Deworming among preschool age children in sub-Saharan Africa: pooled prevalence and multi-level analysis

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Abstract

Background: Sub-Saharan Africa (SSA) preschool age children are more vulnerable to soil-transmitted helminths (STH) which caused millions of morbidity because of low socioeconomic status and lack of clean water and sanitation. Despite this problem, there is minimal evidence on the prevalence and factors associated with deworming medication utilization among preschool age children (pre-SAC) in SSA regions. Hence this study aimed to assess the prevalence and determinants of deworming among preschool age children in SSA.

Methods: Demographic and Health Survey (DHS) data were used for this study with a total weighted 192,652 children aged 24–59 months. Taking deworming medication in the 6 months preceding the interview was our outcome of interest. A multi-level binary logistic regression model was fitted. Adjusted odds ratio (AOR) with 95% confidence interval (CI) was taken to identify significant variables.

Results: The prevalence of deworming medication utilization among preschool age children in SSA was 45.03% (95% CI 44.46%, 45.60%), ranging from 41.82% in Malawi to 50.5% in Lesotho. It was 44.91% (95% CI 44.32%, 45.51%) among countries having endemic STH infection and 46.01% (95% CI 43.64%, 48.38%) for none endemic countries. Factors such as; secondary and above women education [AOR = 2.18; 95% CI 2.10, 2.26], occupation [AOR = 1.31; 95% CI 1.27, 1.34], having ≥ 11 family members [AOR = 0.68; 95% CI 0.64, 0.70], household media exposure [AOR = 1.16; 95% CI 1.13, 1.19] and richer wealth status [AOR = 1.23; 95% CI 1.16, 1.27], vitamin A supplementation [AOR = 6.18; 95% CI 6.02, 6.33] and living rural residence [AOR = 0.94; 95% CI 0.92, 0.98] have significantly associated with deworming among preschool age children.

Conclusions: Utilization of deworming medication among pre-SAC children in sub-Saharan Africa is below half. Factors, such as the education status of women, family size, household media exposure, wealth status, diarrhea, vitamin A supplementation, and residence were significant variables. To increase the utilization of deworming medication for pre-SAC, WHO should work as an integrated approach with other stakeholders, by strengthening women’s education,
Background
Soil-transmitted helminths (STH) affect nearly two billion people worldwide, 90% of whom are living in sub-Saharan Africa [1–3]. The disease affects people living in rural or deprived urban settings with low socioeconomic status, poor sanitation, and a lack of clean water [2, 3]. Moreover, since they usually play in fecal contaminated soil and their weak immunity, preschool and school-aged children are the most vulnerable group and harbor the greatest numbers of intestinal worms [2, 4–6].

This disease caused millions of morbidity among under-five children who live in developing countries [7]. They experience stunting, and diminished physical fitness as well as impaired memory and cognition [2, 4]. The social and economic consequences of helminthic infections go far beyond the obvious health impacts, including lost school attendance and productive working time [6].

It is recommended to treat all preschool age children with deworming drugs, with 6-month intervals in areas where helminth infection is endemic [8]. The strategic plan was to eliminate STH as a public health problem in children by 2020 [9]. Annual or biannual preventive chemotherapy (deworming), using a single dose of albendazole or mebendazole is recommended as a public health intervention for all young children 12–23 months of age, preschool children 2–5 years of age, and school-age children 6–12 years of age living in areas where the baseline prevalence of any soil-transmitted infection is 20% or more among children [10]. Periodic STH deworming has been shown to prevent anemia among preschool age children (pre-SAC) by avoiding iron loss ascribed to hookworm infection [11]. It also improves growth [12], and motor and language development in pre-SAC [13]. The delivery of albendazole every 6 months can reduce 28% of diarrhea episodes in pre-SAC [14], reduce stunting by 9.4%, and improve weight by 35% in infants and pre-SAC within 2 years [14, 15].

Global deworming programs aim to reach 75% of at-risk preschool-age children by 2020 [5, 9]. But, between 2004 and 2017 the mean global deworming coverage in pre-SAC was estimated at 36% [16].

