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Authors: Appiah-Effah, Eugene, Boakye, Kingsley, Salihu, Tarif, Duku, Godwin Armstrong, Fenteng, Justice Ofosu-Darko, et al.

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# Determinants of Open Defecation Among Rural Women in Ghana: Analysis of Demographic and Health Surveys

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Eugene Appiah-Effah[1], Kingsley Boakye[2], Tarif Salihu[3], Godwin Armstrong Duku[1], Justice Ofosu-Darko Fenteng[4], George Boateng[4], Francis Appiah[2,3,4] and Kwabena Biritwum Nyarko[1]

[1]Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK), Department of Civil Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. [2]School of Public Health, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. [3]Department of Population and Health, University of Cape Coast, Cape Coast, Ghana. [4]Department of Social Science, Berekum College of Education, Berekum, Ghana.

**ABSTRACT:** Open defecation continuously remains a major global sanitation challenge, contributing to an estimated 1.6 million deaths per year. Ghana ranks second in Africa for open defecation and had the fourth-lowest sanitation coverage in 2010. Evidence indicates that about 32% of the rural Ghanaian population still practice open defecation due to lack of access to basic sanitation facilities, drifting the country from achieving universal access to sanitation by 2030. Women, particularly those in rural areas, are disproportionately affected by open defecation, facing heightened health risks, harassment, and a loss of dignity. Even though previous studies on open defecation in Ghana exist, they lack national representation and neglect women in rural residents who are disproportionally affected by the repercussions of open defecation. Examining that rural women will contribute to heightening their own vulnerability to health risks by practising open defecation is essential to bridging the literature gap on open defecation practices among rural women. The study investigated determinants of open defecation among rural women in Ghana using data from the female files of the 2003, 2008 and 2014 Demographic and Health Surveys (DHS). A total of 4,284 rural women with complete information on variables of interest were included in the study. The outcome variable was 'open defecation', whilst 14 key explanatory variables (e.g., age, education, wealth status, among others) were used. Two logistic regression models were built, and the outputs were reported in odds ratio. Descriptively, 42 in every 100 women aged 15 to 49 practiced open defecation (n = 1811, 95% CI = 49-52). Open defecation (OD) significantly correlated with educational attainment, wealth status, religion, access to mass media, partner's education, and zone of residence. The likelihood of practicing open defecation reduced among those with formal education [aOR = 0.69, CI = 0.56-0.85], those whose partners had formal education [aOR = 0.64, CI = 0.52-0.80], women in the rich wealth quintile [aOR = 0.12, CI = 0.07-0.20], the traditionalist [aOR = 0.33, CI = 0.19-0.57], and those who had access to mass media [aOR = 0.70, CI = 0.57-0.85]. Residents in the Savannah zone had higher odds of openly defecating [aOR = 21.06, CI = 15.97-27.77]. The prevalence of open defecation is disproportionately pro-poor, which indicates that impoverished rural women are more likely to perform it. Public health initiatives should aim to close the rich-poor divide in OD practice among rural women.

**KEYWORDS:** Demographic and Health Survey, environmental health, Ghana, open defecation, rural women

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**CORRESPONDING AUTHOR:** Godwin Armstrong Duku, Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK), Department of Civil Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Email: godwinarmstrong@gmail.com

## Introduction

Open defecation (OD) continues to remain a major global sanitation and health challenge, contributing to an estimated 1.6 million deaths per year.[1] Open defecation, by definition, is the practice of defecating in an open environment (bushes, fields, ditches, beaches, water bodies, canals and other open spaces) rather than a toilet facility.[2] Globally, 1.7 billion people lack access to improved sanitation, out of which 494 million openly defecate into the environment.[3] It is estimated that about 842 000 people in low and middle-income countries (LMICs) die annually from diarrhoeal diseases due to poor sanitation and hygiene.[4,5] This is because the unsafe management of human excreta from open defecation and poor personal hygiene are closely linked to diarrhoea and parasitic infection, including soil-transmitted helminth.[6]

All the Sustainable Development Goal (SDG) regions have experienced a decline in open defecation,[3] except sub-Saharan Africa, where population growth has slowed progress.[7] Yet, sanitation continues to be a 'poor relation' compared with drinking water when it comes to investment priorities.[8] In many African countries, there is a widespread lack of access to sanitation facilities that can provide the most basic of services. Despite this, investment priorities continue to favour drinking water over sanitation.[8,9] In Nigeria, for instance, more than130 million people, constituting two-thirds of the population, lack access to basic sanitation facilities. Similarly, in South Africa, over 18 million people face a similar challenge.[10,11] In Ghana, nearly half (47%) of the population relies on shared sanitation facilities, such as public toilets, and almost 18% practice open defecation.[3] Ghana ranks second in

