGhana(Rural) | Multi-stage cluster random sample from the 2008 Ghana DHS. Facility data, including GPS coordinates, was obtained from the 2010 Emergency Obstetric Needs Assessment Facility Census. All HFs were considered birthing facilities. Travel time were generated for every 1km-by-1km grid covering the whole of Ghana from road network maps, land-cover spatial later and empirically derived. Travel time were calculated from all DHS clusters to its nearest source of maternity care.N=1,384 births occurred within the five-year recall period | ✕ | ✕ | Time | Motorized | ClusterTONearest HF with maternity care | Estimated | Location | HF | Home | Adjusted; negative;An increase of travel time of one hour reduced the odds of facility birth by 20% (AOR=0.0801, 95%CI=0.69,0.93) | Household asset index tercile | Maternal and paternal education | Parity; ever had a terminated pregnancy  |
| Teferra et al. 201231EthiopiaSekela(Urban and rural) | Multi-stage cluster random sampleN=371 women who gave birth within a one-year recall period | ✕ | ✕ | Time | Walking | UnclearTOAny nearest HF | SR | Location | HF | Home | Crude; negative;women living <1h were more likely to use skilled care compared to women living further away (COR=6.2, 95%CI=1.87,20.5)Adjusted; insignificant,result not presented. | Family income (not significant) | Maternal education | Knowledge of delivery service |
| Amano et al. 201232EthiopiaMunisa Woreda(Urban and rural) | Multi-stage cluster random sampleN=855 women who gave birth within a one-year recall period | ✕ | ✕ | Time | Walking | UnclearTOAny nearest HF | SR | Location | HF (hospitals and health centres) | Home | Crude; negative;women living <30min were more likely to use skilled care compared to women living further away (COR=2.04, 95%CI=1.26,3.30)Adjusted; insignificant,result not presented. | Paternal job type | Maternal education | Parity |
| Nuwaha and Amooti-kaguna 199922UgandaRakai(Mostly rural) | Villages were selected proportional to population size, then standing in the centre of each village. In addition, about 80% of the study population lived <5km from a HF N=211 women given birth within the one-year recall period | ✕ | ✕ | Time | Walking | UnclearTO1 Nearest HF with maternity care2 Nearest HF offering caesarean section (CS) | SR | Location | TBA’s place or HF | Home | Crude; negative;26% of mothers <1h walking time to maternity centre delivered at home, compared to 56% of those who were >1h (COR=0.27,95%CI=0.14-0.65)Adjusted; insignificant,result not presented. |  |  |  |

***Studies not included in Table 3***

**(iv) Inadequately adjusted or crude analysis (distance only)**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Selection** | **Affordability** | **Education** | **(Perceived) need** |
| Hodgkin 198933KenyaSouth Nyanza(Rural) | Cross-sectional multi-stage cluster random sample of householdsN=149 deliveries within the one-year recall period from 552 households | ✕ | ✕ | Distance | Unclear | HomeTONearest HF with maternity care | SR | Location | Hospital and health centre in government, in missionary and in the private sector | TBA’s place, home, others | Adjusted; negative;every 1km increment 🡪 -3.4% in the probability of delivering in a HF | Worth of house | Household lead’s education | × |
| Gitimu et al. 201534KenyaMakueni(Urban and rural) | Multi-stage cluster random sampleN=1,212 women’s latest deliveries | ✕ | ✕ | Distance | Unclear | UnclearTOAny nearest HF | SR | Attendant | People with midwifery skills (doctors, midwives and nurses) | Others | Adjusted; negative;living <5km from a HF was associated with a higher likelihood of SBA – AOR=1.594, ,95% CI, 1.071- 2.371 – compared to living >6km | × | Maternal education | Parity |
| Faye et al. 201035SenegalGossas(Urban and rural) | Sample was selected from all women who gave birth during the period July 2006 to June 2007 and who had at least one antenatal care visit at a health facility.N = 380 women given birth between July 2006 and June 2007 | ✕ | ✓ | Distance | Unclear | Home TOAny nearest HF | SR | Location | Others | Home | Adjusted; negative;a distance of more than 5 km, compared with <5km, to the health facility (AOR = 2.62, 95%CI=1.42-4.84) were Identified as a risk factor. | Woman does some income generating activity | Maternal education | Parity |