Therefore this study aimed to assess the prevalence of deworming medication utilization and to identify the individual and community-level factors associated with it among pre-SAC in the sub-Saharan African countries.

Methods
Study design, setting, and period
The data source was the latest standard Demographic and Health Survey (DHS) data set of sub-Saharan African countries within 10 years (2010–2020). To get all parameters and a large sample size which make representative of the source of population, we used the standardized data set [17]. DHS collects data that are comparable across countries. The surveys are nationally representative of each country and population-based with large sample sizes [17].

The sub-Saharan is the area in the continent of Africa that lies south of the Sahara desert and consists of four vast and distinct regions, i.e., Eastern Africa, Central Africa, Western Africa, and Southern Africa. Together, they constitute an area of 9.4 million square miles and a total population of 1.1 billion inhabitants [18].

Populations
All children aged 6–23 months preceding 5 years of the survey period across 33 sub-Saharan African countries were our source population, whereas children aged 24–59 months in the selected Enumeration Areas (EAs) or primary sampling units of the survey clusters were our study populations. The mother or the caregiver was interviewed for the survey in each country and mothers who had more than one child within the 2 years preceding the survey were asked questions about the most recent child [19]. Moreover, from the included countries’ data set, children in the age category of 24–59 months who are not assessed to deworm medication based on the DHS guideline, and have the missing value of the outcome variable were excluded.

Sample size determination and sampling method
Of the total of 47 countries located in sub-Saharan Africa, only 41 countries had Demographic and Health Survey Report. Of these, five countries namely; Central Africa Republic (DHS report 1994/95), Eswatini (DHS report 2006/07), Sao Tome Principe (DHS report 2008/09), Madagascar (DHS report 2008/09), and Sudan (DHS report 1989–90) have a survey report before the 2010 survey year and excluded from further analysis. Moreover, three countries (Botswana, Mauritania, and Eritrea) were excluded due to the DHS dataset not being publicly available. Finally, a total of 33 sub-Saharan African countries were represented in this study in the four...
were used to generate both descriptive and analytic statistics to describe variables in the study using statistical measurements.

Model building for multi-level analysis
Since the DHS data have hierarchical nature, children were nested within a cluster that violates the standard logistic regression model assumptions such as the independence and equal variance assumptions, a multi-level binary logistic regression model was fitted. Four models were fitted for multi-level analysis. The first was the null model (Model 1) which contains only the outcome variables. It is used to check the variability of deworming utilization across the cluster. The second (Model 2) and the third (Model 3) multi-level models contain individual-level variables and community-level variables, respectively. In the fourth model (Model 4), both individual and community-level variables were fitted simultaneously with the prevalence of deworming utilization. Model comparisons were done with a standard logistics regression model using the log-likelihood and deviance test and the model with the highest log likelihood and lowest deviance was selected as the best-fitted model. The variance inflation factor (VIF) was used to detect multicollinearity between independent variables. Based on the STATA analysis result, all variables had VIF values less than 10 and the mean VIF value of the final model was 1.50 which shows no multicollinearity. In the fixed effect measure of association, the variable which has a significant association with adjusted odds ratio (AOR) ratios was declared using a p-value of < 0.05 with 95% confidence intervals. The random effect used to measure the variation was estimated using the median odds ratio (MOR), intra class correlation coefficient (ICC), and proportional change in variance (PCV) [26–28].

Results
Socio-demographic characteristics of mothers or caregivers
A total weighted sample of 192,652 children of age 24–59 months were included in this study. Nearly half (50.29%) of mothers of children were found in the age group of 20–34 years, with a median age of 29 (IQR: 25, 35) years. More than two-fifths (41.63%) of mothers/carers had no formal education. Most of the respondents lived in West Africa and East Africa regions (79.71%) and from rural (68.48%) residences. More than three-fourths (78.7%) of the children have taken vitamin A in the last 6 months (Table 2).