Africa for open defecation[12] and had the fourth lowest sanitation coverage in 2010.[13] The prevalent poor sanitation and open defecation rates in Ghana are predominantly linked to high poverty levels and the prohibitive cost of toilet technologies[11,14] A study in the Wa Municipality of Ghana identified low income as a significant determinant of open defecation.[15] Consequently, many households who lack the financial means to construct and maintain improved sanitation solutions often resort to open defecation.[14,16] For women, the issue of privacy, safety, accessibility and socio-cultural norms and beliefs can discourage toilet use, leading to open defecation, especially during nights and menstruation periods.[17-19]

Open defecation is linked to excreta-related health risks[20] which is caused by disease-causing microbes such as viruses, bacteria, protozoan cysts and helminths.[5] Exposure to these microorganisms results in diarrhoea, typhoid, cholera and viral infections.[21] In Ghana, sanitation-related diseases are believed to be the third most prevalent disease recorded by health centres across the country.[16] Diarrhoeal disease, which is largely caused by exposure to faecal contamination, is believed to be the cause of about 6600 deaths each year, more than half (50%) of whom are children below the age of five (5).[22]

The economic impact of poor sanitation, including open defecation, on health and mortality is compounded by the negative impact on the environment and, ultimately, on economic growth. The total global cost of inadequate sanitation is estimated at USD 260 billion per year.[1] The Government of Ghana loses 420 million cedis due to poor sanitation, and open defection costs the country USD 79 million annually.[23,24] Despite these economic and health consequences, the allocation to the sanitation sector in the national budget is less than 1%, with only 0.1% directed to rural sanitation.[16,25-27] Notably, rural areas bear the brunt of open defecation, with 14% higher prevalence than the national average,[3] and 90% of open defecators dwell in rural areas and belong to the lowest wealth quintile.[15]

While approximately 32% of the rural Ghanaian population still practices open defecation, the nation is drifting from achieving universal access to sanitation by 2030, the objective set by SDG 6.2.[28] Women, especially those in rural areas, are disproportionately affected by open defecation, facing heightened health risks, harassment, and a loss of dignity.[5,29] Hence, efforts to eliminate open defecation must target these vulnerable groups.[3] Even though previous studies on open defecation in Ghana exist, they lack national representation and neglect rural residents.[15] Hence, this study extends the previous study to ascertain if open defecation practice differs by geographic settings/contexts by conducting a nationally representative study. The study's outcome will provide pragmatic recommendations and appropriate open defecation elimination strategies that will help decline open defecation, especially among rural folks and achieve the sustainable development goal.

## Methods

### *Data source*

The study used the female file of the 2003, 2008 and 2014 Ghana Demographic and Health Survey (GDHS) waves. The study excluded previous surveys before 2003 since most of the key explanatory and outcome variables were not captured in those surveys. These surveys are implemented by the Ghana Statistical Service (GSS), the Ghana Health Service (GHS), and the National Public Health Reference Laboratory (NPHRL) of the GHS, whilst ICF International provides technical assistance through the DHS programme. These surveys objectively provide current evidence on various demographic and health-specific topics such as fertility levels and preferences, childhood deaths, contraception and family planning methods, maternal and child health and HIV/AIDS and other sexually transmitted infections information. The eligibility criteria for a woman to be included in the survey were that she should fall within 15 to 49 years and must be a usual member of the selected households and spend the night before the survey in the selected household.[30]

The Ghana Statistical Service (GSS) created a sampling frame following the Population and Housing Census (PHC), which was the basis for the GDHS in 2003, 2008 and 2014. This frame includes an exhaustive listing all census enumeration areas (EAs) established during censuses, together with detailed information on the EA's location (rural or urban) and estimated residential household count. EAs are chosen in each stratum in 2 steps using a 2-stage sample design. By classifying the sampling frame within each sampling stratum before sample selection, according to administrative units in various levels, and by using a probability proportional to size selection at the first stage of sampling, implicit stratification and proportional allocation are achieved at each of the lower administrative levels. In the initial stage, EAs were chosen independently within each sample stratum with a probability proportional to size of the EAs.