| Van den Broek et al. 200336MalawiUnclear(Rural) | Study sample is the entire population living in the catchment area of the Namitambo health centre. The HF is staffed by a clinical assistant and five to seven nurses. The two nearest hospitals (staffed by medical doctors) are >1h via untarred tracks away.N=2179 childbirths within the one-year recall period | ✓ | ✕ | Distance | Unclear | UnclearTONamitambo Health Centre | SR | Attendant | Trained healthcare workers (doctor, nurse and midwives) | TBAs, unskilled female relatives and others | Adjusted; negative;as distance increased, assistance at childbirth is more likely to be given by a TBA or female relative than by a trained midwife (p<0.0001). | × | Maternal education | × |
| Moindi et al. 201637KenyaKilifi(Rural) | Facility-based study of women attending who had invited to participate.N=410 given birth within the six-month recall period | ✕ | ✓ | Distance | Unclear | HouseholdTONearest hospital | SR | Location | HF | Home | Adjusted; negative;living >10km away from the nearest hospital was associated with adjusted RR of 3.86 (95%CI=2.13-7.02). | × | Own and partner’s education | Parity |
| Van Rijsbergen and D’Exelle 201238TanzaniaLake Zone(Urban and rural) | Multi-stage cluster random sampleN=518 women’s latest deliveries | ✕ | ✕ | Distance | Unclear | CommunityTOAny nearest HF | Unclear | Location | 1 Local HF (dispensary/ health centre)2 Hospital | Home or on the way | Adjusted; mixed;multinomial probit regression models gave coefficient of the distance variable is negative (p<0.1) for hospital delivery and negative (p<0.01) for delivery at a local HF.Notes: distance was zero if any HF was available in the community | Wealth | × | Parity  |
| Mwaliko et al. 201439KenyaWebuye(Rural) | The study included all households (residing within the Webuye HDSS) registered during census and had reported at least one birth within one year preceding the census.N=3255 households reported at least one birth within the two-year recall period | ✕ | ✓ | Distance | Straight | HomeTO1 Any nearest HF2 hospital | Est. | Location | Others | Home | Adjusted; negative;distance to the hospital strongly negatively correlated with home births; AOR of home births for women living >4km from a hospital was 2.07, 95%CI=1.08–1.60. In another model with distance to the nearest any HF instead, AOR=1.32 (p=0.006) comparing <2km and >2km. | Household lead’s employ-ment status  | Household lead’s education | × |
| McLaren et al. 201440South AfricaSouth Africa(Urban and rural) | Multi-stage cluster random sample from the first wave of the National Income Dynamics Study. GPS coordinates of the household were taken using handheld GPS units. Data on HFs were shared by five public sources, which were combined to create a master list of all HFs. N=3003 children <5 years old  | ✕ | ✕ | Distance | Straight | HomeTONearest public HF | Est. | Attendant | Doctor or nurse | Others | Adjusted; negative;children in households >2km from the nearest pubic HF are 3 percentage points less likely to have had a doctor or nurse present at their birth (p < 0.05). | Household per capita income quintile | × | × |
| Kenny et al. 201541LiberiaKonobo and Glio-Twarbo(Rural) | Multi-stage cluster random sample, but excluded villages that either could only be reached on foot or only accessible by canoe, or had less than 20 households. Distance was measured with handheld GPS devices by enumerators during travel to each cluster using recorded GPS tracks. Distance was then divided into quartiles and analysed as a categorical variable.N=600 women given birth within the five-year recall period  | ✓ | ✕ | Distance | Road | ClusterTOKonobo Health Centre (the only formal HF to the study area) | Measured | Location | HF (with any provider) | Others | Adjusted; negative;women at farther distances were less likely to have a facility–based delivery (AOR = 0.41,P=0.006 for the most distant vs nearest quartile; p=0.04 for trend). | × | Maternal education | × |