The pooled magnitude of deworming among preschool age children in sub-Saharan Africa
The overall pooled estimate of deworming among preschool age children in sub-Saharan African countries

Study variables
The outcome variable of this study was taking deworming medication by preschool aged children. During the survey, their mother was asked questions about their under 5 years children who took deworming medication in the 6 months preceding the interview, and if they answered ‘yes’ they are considered as taking deworming [17]. Endemicity was categorized as endemic and non-endemic based on the WHO report on STH prevalence [9]. Individual and community-level independent variables have been studied (Table 1).

Data processing and analysis
The standard DHS dataset was downloaded in STATA format then cleaned, integrated, transformed, and appended to produce favorable variables for the analysis. Microsoft Excel and STATA version 14.2 software [25] were used to generate both descriptive and analytic

regions namely Eastern Africa, (Burundi, Comoros, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe), Central Africa (Angola, Cameroon, Chad, the Democratic Republic of the Congo, Republic of the Congo, Gabon), Western Africa (Benin, Burkina Faso, Ivory Coast, Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo) and Southern Africa (Lesotho, Namibia, South Africa) [20]. Of these, only five countries had not the endemic prevalence of STH infections based on WHO reports [9].

In general, the most recent standard census frame was used in all of the surveys conducted in the selected countries. Typically, DHS samples are stratified by administrative geographic region and by urban/rural areas within each region. In the first stage of sampling, enumeration areas (EAs) were selected with probability proportional to size within each stratum. In selected EAs, a fixed number of households is selected by the systematic sampling method in the second stage of sampling. Following the listing of the households, a fixed number of households is selected by equal probability systematic sampling in the selected cluster [17].

The children's records or kid's records (KR) DHS datasets were used. Weighted values were used before using the DHS dataset to restore the representativeness of the sample data. Since the overall probability of selection of each household is not constant. DHS guidelines set four sampling weighting methods and from that, we used the individual weight for women (v005). Individual sample weights are generated by dividing (v005) by 1,000,000 before being used to approximate the number of cases [21]. Finally, a total weighted sample of 192,652 children in the age category of 24–59 months from all 33 countries was included in this study.
was 45.03% (95% CI 44.46%, 45.60%), with \( I^2 = 74.8\% \) and ranging from 41.82% in Malawi to 50.5% in Lesotho (Fig. 1). The \( I^2 \) value shows that there were moderate true variabilities (the variability not by chance) of deworming among preschool age children in 33 countries, then further subgroup analyses were done based on the endemcity. Therefore the prevalence of deworming among 28 SSA countries that have endemic STH infection was 44.91% (95% CI 44.32%, 45.51%) with \( I^2 = 75.2\% \), whereas it was 46.01% (95% CI 43.64%, 48.38%) with \( I^2 = 74.3\% \) among 5 SSA countries which have none endemic STH infection (Fig. 2).

Multi-level analysis of determinants of deworming among preschool age children in sub-Saharan Africa

Model comparison and random effect analysis

Of the four models of multi-level analysis, model 4 is the better model, since it has the lowest deviance value. About 10% of the variations in deworming among preschool children in SSA were attributed to cluster differences. Moreover, about 43.5% of the variation in deworming among preschool children in SSA was explained by both community-level and individual-level variables.

Fixed effect analysis

In the final adjusted model of model 4 multi-level logistics regression analysis variables such as; education status of women, media exposure and wealth status of the household, family size, having diarrhea, vitamin A supplementation, and residence had a significant association with taking deworming medication of preschool age children in SSA.

Women who have primary and above primary educational status were 1.95 and 1.18 times more likely to take their child deworming medication than women with no formal education [AOR = 1.95; 95% CI 1.89, 2.00] and [AOR = 2.18; 95% CI 2.10, 2.26], respectively.

The odds of having deworming among preschool age children whose mothers had worked were 1.47 times
higher as compared to children from no worked mothers [AOR = 1.31; 95% CI 1.27, 1.34].