In each of the chosen EAs, a household listing operation is carried out, and the lists of homes produced and serves as a sampling frame for the second stage of household selection. The newly constructed household listing was used to pick a specified number of households per cluster with equal probability of systematic selection in the second step of the selection process. Only the chosen houses were visited and interviewed. To avoid bias, no substitutions or changes to the chosen households are permitted during data collection.[30] Overall, the present study relied on a pooled sample size of 4,284 rural women who had complete information about the variables analysed.

### *Outcome variable*

The main outcome variable was 'open defecation' operationalised as defecating in an open space such as bushes, fields, ditches, beaches, water bodies, canals and other open spaces)

rather than a toilet facility.[2] In the surveys, women were asked 'what kind of toilet facility do members of your household usually use?' and the responses were: (1) flush or pour toilet/flush to a piped sewer system (ie, flush to a septic tank, flush to pit latrine, flush to somewhere else, flush, don't know where); (2) pit latrine (ie, ventilated improved pit latrine, pit latrine with slab, pit latrine without a slab, open pit); (3) bucket toilet; (4) hanging toilet/hanging latrine; (5) no facility/bush/field; and (6) other (specify). To specifically calculate those who practiced open defecation or otherwise, all women who asserted that they have 'no facility/bush/field' was classified as 'open defecation' whilst the remaining responses were classified as having 'open defecation'.[2] We then recorded 'open defecation' as '1' and 'no open defecation ' as '0'.

### *Explanatory variables*

The study selected 14 key explanatory variables and were age, education, wealth status, employment status, marital status, religion, ANC visits, parity, access to mass media, women's household decision-making autonomy, sex of household head, partner's education, zone of residence, and survey year. These variables were chosen due to their practical importance and relevance to sanitation and hygiene.[18,31] To make the results reader-friendly, some of these variables were recoded. Education was recoded into 'no formal education', and 'formal education'; wealth status was recoded into 'poor', 'middle' and 'rich'; employment was status recoded into 'none working class' and 'working class'; marital status was recoded into 'married', 'cohabiting' and 'others'; religion was recoded as 'no religion', 'Christian', 'Muslim', 'traditionalist' and 'others'; and ANC visits (defined as number of times one attended antenatal care services) was recoded into '⩽7 visits' and '⩾8 visits'. Based on the total fertility rate of Ghana, which is 4.2 children per woman,[30] parity was recoded as 'one birth', 'two births', 'three births' and 'four or more births'. Following[32] computation of access to mass media from 3 cardinal variables (ie, frequency of reading newspapers/magazines; frequency of listening to the radio; and frequency of watching television), we categorised mass media into 'yes' and 'no'. Women's household decision-making autonomy recoded as 'not autonomous' and 'autonomous'; sex of the household head recoded as 'male', and 'female'; partner's education recoded as 'no formal education', and 'formal education'; and zone of residence recoded as 'coastal zone', 'middle zone' and 'savanna zone'.

### *Statistical analysis*

The statistical analysis proceeded with steps. Firstly, descriptive computations were conducted on the general sample characteristic, including trend analysis of open defecation across the survey waves (see Figure 1). Next, a cross-tabulation was done and accompanied by a chi-square test of independence. At a cut-off point of 5%, any key explanatory variable that had no association with the outcome variable was not entered into the regression model.