| Gabrysch et al. 201116ZambiaZambia(Rural) | Multi-stage cluster random sample from the 2007 Zambia DHS. The Zambia Health Census 2005 provided facility data, including GPS coordinates, on all public, semi-public as well as larger private for-profit HFs in the country.N=4,146 births occurred within the five-year recall period | ✕ | ✕ | Distance | Straight | ClusterTONearest HF with maternity care | Estimated | Location | HF | Home | Adjusted; negative;the final, fully adjusted model showed a 29% decrease in odds of facility delivery for every doubling of distance, and a 26% increase in odds of facility delivery for every step increase in level of EmOC, assuming a linear effect. | Household asset | Maternal education | × |
| Kruger et al. 201142TanzaniaMbulu(Rural) | Facility-based study, data on all children attending the eight reproductive and child health (RCH) clinics during the study period were included. N=3868 infants registered at RCH clinics in 1998, 1999, 2006 and 2007 | ✕ | ✓ | Distance | Unclear | RCH clinic of birthTOHaydom Lutheran Hospital (HLH) or another high-level HF | SR(by RCH staff) | Location | Hospital, health centre, dispensary | Home  | Crude; negative;Shorter distance to a higher-level HF with maternity care was a significant predictor in 1999, 2006 and 2007 and for all years combined (COR=1.02, 95%CI=1.01-1.02)Adjusted; insignificant;AOR for all years combined was 1.65, 95%CI=1.04-2.61. |  |  |  |
| Esmai et al. 200243NigeriaIle-Ife(Urban) | A systematic sample of women residing in the urban town of Ile-Ife.N=117 women given birth  | ✕ | ✕ | Distance | Unclear | UnclearTOApproved health facilities | SR | Location | Hospital or health centre | Home | Crude; negative;distance >5km was associated with reduced use of skilled care at birth (p-value<0.05) |  |  |  |
| Nhindiri et al. 199644ZimbabweGutu(Rural) | Multi-stage cluster random sample from communal farming area. Women from commercial lands were excluded. N=520 women given birth within the one-year recall period | ✓ | ✕ | Distance | Unclear | UnclearTORural health center (RHC) with maternity care | SR | Location | RHC, clinic or hospital | Home | Crude; negative;109 women delivered at home, 27.8% was <5km, compared to 35.9% of 195 who delivered in a hospital (p-value=0.093);69.4% of 109 women delivered at home was <10km, compared to 72.3% of 195 women who delivered in a hospital (p=0.284).  |  |  |  |
| Nwakoby 199245NigeriaObukpa Town(Rural) | Multi-stage cluster random sampleN=488 women given birth within the two-year recall period  | ✕ | ✕ | Distance | Unclear | VillageTOComprehensivehealth centre in Obukpa Town | Measured directly from a map | Location | Compre-hensivehealth centre in Obukpa Town | Home | Crude; inconclusive;(no test was performed to assess the strength of evidence of the bivariate relationship)87% of the women living <1km used the facility for delivery. The percentage fell as the distance between the facility and place of residence increased. At >3km, only 24% of the women used the comprehensive health centre for delivery.  |  |  |  |
| De Groot et al. 199046TanzaniaSengerema(Unclear) | Women were interviewed at birth at the Sengreme District Hospital. All births outside of this facility were considered non-hospital (unskilled) births. Total number of non-hospital births was estimated from local population data.N=179 deliveries at the Sengreme District Hospital and 957 expected deliveries estimated using local population data | ✕ | ✕ | Distance | Straight | VillageTOSengreme District Hospital | SR for facility births and est. for non-facility births | Location | Sengreme District Hospital | Others | Crude; negative;98% of all deliveries within 5km took place in hospital, including both high and low risk pregnancies. Only 21% of high risk pregnancies beyond 5km came to hospital for delivery. |  |  |  |

**(v) Travel time with an unspecified mode of transportation or inadequately adjusted or crude analysis only**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Selection** | **Affordability** | **Education** | **(Perceived) need** |
| Wilunda et al. 201547EthiopiaSouth West Shoa Zone(Urban and rural) | Multi-stage sample; in the first stage, villages were selected at random. In the second stage, enumerators walked down a randomly selected direction (method unspecified), visiting consecutive households whilst other enumerators walked from the end of village along this direction, visiting consecutive houses.N=500 women given birth within a two-year recall period | ✕ | ✕ | Time | Unclear | UnclearTONearest HF with maternity care | SR | Attendant | Doctor, nurse, midwife, or a health officer | Others | Adjusted; negative;the odds of delivery by a SBA decreasedwith increasing time to the nearest HF with maternity care – <30min as base, AOR for 30-59 min = 0.48 (95%CI=0.23-.96) and AOR for >60min = 0.35 (95%CI=0.15-0.82). | Household asset index quintile | Maternal and paternal education | Had a pregnancy/delivery related problem |