As the household family size increase to 5–10 and ≥ 11 members, the odds of deworming preschool children decrease by 11% and 36% [AOR = 0.93; 95% CI 0.89, 0.96] and [AOR = 0.68; 95% CI 0.64, 0.70], respectively.

Children who lived in households that have media exposure and richer wealth status were 16% and 23% more likely to take children deworming medication as compared to households that have no media exposure [AOR = 1.16; 95% CI 1.13, 1.19] and [AOR = 1.23; 95% CI 1.16, 1.27], respectively.

Table 2 Socio-demographic characteristics of the mothers/caregivers and the children in a study of deworming among preschool age children in sub-Saharan Africa

| Variables                                      | Categories                        | Weighted frequency (n) | Weighted percentage (%) |
|------------------------------------------------|-----------------------------------|------------------------|-------------------------|
| Socio-demographic characteristics and health service utilization of the mothers |                                    |                        |                         |
| Age of women (years)                          | 15–19                             | 46,327                 | 24.05                   |
|                                               | 20–34                             | 96,885                 | 50.29                   |
|                                               | 35–49                             | 49,440                 | 25.66                   |
| Educational attainment of women               | No education                      | 80,195                 | 41.63                   |
|                                               | Primary education                 | 59,819                 | 31.05                   |
|                                               | Secondary and above               | 52,639                 | 27.32                   |
| Occupation of women                           | Not working                       | 57,833                 | 30.10                   |
|                                               | Worked                            | 134,819                | 69.90                   |
| Household family size                         | 1–4                               | 46,630                 | 24.2                    |
|                                               | 5–10                              | 119,501                | 62.03                   |
|                                               | ≥ 11                              | 26,521                 | 13.77                   |
| Media exposure                                | No                                | 70,703                 | 36.77                   |
|                                               | Yes                               | 121,607                | 63.23                   |
| Wealth index                                  | Poorer                            | 84,006                 | 43.61                   |
|                                               | Middle                            | 38,596                 | 20.03                   |
|                                               | Richer                            | 70,050                 | 36.36                   |
| Child related characteristics                 |                                    |                        |                         |
| Sex of child                                  | Male                              | 96,867                 | 50.28                   |
|                                               | Female                            | 95,785                 | 49.72                   |
| Age of child                                  | 24–35 months                      | 48,162                 | 33.21                   |
|                                               | 36–47 months                      | 48,936                 | 33.74                   |
|                                               | 48–59 months                      | 47,926                 | 33.05                   |
| Vitamin A in the last 6 months                | No                                | 41,037                 | 21.3                    |
|                                               | Yes                               | 151,615                | 78.7                    |
| Diarrhea in 2 weeks                           | No                                | 168,979                | 87.71                   |
|                                               | Yes                               | 23,673                 | 12.29                   |
| Community-level variables                     |                                    |                        |                         |
| Income level of the country                   | Lower                             | 126,468                | 65.68                   |
|                                               | Lower middle                      | 50,948                 | 26.46                   |
|                                               | High middle                       | 15,128                 | 7.86                    |
| Survey year                                   | < 2015                            | 94,680                 | 49.17                   |
|                                               | ≥ 2015                            | 97,864                 | 50.83                   |
| Residence                                     | Urban                             | 60,537                 | 31.42                   |
|                                               | Rural                             | 132,116                | 68.58                   |
| Region in SSA                                  | Central Africa                    | 34,571                 | 17.95                   |
|                                               | East Africa                       | 75,313                 | 39.11                   |
|                                               | West Africa                       | 78,178                 | 40.6                    |
|                                               | Southern Africa                   | 4,483                  | 2.33                    |
Children who took vitamin A supplementation for 6 months were six times more likely to have deworming medication as compared to those who did not \([\text{AOR} = 6.18; 95\% \text{ CI } 6.02, 6.33]\). Moreover, children who had diarrhea in the last week before the survey were a 16% higher chance of getting deworming medication as compared to no diarrhea episode \([\text{AOR} = 1.17; 95\% \text{ CI } 1.12, 1.21]\). Children who live in rural residence have 6% less likely to take deworming medication as compared to urban \([\text{AOR} = 0.94; 95\% \text{ CI } 0.92, 0.98]\) (Table 3).