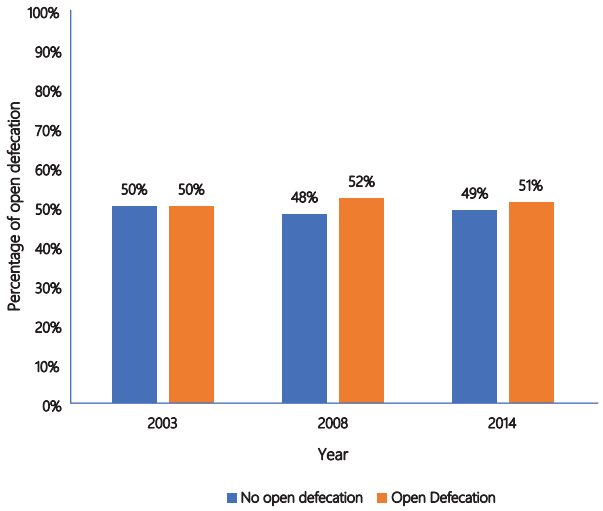


**Figure 1.** Defecating practices among rural women in Ghana.

At a 95% confidence interval, we built 2 logistic regression models. The Model I was a bivariate calculation between the outcome variable and the explanatory variables. In the Model II, we controlled for the effect of other covariates. The results for Model I were reported in Odds Ratio, whilst Model II was reported in adjusted Odds Ratio. We interpreted the odds as having a higher likelihood of open defecation when the odds were above 1 and vice versa. To ascertain the model fit, the Hosmer-Lemeshow post-estimation test was utilised, and the results indicated no evidence of poor fit/misspecified. Also, the weighting factor in the datasets was applied to offset estimations and sampling biases. Additionally, we checked for collinearity between the explanatory variables using the Variance Inflation Factor (VIF) (see Appendix 2 of the Supplemental Information). The results showed no evidence of multicollinearity between our key explanatory variables (Mean VIF = 1.44, Maximum VIF = 2.07, Minimum VIF = 1.08).

### *Ethical considerations*

The present study utilised an existing dataset. Therefore, the authors did not participate in any data collection exercise. As such, ethical principles applicable to the study involving human participants did not apply to this study. However, the datasets were requested from the measure DHS platform and downloaded after access to the datasets was granted. However, the measure DHS anonymised the dataset before making it public. The datasets are publicly available at the Measure DHS dataset repository and can be downloaded at www.measuredhs.org.

## Results

### *Descriptive statistics for the Study*

Generally, 42 in every 100 women aged 15 to 49 practiced open defecation (n = 1811, 95% CI = 49-52), with 58% exhibiting

good defecation practices (n = 2472, 95% CI = 48-51) (data not shown). Figure 1 displays defecating types among rural women in Ghana. It was found that open defecation increased from 50% to 52% between 2003 and 2008 and remained similar (51%) in 2014.

Table 1 is a descriptive result of the study. It was found that open defecation peaked among women aged 45 to 49 (61%), those with no formal education (72%), the poor (61%) and the married (56%). Women who had ⩽ 7 of ANC visits (54%), at parity 4 or more (53%), had no access to mass media (62%), were not autonomous in household decision-making process (51%), whose household was headed by a male (55%), whose partner has no formal education (77%) and reside in the Savannah zone (90%) topped the practice of open defecation. With the exception of employment status ($X^2 = 0.073$, *P*-value = .787) and women's household decision-making autonomy ($X^2 = 2.706$, *P*-value = .100), the rest of the key explanatory variables were significantly associated with open defecation (Table 1).

### *Inferential results for the Study*

Table 2 shows the results of the association between open defecation and the explanatory variables. Compared with women who had no formal education, the likelihood to practice open defecation reduced among those with formal education [aOR = 0.69, CI = 0.56-0.85], just as among those whose partners had formal education compared with those whose partners had no formal education [aOR = 0.64, CI = 0.52-0.80]. Women in the rich wealth quintile had lesser odds of practicing open defecation than the poor [aOR = 0.12, CI = 0.07-0.20]. The likelihood to defecate openly was lesser among the traditionalist than those not affiliated with any religion [aOR = 0.33, CI = 0.19-0.57]. Women who had access to mass media had fewer odds of practicing open defecation than their counterparts without access to mass media [aOR = 0.70, CI = 0.57-0.85]. Residents in the Savannah zone had higher odds of practising open defecation compared to those in the coastal zone [aOR = 21.06, CI = 15.97-27.77].

## Discussion

The study assessed the prevalence and determinants of open defecation among rural women in Ghana. The finding revealed an increase in open defecation from 50% to 52% between 2003 and 2008 and stabilising at 51% in 2014. During these periods, notable interventions such as Community Led Total Sanitation (CLTS), National Community Water and Sanitation Programme (NCWSP) were implemented in rural communities and small towns to enhance access to safe water, sanitation and hygiene as way to improving living standards. However, these interventions failed to produce the anticipated outcomes due to financial constraints, weak sector coordination and collaboration, poor operations and maintenance culture, and inadequate hygiene education and sanitation[33,34]. The rates of OD observed in this study align with earlier studies carried out in Ghana 49.5%,[15] and Benin 53.9%.[18] However, the open defecation rates were greater than those recorded in Kenya 23.5%,[35] Senegal 12.4% and Nigeria 24.5%,[18] but lower than those observed in Niger 72.7% and Chad 70.6%, respectively.[18] The variation in open defecation rates could be attributed to the differences in implementation frameworks, socio-economic statuses, and study design approaches.[36] This may also be due to the varying government pledges and participation in various community initiative programmes, which take a better method to reducing OD practice and achieving the preferred sanitation programme.[2,36] Notably, the higher OD rates observed in this study could be due to the lack of funds available to rural women to construct sanitation facilities (toilet facilities).[37] However, having a sanitation facility (toilet facility) at home does not necessarily mean you will utilise it.[15] Another factor contributing to the increase in OD practice may be the rural women's previous habits of being used to the practice.[37]