| Habte et al. 201548EthiopiaCheha(Urban and rural) | Household having eligible women were identified by house to house visit made by local health officials. From this compilation, the final study sample was randomly selected.N=816 women who gave birth within a two-year recall period | ✕ | ✕ | Time | Unclear | UnclearTONearest HF with maternity care | SR | Both | In a HF attended by skilled birth attendants | Others | Adjusted; negative;Women who should travel >60 min and 30-60 min were less likely to deliver at health facility than women living <30 min AORs were 0.22 (95%CI=0.09,0.55) and 0.42 (95%CI=0.18,0.95). | Able to afford a facility-based delivery | Paternal education (not significant) | Maternal and paternal attitudes towards facility-based delivery |
| Tadese and Ali 201449EthiopiaRaya Alamata(Urban and rural) | Multi-stage cluster random sampleN=600 women given birth within the one-year recall period | ✕ | ✕ | Time | Unclear | UnclearTOAny nearest HF | SR | Attendant | Health professionally trained health worker havingthe essential midwifery skills | Others | Adjusted; insignificant;comparison of women living <30 minute to >30 minute showed no significant effect on skilled care at birth | Monthly expendi-ture  | Maternal and paternal education | Knowledge about obstetriccomplica-tions |
| Alemayehu and Mekonnen 201550EthiopiaAkansha Guagusa(Urban and rural) | Multi-stage cluster random sample; study participants were identified by health services extension workers as field guides. N=373 women given birth within the one-year recall period | ✕ | ✓ | Time | Unclear | UnclearTOAny nearest HF | SR | Attendant | with nursing and above level of training | Others | Adjusted; insignificant;comparison of women living <1 hour and 1 hour to >1 hour showed no significant effect on skilled care at birth | × | × | Ever given birth at HF |
| Van den Boogaard et al. 200851ZambiaLusaka(Rural) | 8 HCs and their catchment areas were selected for convenience.N=444 women given birth within the five-year recall period | ✓ | ✕ | Time | Walking | VillageTOHC (staff are supposed to provide BEmOC) | Unclear | Attendant | Persons with midwifery skills(doctor, nurse, midwives and health officer) | Others | Adjusted; negative;p=0.003, no other information.Crude; negative; p=0.002;<0.5h: SBA = 54%0.5-2h: SBA = 38%2h+: SBA = 34% | × | Maternal education | Parity |
| Kabakyenga et al. 201252UgandaMbarara(Semi-urban and rural) | Households in which there was a women who had recently delivered or currently was pregnant were identified with assistance of local health officials. First two women from each village who met this criteria were interviewed.N=750 who given birth within the one-year recall period | ✕ | ✓ | Time | Unclear | UnclearTONearest HF with maternity care | SR | Attendant | Persons with midwifery skills(doctor, nurse, midwives and health officer) | Others | Crude; negative;women >1h from a HF offering childbirth services were less likely to choose assistance by skilled birth attendant (COR=0.7, 95%CI=0.5,1.0). |  |  |  |
| Stekelenburg et al. 200453ZambiaKalabo(Rural) | HFs in the study area were randomly selected and women living within the catchment areas of selected HFs were selected.N=322 women’s last delivery | ✓ | ✕ | Time | Walking | HomeTOHF of actual childbirth | SR | Location | Hospital, clinics | Others | Crude: negative;71% of those <2h walk delivered in a HF, but only 35% of those living >2h did (COR=4.7, 95%CI=2.6-8.3)Note: the question about walking time to the clinic was only put to those who did walk there. |  |  |  |

**(vi) Others**

| **Citation****Country****Region****(Settings)** | **Study sample** | **Distance/travel time (exposure) measurement** | **Study outcome** | **Results** |
| --- | --- | --- | --- | --- |
| **Sampling design,** **health facility data (where applicable) and sample size** | **Potential bias** | **Distance****vs.****time** | **Line/****Transport****type** | **Start-end** | **SR vs.****Est.1** | **Birth location/ attendant** | **Skilled****care** | **Unskilled****care** | **Crude/Adjusted analysis;** **summary of key results** | **Adjustment** |