**Discussion**

This study aimed to identify factors associated with the utilization of deworming medication as chemoprophylaxis among pre-SAC in sub-Saharan African countries. Based on this, the pooled estimate of deworming medication utilization among preschool age children in sub-Saharan African countries was 45.03% (95% CI 44.46%, 45.60%), ranging from 41.82% in Malawi to 50.5% in Lesotho. It was 44.91% (95% CI 44.32%, 45.51%) among STH infection endemic SSA countries, whereas 46.01% (95% CI 43.64%, 48.38%) among non-endemic countries. This is higher than the schistosomiasis and soil-transmitted helminthiasis progress report, 2020 which has 9.21% coverage among 13 African countries [29]. But, our study is lower than a study conducted in 39 countries UNICEF offices (49.1%) [5] and global deworming programs aim to reach 75% pre-SAC by 2020 [5, 9]. These differences might be due to variations in socio-cultural aspects among study participants and due to differences in awareness level and familiarity with the importance of deworming for the prevention of STH infections in preschool children [30, 31]. This data was collected based on standardized similar questionnaires developed. Even if there is no significant difference, the higher prevalence of deworming in non-endemic countries might be due to increased health-seeking behavior and adaptations of the deworming program eventually leading to controlling the
STH infections. The difference in sample size included in the two groups might be the other variations.

This study results that women who have primary and above primary educational status were more likely to have dewormed children than no formal education. This is in line with studies in Cameroon [26], and Ghana [27]. This shows that when mothers become more educated, they are more likely to utilize the deworming medication for their children and themselves. This might be because the educated mother has health-related information and are better at practicing it [27, 28].

In this study, the odds of taking deworming medication among pre-SAC whose mothers had worked were higher. This is supported by a study conducted in Ghana [27], which showed, that working mothers were more likely to deworm their children relative to not working counterparts. This is because of that, the employed people might have exposure to the importance of supplements and the ability to perches medications [24, 27].

As the household family size increase to 5–10 and > 11 members, the odds of deworming preschool children decrease. This is comparable with a study in Ethiopia [30]. This might be because as family size increases they deserve more attention and need more time. As a result, it might be difficult to fill all the needed care for children [30].

In this study, households which have media exposure were more likely to have dewormed children as compared to households that have no media exposure. It is in line with studies in India [29] and 26 sub-Saharan African countries [30]. This is supported by a study done in Nigeria which showed that utilization of health care can be improved when maternal media exposure increases [25]. Exposure to media could have a tremendous role in