According to the study, OD among rural women aged 15 to 49 in Ghana is significantly influenced by factors like education, wealth position, religion, access to mass media, partners' educational levels, and zone of residence. Education has a big impact on the practice of OD. Rural women with formal education showed less likelihood to practice OD than those without formal education. This is backed by prior studies conducted in Tanzania,[38] Nigeria[39] and Ghana.[15] Education decreased the probability of OD, according to research conducted in Ghana.[15] This could be because educated women are generally more aware of the importance of having sanitation facilities and the consequences of OD practice. Additionally, having more knowledge augments the likelihood that households will be able to produce an income, which is the biggest obstacle to building sanitation facilities.[18,37] The lack of schooling or poor level of education among rural women suggests a limited understanding of faecal-oral routes of disease transmission. Therefore, these women would not view open defecation as improper.[19] This calls for hands-on sanitation and cleanliness interventions to raise rural women's understanding and awareness about cleanliness and hygiene practices.

As opposed to poor women in rural Ghana, women in the rich wealth quintile exhibited reduced odds of practicing OD, according to this study. This conclusion is corroborated by prior research from Mozambique,[40] Nigeria,[39] India[41] and Ghana[15] that found poorer households have a greater propensity to resort to OD than affluent households. However, wages cannot fully account for greater OD rates.[39] In a study in Ghana to determine the causes of OD, it was shown that respondents had major income challenges, with many bemoaning the debt they had accumulated through borrowing money for other items, such as food. They consequently lacked the resources necessary to build sanitation facilities.[14,42] In accordance with findings from additional studies, households of lower

**Table 1.** Descriptive results for the study (weighted N = 4284).

| KEY EXPLANATORY VARIABLES | WEIGHTED FREQUENCY (N) | WEIGHTED PERCENT (%) | DEFECATING PRACTICES | | $X^2$ | *P-VALUE* |
|---|---|---|---|---|---|---|
| | | | NO OPEN DEFECATION (%) | OPEN DEFECATION (%) | | |
| *Age (in years)* | | | | | 15.721 | .015 |
| 15-19 | 144 | 3 | 49 | 51 | | |
| 20-24 | 751 | 18 | 51 | 49 | | |
| 25-29 | 1070 | 25 | 46 | 54 | | |
| 30-34 | 909 | 21 | 52 | 48 | | |
| 35-39 | 795 | 19 | 50 | 50 | | |
| 40-44 | 425 | 10 | 50 | 50 | | |
| 45-49 | 190 | 4 | 39 | 61 | | |
| *Education* | | | | | 784.245 | .000 |
| No formal education | 1923 | 45 | 28 | 72 | | |
| Formal education | 2361 | 55 | 71 | 29 | | |
| *Wealth status* | | | | | 641.475 | .000 |
| Poor | 2962 | 69 | 39 | 61 | | |
| Middle | 867 | 20 | 79 | 21 | | |
| Rich | 455 | 11 | 94 | 6 | | |
| *Employment status* | | | | | 0.073 | .787 |
| None working class | 418 | 10 | 49 | 51 | | |
| Working class | 3866 | 90 | 49 | 51 | | |
| *Marital status* | | | | | 183.112 | .000 |
| Married | 3339 | 78 | 44 | 56 | | |
| Cohabiting | 819 | 19 | 70 | 30 | | |
| Others | 128 | 3 | 75 | 25 | | |
| *Religion* | | | | | 466.528 | .000 |
| No religion | 154 | 4 | 23 | 77 | | |
| Christian | 2701 | 63 | 61 | 39 | | |
| Muslim | 623 | 15 | 43 | 57 | | |
| Traditionalist | 616 | 14 | 26 | 74 | | |
| Others | 190 | 4 | 13 | 87 | | |
| *ANC visits* | | | | | 85.060 | .000 |
| ⩽7 visits | 3469 | 81 | 46 | 54 | | |
| ⩾8 visits | 815 | 19 | 64 | 36 | | |
| *Parity* | | | | | 11.176 | .011 |
| One birth | 647 | 15 | 54 | 46 | | |
| Two births | 728 | 17 | 51 | 49 | | |