| **Location** | **Selection** | **Affordability** | **Education** | **(Perceived) need** |
| Feyissa and Genemo 201454EthiopiaEast Wollega(Urban and rural) | The source population for the study was all women who gave birth in last five years; the study sample was selected by consecutive sampling technique.N=320 women’s latest deliveries | ✕ | ✕ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear\_\_\_\_\_\_\_\_\_Unclear | UnclearTOAny nearest HF | SR | Location | Any HF | Others | Adjusted; negative;adjusting for time to reach HF, among variables, distance >10km (AOR: 0.665, 95% CI:.173–.954) compared to <5km was significantly associated with institutional delivery\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Adjusted; insignificant;adjusting for distance from HF and mode of travel (foot vs. others), among others, the effect of time to reach HF was insignificant | ×\_\_\_\_\_\_\_\_\_× | ×\_\_\_\_\_\_\_\_\_× | ×\_\_\_\_\_\_\_\_\_× |
| Anastasi et al. 201555UgandaGulu District (Conflict conditions) | Women attending ANC at one HF were interviewed and asked about their previous birth.N=130 currently pregnant women previously given birth within the two-year recall period | ✕ | ✓ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear\_\_\_\_\_\_\_\_\_Unclear | UnclearTONearest HF with maternity care\_\_\_\_\_\_\_\_\_UnclearTO1 Nearest HF with maternity care2 A specifically named HF | SR | Location | HF | Others | Crude; insignificant;p=0.44\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1 Nearest HF with maternity care - crude; insignificant;p=0.142 a specifically named HF - crude; insignificant;p=0.45 |  |  |  |
| Nesbitt et al. 201456GhanaBrong Ahafo(Rural) | Surveillance of all women of reproductive age in the study area through monthly visits was undertaken as part of health and demographic surveillance for several field studies. The surveillance included taking GPS coordinates of 433 village centroids and, in 173 larger villages, coordinates of 47,537 compounds.A health facility assessment of all HFs were conducted and geographic coordinates were obtained.A detailed road network of all roads in the study area was created using GPS trackers. The road network was then integrated into a spatial layer of land-cover for additional information on road condition, surface type and etc. Travel time by vehicle were obtained for 88 journey segments to calibrate road speeds.N=9306 births in 2009 | ✕ | ✕ | Distance\_\_\_\_\_\_\_\_\_Time | Straight and road\_\_\_\_\_\_\_\_\_Non-motorized and motorized | 1 Compound2 VillageTO1 Nearest HF with maternity care2 Nearest CEmOC | Est.Travel time were obtained for roads (network time), and from available land-cover speed map (raster time)\*.\*GlobCover 2009, GEM European Commission project | Location | HF | Others | Crude; negative;ORs for facility use were the same for all four of straight-line and road distances, as well as non-motorized network and raster time: the odds of women delivering in a HF decreased by 67% (OR=0.33) per standard deviation (SD) increase in each measure (to the nearest HF with maternity care). There was a smaller effect with motorized measures from both origins – CORs range between 0.71-0.91.The odds of women delivering in a HF decreased by 55-60% per SD increase in each distance and non-motorized travel time measure (to the nearest CEmOC). The authors also noted that multivariate analysis adjusted for age, parity and wealth quintile gave similar results, but these results were not shown. |  |  |  |
| Mwaniki et al. 200257KenyaMbeere(Rural) | Cross-sectional descriptive survey, whose study population comprised mothers bringing their children to the child welfare clinics.N=200 women given birth  | ✕ | ✓ | Distance\_\_\_\_\_\_\_\_\_Time | Unclear\_\_\_\_\_\_\_\_\_Unclear | UnclearTOAny nearest HF | SR | Location | HF | Others | Crude; negative;More of those who lived <5km to a HF delivered in a HF compared to women living >5km (Χ2=7.57; p=0.0059; df=1)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_No results on travel time and use of skilled care at birth were presented. |  |  |  |

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