### Sub group analysis of deworming utilization among Pre SAC in SSA by Endemicity

| Country       | Year       | Magnitude (95% CI) | % weight |
|---------------|------------|--------------------|----------|
| **Endemic**   |            |                    |          |
| Angola        | 2015/2016  | 44.39 (43.48, 45.30) | 4.03     |
| Burkina Faso  | 2016       | 45.34 (44.36, 46.33) | 3.96     |
| Benin         | 2017/2018  | 44.59 (43.20, 45.99) | 3.55     |
| Rep of Congo  | 2013/2014  | 44.79 (43.28, 46.30) | 3.42     |
| Congo         | 2011/2012  | 43.69 (41.31, 46.00) | 2.56     |
| Ivory Coast   | 2011/2012  | 45.86 (44.14, 47.51) | 3.07     |
| Cameroon      | 2018       | 42.32 (41.11, 43.53) | 3.74     |
| Ethiopia      | 2016       | 43.95 (40.97, 46.99) | 2.01     |
| Gabon         | 2012       | 44.78 (41.82, 47.74) | 2.04     |
| Ghana         | 2014       | 45.79 (43.80, 47.79) | 2.90     |
| Gambia        | 2019/2020  | 45.60 (43.95, 47.25) | 3.26     |
| Guinea        | 2018       | 49.32 (47.44, 51.20) | 3.03     |
| Kenya         | 2014       | 46.23 (43.26, 49.20) | 2.03     |
| Comoros       | 2012       | 47.08 (45.39, 48.78) | 3.22     |
| Liberia       | 2019/2020  | 45.87 (44.35, 47.40) | 3.40     |
| Mali          | 2018       | 41.82 (40.57, 43.07) | 3.70     |
| Malawi        | 2015/2016  | 45.71 (44.18, 47.25) | 3.39     |
| Mozambique    | 2015       | 45.15 (44.23, 46.06) | 4.03     |
| Nigeria       | 2018       | 46.68 (45.28, 48.09) | 3.54     |
| Niger         | 2012       | 44.87 (43.12, 46.62) | 3.17     |
| Sierra Leone  | 2019       | 44.14 (43.16, 45.60) | 3.46     |
| Senegal       | 2019       | 42.89 (41.82, 43.96) | 3.88     |
| Chad          | 2014/2015  | 42.83 (41.36, 44.30) | 2.45     |
| Togo          | 2013/2014  | 44.41 (42.86, 45.96) | 3.38     |
| Tanzania      | 2015/2016  | 43.21 (41.86, 44.56) | 3.59     |
| Uganda        | 2016       | 45.89 (44.21, 47.57) | 3.24     |
| Zambia        | 2018       | 46.08 (43.85, 48.31) | 2.68     |
| **Subtotal**  |            | 44.91 (44.32, 45.51) | 89.03    |

| Non endemic   |            |                    |          |
|---------------|------------|--------------------|----------|
| Burundi       | 2016/2017  | 44.96 (43.76, 46.17) | 3.75     |
| Lesotho       | 2014       | 50.14 (46.50, 53.77) | 1.60     |
| Namibia       | 2013       | 42.35 (38.68, 46.03) | 1.58     |
| Rwanda        | 2019/2020  | 48.52 (45.90, 51.14) | 2.31     |
| South Africa  | 2016       | 44.11 (40.70, 47.52) | 1.73     |
| **Subtotal**  |            | 46.01 (43.64, 48.38) | 10.97    |
| **Overall**   |            | 45.03 (44.46, 45.60) | 100.00   |

NOTE: Weights are from random effects analysis

![Fig. 2](Subgroup analysis of the magnitude of deworming among preschool age children in SSA based on endemicity)
## Table 3  Multi-level analysis of factors associated with deworming among children aged 24–59 months in SSA