*(Continued)*

**Table 1.** (Continued)

| KEY EXPLANATORY VARIABLES | WEIGHTED FREQUENCY (N) | WEIGHTED PERCENT (%) | DEFECATING PRACTICES | | $X^2$ | *P-VALUE* |
|---|---|---|---|---|---|---|
| | | | NO OPEN DEFECATION (%) | OPEN DEFECATION (%) | | |
| Three births | 726 | 17 | 49 | 51 | | |
| Four or more births | 2183 | 51 | 47 | 53 | | |
| *Access to Mass Media* | | | | | 406.738 | .000 |
| No | 2601 | 61 | 38 | 62 | | |
| Yes | 1683 | 39 | 71 | 29 | | |
| *Women's household decision autonomy* | | | | | 2.706 | .100 |
| not autonomous | 3538 | 83 | 49 | 51 | | |
| Autonomous | 746 | 17 | 52 | 48 | | |
| *Sex of household head* | | | | | 128.005 | .000 |
| Male | 3502 | 82 | 45 | 55 | | |
| Female | 782 | 18 | 69 | 31 | | |
| *Partner's education* | | | | | 937.133 | .000 |
| No formal education | 1578 | 37 | 23 | 77 | | |
| Formal education | 2706 | 63 | 70 | 30 | | |
| *Zone of residence* | | | | | 2.100 | .000 |
| Coastal zone | 1026 | 24 | 82 | 18 | | |
| Middle zone | 1879 | 44 | 80 | 20 | | |
| Savanna zone | 1379 | 32 | 10 | 90 | | |

Source: Computed from 2003, 2008 and 2014 GDHS.

socio-economic status are less likely to possess latrines than those of higher socio-economic status.[15,43]

Comparable to this, a study that looked at the causes of OD identified a major issue as a lack of funding for maintaining or constructing lasting restroom facilities.[36] This highlights how crucial it is to incorporate household income enhancement sectors when creating sanitation and hygiene promotion programmes to remove obstacles to achieving ODF families.[19] According to Belay et al,[18] most OD activities occur in rural parts of low-income nations like Ghana. There are also financial disparities between the rich and the poor in OD behaviours.[44] Open defecation was a common practice in nations with significant poverty levels, and the wealth gap between the rich and the poor was particularly vast.[15,18] According to a study, the amount of sanitation aid distributed per person in low-income nations like Ghana significantly impacted the decline in OD practice.[18]

In terms of mass media access, this study found that rural women who had access to the media were less likely to practice open defecation than their peers who did not. This outcome demonstrates the value of the mass media in disseminating information about sanitation and hygiene. This result corroborates earlier studies from Haiti,[45] Nigeria[46] and India[47] that found employing mainstream media, social media, and community-based media was crucial for avoiding OD practice. This may be due to the fact that media exposure raises awareness of the detrimental effects of OD, influences attitudes and behaviours in the home, and helps people internalise the benefits of using the restroom.[37,44,45] Reduced exposure to the media has been linked to decreased availability of information that may impact OD practices and regional unhygienic attitudes and practices.[38,47-49] This result suggests that the Ghanaian government should deploy the media to spread awareness of poor sanitation and hygiene behaviours, such as open defecation. This may raise rural women's knowledge of the harmful health implications of open defecation and the need to stop engaging in this hazardous behaviour.[48]

Education is crucial for improving human assets and understanding the significance of environmental cleanliness. Environmental health officials and citizens must share a

