**S1 File Table 1:** Estimation of the sample size required for identifying predictors of MHSU.(For all calculations, power was set at 80%, level of significance at 5%, and the ratio of unexposed-to-exposed at 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables** | | **Maternal health service utilization rate (%)** | **AOR** | **Sample size in each category** | **Total sample size adjusted for NRR** |
| Knowledge about pregnancy complications [[1](#_ENREF_1)] | Yes | 16.6 | 1.97 | 477 | 954 |
| No | 6.3 |  | 477 |  |
| Illness experience [[2](#_ENREF_2)] | Yes | 15.4 | 1.87 | 423 | 846 |
| No | 9.1 |  | 423 |  |
| Gave birth at HF [[1](#_ENREF_1)] | Yes | 14.6 | 2.19 | 283 | 566 |
| No | 8.0 |  | 283 |  |
| Husbands who attend ANC with their spouse [[3](#_ENREF_3)] | Yes | 84.4 | **1.73** | **552** | **1,140** |
| No | 84.5 |  | **552** |  |
| The educational level of the husband [[1](#_ENREF_1)] | Unable to read and write | 3.2 |  | 235 | 470 |
| Secondary school and above | 8.6 | 3.38 | 235 |  |
| The educational level of the husband [[1](#_ENREF_1)] | Unable to read and write | 38.7 |  | 29 | 58 |
| Secondary school and above | 11.1 | 5.68 | 29 |  |

**Note**: AOR = Adjusted odds ratio, NNR = Non-response rate

**S1 File Table 2:** Description of study variables

|  |  |
| --- | --- |
| Study variables | Description |
| **Individual-level variables** | |
| Maternal knowledge regarding ODS | were measured using the 30 questions during three phases namely antepartum (9 questions), intra-partum (12 questions), and postpartum (9 questions). The correct answers were assigned a score of 1, while incorrect answers were assigned a score of 0. Lastly, the total knowledge scores range from 0 to 30 [[4](#_ENREF_4),[5](#_ENREF_5)]. |
| Spontaneous knowledge | is defined as the knowledge of study participants who can name or call an ODS without being read the name of that sign by data collectors. Merely true ODS spontaneously mentioned by study participants were recorded during the interview [[6](#_ENREF_6)]. |
| Distance from the HF | is considered as close to HF if a woman is reported to travel less than 5 km or walking hours less than 30 minutes by foot to reach the nearest [[7](#_ENREF_7),[8](#_ENREF_8)]. |
| Use of mass media | isgenerated by combining whether a study participant listens to the radio, watches television, and reads the newspaper and categorized as “yes” if the respondent is exposed to at least 1 of the 3 media and “no” otherwise [[9](#_ENREF_9),[10](#_ENREF_10)]. |
| Family size | is defined as a total number of individuals existing in the household and is categorized as small when it is < 5, and large (> 5) [[11](#_ENREF_11)]. |
| Formal education | is the education extending from primary to secondary and higher education and requires an organized and careful purpose that concretizes itself in an official curriculum, applied with a defined calendar and timetable [[12](#_ENREF_12)]. |
| Women’s autonomy | a woman is considered autonomous if a woman can decide when and where to use MHS or on the health care spending by herself alone or with her husband together and a non-autonomous otherwise using a woman’s self-report [[13](#_ENREF_13)]. |
| **Community-level variables** | |
| Place of residence | categorized as urban and rural |
| Community-level women's literacy | the aggregate value of community-level women's literacy was generated by the percentage of women population in the cluster that had at least a primary level of literacy derived from the individual participants’ data.Categorized asa **“**high” concentration of literate women in the Kebeles if the percentage of women who were at least primary level of education >50% and “low” otherwise [[14](#_ENREF_14),[15](#_ENREF_15)]. |
| Community-level poverty | the aggregate value of community-level poverty was generated by the percentage of households in the cluster in the poorest and poorer quintile derived from the individual participants’ data.Categorized asa **"**high” concentration of poverty in the Kebeles if the percentage of households in the poorest and poorer quintile >50% and “low” otherwise[[14-16](#_ENREF_14)]. |
| Community-level social media use | the aggregate value of community-level social media use was generated by a percentage of study participants who listens to the radio, watches television and reads the newspaper in cluster derived from the individual participants’ data.Categorized as **“**high” concentration of social media use in the Kebeles if the proportion of a study participant who uses at least one social media >50% and “low” otherwise[[15](#_ENREF_15),[17](#_ENREF_17)]. |
| Distance from nearest HF | was considered as “close” to HF if a woman reported a walking hour of less than 30 minutes by foot to reach the nearest HFs and “far” otherwise [[8](#_ENREF_8)]. The aggregate value of community-level distance was generated by the percentage of a study participant walking hours to the nearest HF in a cluster derived from the individual participants’ data.Categorized as **“**not big problem” in the Kebeles if>50% of study participants reported as “close” and “a big problem” otherwise [[8](#_ENREF_8),[18](#_ENREF_18),[19](#_ENREF_19)]. |