| Variables                  | Categories | Null model | Model 1 AOR [95% CI] | Model 2 AOR [95% CI] | Model 3 AOR [95% CI] |
|----------------------------|------------|------------|----------------------|----------------------|----------------------|
| Age of women (years)       | 15–19      | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | 20–35      | 1.15 [1.11, 1.19] | –                    | 1.15 [1.11, 1.18]*   | 1.30 [1.26, 1.35]*   |
|                            | 36–49      | 1.31 [1.27, 1.36] | –                    | 1.30 [1.26, 1.35]*   | 1.30 [1.26, 1.35]*   |
| Educational attainment of women | No education | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Primary education | 1.95 [1.89, 2.00]*** | –                    | 1.95 [1.89, 2.00]*** | 2.18 [2.10, 2.26]*** |
|                            | Secondary and above | 2.20 [2.12, 2.27]*** | –                    | 2.18 [2.10, 2.26]*** | 2.18 [2.10, 2.26]*** |
| Occupation of women        | Not worked | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Worked     | 1.30 [1.27, 1.35] | –                    | 1.31 [1.27, 1.34]*** | 1.31 [1.27, 1.34]*** |
| Household family size       | 1–4        | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | 5–10       | 0.92 [0.90, 0.95] | –                    | 0.93 [0.89, 0.96]*   | 0.93 [0.89, 0.96]*   |
|                            | ≥ 11       | 0.67 [0.64, 0.70] | –                    | 0.68 [0.64, 0.70]**  | 0.68 [0.64, 0.70]**  |
| Media exposure              | No         | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Yes        | 1.17 [1.14, 1.20]*** | –                    | 1.16 [1.13, 1.19]**  | 1.16 [1.13, 1.19]**  |
| Wealth index                | Poorer     | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Middle     | 1.09 [1.05, 1.13]* | –                    | 0.92 [0.71, 1.17]    | 0.92 [0.71, 1.17]    |
|                            | Richer     | 1.26 [1.22, 1.30]*** | –                    | 1.23 [1.16, 1.27]*   | 1.23 [1.16, 1.27]*   |
| Sex of child                | Male       | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Female     | 0.98 [0.95, 1.00] | –                    | 0.98 [0.95, 1.01]    | 0.98 [0.95, 1.01]    |
| Age of child                | 24–35 months |          | Ref.                 | Ref.                 | Ref.                 |
|                            | 36–47 months | 0.99[0.96, 1.02] | –                    | 0.99[0.96, 1.02]     | 0.99[0.96, 1.02]     |
|                            | 48–59 months | 1.00[0.97, 1.03] | –                    | 1.00[0.97, 1.03]     | 1.00[0.97, 1.03]     |
| Vitamin A                   | No         | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Yes        | 6.16 [6.01, 6.32]*** | –                    | 6.18 [6.02, 6.33]*** | 6.18 [6.02, 6.33]*** |
| Diarrhea                    | No         | Ref.       | Ref.                 | Ref.                 | Ref.                 |
|                            | Yes        | 1.16 [1.13, 1.21]** | –                    | 1.17 [1.12, 1.21]**  | 1.17 [1.12, 1.21]**  |
| Community-level variables   | Income level of the country | Lower-income | Ref.                 | Ref.                 | Ref.                 |
|                            | Lower middle | –                      | 1.02 [1.01, 1.04] | 0.93[0.92,0.99]     | 0.93[0.92,0.99]     |
|                            | Upper middle | –                      | 0.99[0.94,1.04]  | 1.95 [0.88, 1.02]   | 1.95 [0.88, 1.02]   |
| Survey year                 | < 2015     | –                      | Ref.                 | Ref.                 | Ref.                 |
|                            | ≥ 2015     | –                      | 0.97 [0.95, 0.99] | 0.99[0.96,1.03]     | 0.99[0.96,1.03]     |
| Residence                   | Urban      | –                      | Ref.                 | Ref.                 | Ref.                 |
|                            | Rural      | –                      | 0.66 [0.64, 0.67]** | 0.94[0.92,0.98]**     | 0.94[0.92,0.98]**     |
| Region                      | Central Africa |              | Ref.                 | Ref.                 | Ref.                 |
|                            | East Africa | –                      | 1.02 [0.98,1.06] | 0.95 [0.90, 1.00]   | 0.95 [0.90, 1.00]   |
|                            | West Africa | –                      | 1.03 [0.99, 1.07] | 0.97 [0.90, 1.00]   | 0.97 [0.90, 1.00]   |
|                            | Southern Africa | –                  | 1.00 [0.93, 1.08] | 1.01 [0.92, 1.12] | 1.01 [0.92, 1.12] |
| Random effect               | Variance   | 0.33                  | 0.24                 | 0.30                 | 0.23                 |
|                            | ICC        | 0.10                  | 0.07                 | 0.08                 | 0.06                 |
|                            | MOR        | 1.50                  | 1.26                 | 1.41                 | 1.24                 |
|                            | PCV        | Ref.                  | 37.5%                | 10.0%                | 43.5%                |
| Model comparison            | Deviance   | 130,830               | 80,065               | 129,948              | 80,000               |
|                            | Mean VIF   | –                     | 1.50                 | 1.62                 | 1.87                 |

AOR adjusted odds ratio, CI confidence interval, ICC inter cluster correlation coefficient, MOR median odds ratio, PCV proportional change in variance, VIF variance inflation factors

*P value < 0.05
**P value < 0.01
***P value < 0.001
increasing awareness and knowledge for mothers and the dissemination of health-related information [30].