**Table 2.** Logistic regression results of association between outcome and explanatory variables.

| KEY EXPLANATORY VARIABLES | MODEL I | | MODEL II | |
|---|---|---|---|---|
| | OR | 95% CI | AOR | 95% CI |
| *Age (in years)* | | | | |
| 15-19 | Ref | 1,1 | Ref | 1,1 |
| 20-24 | 0.92 | [0.64-1.31] | 0.99 | [0.59-1.68] |
| 25-29 | 1.09 | [0.77-1.54] | 0.96 | [0.56-1.67] |
| 30-34 | 0.87 | [0.61-1.23] | 0.68 | [0.38-1.22] |
| 35-39 | 0.94 | [0.66-1.34] | 0.61 | [0.33-1.11] |
| 40-44 | 0.96 | [0.66-1.40] | 0.68 | [0.35-1.27] |
| 45-49 | 1.47 | [0.96-2.27] | 0.84 | [0.41-1.70] |
| *Education* | | | | |
| No formal education | Ref | 1,1 | Ref | 1,1 |
| Formal education | 0.16*** | [0.14-0.18] | 0.69*** | [0.56-0.85] |
| *Wealth status* | | | | |
| Poor | Ref | 1,1 | Ref | 1,1 |
| Middle | 0.17*** | [0.14-0.21] | 0.57*** | [0.44-0.73] |
| Rich | 0.04*** | [0.03-0.07] | 0.12*** | [0.07-0.20] |
| *Marital status* | | | | |
| Married | Ref | 1,1 | Ref | 1,1 |
| Cohabiting | 0.34*** | [0.29-0.41] | 0.93 | [0.72-1.19] |
| Others | 0.26*** | [0.16-0.40] | 0.73 | [0.40-1.32] |
| *Religion* | | | | |
| No religion | Ref | 1,1 | Ref | 1,1 |
| Christian | 0.19*** | [0.13-0.28] | 0.40*** | [0.25-0.65] |
| Muslim | 0.41*** | [0.28-0.60] | 0.66 | [0.39-1.12] |
| Traditionalist | 0.86 | [0.58-1.27] | 0.33*** | [0.19-0.57] |
| Others | 2.07** | [1.22-3.49] | 0.79 | [0.39-1.60] |
| *ANC visits* | | | | |
| ⩽7 visits | Ref | 1,1 | Ref | 1,1 |
| ⩾8 visits | 0.47 | [0.40-0.55] | 0.95 | [0.75-1.21] |
| *Parity* | | | | |
| One birth | Ref | 1,1 | Ref | 1,1 |
| Two births | 1.11 | [0.90-1.38] | 0.97 | [0.69-1.36] |
| Three births | 1.22 | [0.99-1.52] | 1.16 | [0.80-1.68] |
| Four or more births | 1.32** | [1.11-1.57] | 0.99 | [0.67-1.45] |
| *Access to Mass Media* | | | | |
| No | Ref | 1,1 | Ref | 1,1 |
| Yes | 0.25*** | [0.22-0.29] | 0.70*** | [0.57-0.85] |

*(Continued)*

**Table 2.** (Continued)

| KEY EXPLANATORY VARIABLES | MODEL I | | MODEL II | |
|---|---|---|---|---|
| | OR | 95% CI | AOR | 95% CI |
| *Sex of household head* | | | | |
| Male | Ref | 1,1 | Ref | 1,1 |
| Female | 0.38*** | [0.32-0.45] | 0.97 | [0.76-1.24] |
| *Partner's education* | | | | |
| No formal education | Ref | 1,1 | Ref | 1,1 |
| Formal education | 0.13*** | [0.11-0.15] | 0.64*** | [0.52-0.80] |
| *Zone of residence* | | | | |
| Coastal zone | Ref | 1,1 | Ref | 1,1 |
| Middle zone | 1.14 | [0.92-1.42] | 0.94 | [0.74-1.18] |
| Savannah zone | 41.67*** | [32.91-52.76] | 21.06*** | [15.97-27.77] |
| *Survey wave* | | | | |
| 2003 | Ref | 1,1 | Ref | 1,1 |
| 2008 | 1.11 | [0.94-1.30] | 1.15 | [0.89-1.49] |
| 2014 | 1.05 | [0.92-1.20] | 1.05 | [0.84-1.31] |
| *Model specification* | | | | |
| Number of observations | | | 4284 | |
| Number of covariate patterns | | | 2692 | |
| Pearson chi² (2665) | | | 2976.52 | |
| Sig. level | | | .193 | |

Exponentiated coefficients; 95% confidence intervals in brackets, OR = odd ratio, aOR = adjusted odds ratio, $^{**}P < .01$, $^{***}P < .001$, 1 = Reference category; Source: Computed from 2003, 2008 and 2014 GDHS.