**The wealth index** was calculated by using principal component analysis (PCA) as a combined indicator of life standard based on 42 questions related to ownership of prudently selected household assets like the owner of the house, materials used for house construction, the number of rooms in a house, size of agricultural land, presence of herd or farm animals and livestock, types of fuel used for cooking, possession of improved sanitation and water facility [[11](#_ENREF_11),[20](#_ENREF_20)]. The multiple response variables were categorized into binary responses (yes/no) and “I don’t know” responses often coded as 999 to zero (Table 3). Similarly, the "I don't know" response and any missing value are often coded as 999 to zero for the continuous variables [[21](#_ENREF_21)]. The predictors that can differentiate between comparatively "poor" and "rich" households were selected using simple frequency analysis. Thus, our PCA didn’t comprise any assets or variables that were possessed by less than 5% or more than 95% of the individuals in the sample [[8](#_ENREF_8),[21](#_ENREF_21)]. Finally, the component factors or wealth index scores were ranked into 5 classes such as lowest, second-lowest, middle, second-highest, and highest [[11](#_ENREF_11),[20](#_ENREF_20)]. The PCA was carried out for the computation of the wealth index [[20](#_ENREF_20),[21](#_ENREF_21)]. All the basic assumptions of PCA were checked before ranking the components' factor scores into wealth quintiles. We removed the variables from PCA that didn’t satisfy the assumptions such as the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy less than 0.5, commonalities less than 0.5, and variables that contain the complex structure (high loading correlation >0.4 on greater than one component) [[20](#_ENREF_20),[22](#_ENREF_22)].

**S1 File Table 3:** Some of variables and given values to facilitate the computation of wealth index

|  |  |  |
| --- | --- | --- |
| S.no | Variables | Given values |
| 1 | Main source of drinking water | Improved: Piped water, tube well or borehole, protected well, protected spring = 1  Unimproved: Unprotected well, Unprotected spring, Lake/pond/stream/canal = 0 |
| 2 | Main source of water used for other purposes such as cooking and hand washing | Improved: Piped water, tube well or borehole, protected well, protected spring = 1  Unimproved: Unprotected well, Unprotected spring, Lake/pond/stream/canal, Surface water (River/dam) = 0 |
| 3 | Where is that water source located? | In own dwelling or yard/plot = 1  Elsewhere = 0 |
| 4 | Type of toilet facilities | Improved: comprise any non-shared toilet of the subsequent kinds: pour/flush toilets to septic tanks, piped sewer systems, and pit latrines; pit latrines with slabs; ventilated improved pit (VIP) latrines; and composting toilets = 1  Unimproved: Pit latrine without slab/open pit, bucket toilet and hanging toilet = 0 |
| 5 | Where is this toilet facility located? | In own dwelling or yard/plot = 1  Elsewhere = 0 |
| 6 | Type of fuel the household mainly use for cooking | Clean fuels include electricity, liquefied petroleum gas (LPG), natural gas, and biogas = 1  Solid fuels include coal, charcoal, wood, straw/shrub/grass, agricultural crops, and animal dung = 0 |
| 7 | Where is the cooking usually done? | In the house and outdors = 0  In a separate building = 1 |
| 8 | Who is the owner of the house? | Me = 1  Rental, family, and relative = 0 |
| 9 | Main material of the roof of the house | Natural roofing (no roof, mud, and sod) = 0  Rudimentary and finished roofing = 1 |
| 10 | Main material of the floor of the house | Natural floor (Earth/sand, dung) = 0  Rudimentary and finished floor = 1 |
| 11 | Main material of the wall of the house | Natural walls (no walls, cane/palm/trunks/bamboo/ree, dirt) = 0  Rudimentary and finished wall = 1 |
| 12 | All other categorical variables were considered as yes and no form | Yes = 1 and no =0 |
| 13 | All continuous variables were treated as continuous |  |
| 14 | “I don’t know” response often coded as 999 for categorical variables | 999 = 0 |
| 15 | “I don’t know” response and any missing value often coded as 999 to zero | 999 and missing value = 0 |

**S1 File Table 4:** Multilevel regression analysis result of a random intercept model for ODS knowledge variation at cluster level in north zone of Sidama region, Ethiopia, 2022 (N = 1,130)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure of variation | Model 0 (95% CI) | Model 1 (95% CI) | Model 2 (95% CI) | Model 3 (95% CI) | Model 4 (95% CI) |
| Variance of intercept | 0.06 (0.03, 0.11) | 0.05 (0.02, 0.09) | 0.04 (0.02, 0.08) | 0.03 (0.02, 0.09) | 0.02 (0.01, 0.09) |
| ICC percentage | 11.91 (6.33, 21.28) |  |  |  |  |
| MPR | 1.26 (1.17, 1.37) | 1.22 (1.14, 1.33) | 1.19 (1.14, 1.31) | 1.17 (1.14, 1.33) | 1.14 (1.09, 1.33) |
| Model fitness |  |  |  |  |  |
| Log-likelihood ratio | -2916.75 | -2755.60 | -2914.08 | -2754.91 | -2742.88 |
| AIC | 5839.51 | 5555.20 | 5840.16 | 5559.83 | 5549.84 |
| BIC | 5854.59 | 5665.86 | 5870.34 | 5685.58 | 57541.51 |
| Variance of random coefficient of women decision making power |  |  |  |  | 0.21 (0.10, 3.22) |

ICC: Intra-class correlation coefficient; MPR: Median prevalence ratio; AIC: Akaike information criteria; BIC: Bayesian information criteria; CI: confidence interval.

**Effect modification result of ODS knowledge**

We We entered the interaction terms in the final model for women's education and women's decision making, women's education and women's place of residence, women's education and women's mass media use, women's occupation and women's decision making power to see if women's education modifies the effect of women's decision making power, if women's place of residence modifies the effect of women’s education, .if women's education modifies the effect of women's mass media use, if women's occupation modifies the effect of women's decision making power. None of the interaction terms was statistically significant, implying the absence of a significant effect modification.

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