Children who lived in households that have richer wealth status were more likely to take their child’s deworming medication as compared to households that have poorer households. This is supported by wealthier women being more likely to use deworming drugs than the poorer [32]. This might be linked to the ability to perches deworming medication if not free camping supplementation.

Children who took vitamin A supplementation (VAS) within 6 months were six times more likely to have deworming medication as compared to those who did not. This is maintained by a study in Ethiopia [30]. This might be because VAS and deworming supplements are provided in a campaign integrative way [30].

Moreover, children who had diarrhea in the last week before the survey were a 16% higher chance of getting deworming medication as compared to no diarrhea episode. This is similar to a study in Ethiopia [30]. This might be because, during diarrheal disease treatment, mothers/caregivers might get counseling services regarding deworming supplementation [30]. Moreover, the drug used for the treatment of diarrheal disease and deworming are similar [33].

Children who lived in rural residences were less likely to take deworming medication as compared to urban. This is supported by a study in Ghana [34]. This might be due to the availability and accessibility of health services and deworming programs. Moreover, the difference in socioeconomic inequalities between rural and urban might contributed to this difference [34].

**Strength and limitation**

The main strength of this study was the use of large sample data which is weighted by individual weight that makes it representative of each country’s levels as well as the sub-Sahara Africa region. But, since the data were secondary data collected cross-sectional, would be prone to recall and social desirability bias. The other limitation is that since all populations in each SSA country/sub-nation would not have the same higher prevalence of soil-transmitted helminths, they might not be populations that need regular deworming. But we cannot get a national report on the prevalence of soil-transmitted helminths in each SSA country/sub-nation in each country’s DHS year.

**Conclusion and recommendation**

The prevalence of deworming medication among pre-SAC children in sub-Saharan Africa is below half. Individual-level factors, such as the education status of women, family size, media exposure and wealth status of the household, having diarrhea, and vitamin A supplementation, and community-level variables such as residence were significant variables for utilization of deworming medication among pre-SAC in sub-Saharan Africa.

There are six 2030 global targets for soil-transmitted helminthiases and of which achieving and maintaining the elimination of STH morbidity in pre-school and school-age children is the first one [35]. Therefore, to increase the utilization of deworming medication among pre-SAC in sub-Saharan Africa, WHO should work as an integrated approach with other stakeholders, to strengthen women’s education, household, and media exposure. Maternal employment should be promoted and prior attention should be given to rural children.

**Abbreviations**

AOR: Adjusted odds ratio; ANC: Antenatal care; CI: Confidence interval; CSA: Central Statistical Agency; EDHS: Ethiopian Demographic and Health Survey; KR: Kids record; MOH: Ministry of Health; pre-SAC: Pre-school age children; SDG: Sustainable Development Goal; STH: Soil-transmitted helminthic; WHO: World Health Organization.

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**Author contributions**

The conception of the work, design of the work, acquisition of data, analysis, and interpretation of data was done by DGB, DC, MD, WS, YY, and DS. Data curation, drafting of the article, revising it critically for intellectual content, validation, and final approval of the version to be published was done by DGB, AAA, AMS, DAB, MAS, HBE, TDJ, YP, YYS, and AAK. All authors read and approved the final manuscript.

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**Availability of data and materials**

Data are available to publically access from the open databases. It can be accessed from the following website: https://dhsprogram.com/data/dataset_admin/login_main.cfm?CFID=10818526&CFToken=131014a480ef56-6E0C6B7F-F551-E6B2-50.

**Declarations**

**Ethics approval and consent to participate**

All methods were carried out following relevant guidelines and regulations of the Institutional Review Boards (IRB) of the University of Gondar (UG) and the Demographic and Health Surveys (DHS) program. Informed consent was waived from the International Review Board of Demographic and Health Surveys (DHS) program data archivists after the consent paper was submitted to DHS Program/ICF International Inc, a letter of permission to download the dataset for this study. The dataset was not shared or passed on to other bodies and has maintained its confidentiality. The study is not an experimental study.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

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