common understanding for environmental health policies to be implemented, which calls for some education.[15,49] In our analysis, we discovered a strong correlation between partners' educational attainment and their practice of open defecation. Women with educated spouses are less likely to defecate in public than women with uneducated partners (ie, as the partner's level of education rises, the chance of open defecation among women decreases). This finding supports a prior study conducted in Haiti among agricultural households, which indicated that households with greater educated members, including husbands, were less likely to defecate in the open than those with no educated members.[45] A greater degree of education may increase a husband and wife's ability to generate money, increasing their capability to build a restroom and even embrace superior technologies.[15] Education raises an understanding of the importance of having a toilet, responsible health behaviours, and sustainable sanitation practices.[15] Prior research has indicated that the amount of schooling can influence the household income required to purchase a toilet.[45] It should be mentioned that our analysis looked at the education of partners, which leaves out important details. Existing research, however, suggests that assessing the educational background of every family member leads to a more comprehensive understanding. Paul[45] argues that household members, rather than just the head of the family (husbands), can be the source of motivation for adopting proper sanitation practices and raising knowledge of the deleterious effects of OD. Since husbands in Ghana typically decide whether to embrace latrines, their level of education is crucial.[39]

The current study also found that the zone of residence is a key determinant of whether rural women practice open defecation. Compared to rural women living in the coastal zone, OD practice was highest among those living in the savannah zone. Similar to the current study, zonal disparities in OD prevalence have also been found in Tanzania,[50] Nigeria,[39] Ethiopia and Ghana,[51] all of which have high rates of open defecation. This is because this region has the biggest percentage of pastoralist groups and a relatively low level of commitment to planning for outcomes that prevent open defecation.[44] Also, a combination of traditional behaviours, ignorance, and a lack of resources

make rural residents of the Savannah zone more prone to practice OD.[52-54] It was discovered by Routray et al[55] that even in situations when they have access to their own restrooms, individuals choose to continue with their custom of open defecation in areas that are open, such as fields, marshes and shrubs.[53-55] High rates of drought and conflicts involving water are also probably significant contributors to the area's inadequate sanitation and hygiene coverage.[18,56,57]

Additionally, since farming is the main activity in this area, these women resort to open defecation in the gardens, shrubs, and tree plantations because there are no restrooms or facilities for washing their hands close to the farmlands.[31] In a study conducted in Uttarakhand, India,[41] established that the majority of farmers (men and women) who defecate openly do so because of their work as farmers and the fact that these farmers spend most of their time on their farmlands. Evidence indicates that livestock and agriculture fragmentation (dividing land into roughly equal plots) are 2 factors that affect OD practices in Haiti.[45] Two aspects of a farm (the quantity of plots and the presence of livestock) can cause farmers or other agricultural household members to spend a lot more time away from home. Under such circumstances, they may determine that having a restroom that is unoccupied is not as vital. On one hand, the farmer is expected to put in more time managing the farm the more dispersed it is. On the other hand, animals are usually confined on ropes and moved from plot to plot in search of food. This farming technique requires more time spent outside and is labour-intensive. In these circumstances, purchasing toilets may be seen as pointless, and as a result, OD may become more common.[45] Additionally, it has long been customary in rural farming for agricultural households raising pigs to excrete their waste in front of the animals who once consumed it.[45] It is crucial for sanitation advocates to consider and concentrate on assisting farming women to climb the sanitation ladder in rural Ghana.[19]

### *Policy implications*

This study assessed the prevalence and determinants of OD practices. A possible consequence for policy is suggested by the use of wealth status in explaining OD behaviours. The policy suggestion relates to the function of the general policy for reducing poverty, whose results should include effects on progressive outcomes like better access to sanitation facilities. The rising importance of income in determining whether or not one defecates leads to the conclusion that a tax cut and better supply-side competitiveness are essential components of the optimum fiscal framework for making enhanced sanitation facilities accessible to all. For most sanitation-related goods and services in rural Ghana, there may be an option to exclude these from value-added tax (VAT).

More so, subsidies or the installation of toilets could be some of the strategies for developing better sanitation in rural regions. However, research favours a larger role for supplementary public campaigns that use behavioural change communication (BCC) through the mass media. Studies have recently supported the significance of BCC using the mass media to address inadequate sanitation. Some of the underprivileged homes that NGOs helped instal toilets in Nigeria and India did not use them, primarily because they were unaware of how important they were.[58,59] Therefore, it would be possible to use the mass media to inform rural women about the negative effects of excreting in public on their health and socio-economic status.

The current capital allocation and education improvements must be augmented and may eventually hasten access to better sanitation. These developments include the growth of secondary and higher education and the rising sectoral share of education. Education could also reduce the impact of rurality in elucidating disparities in OD practice.[59] Greater resources are available to urban dwellers in terms of institutions, assets, and education.[60] If the rural-urban difference in OD occurrence is to be minimised, these issues merit an equity-based strategy drive. The better educated the population, the greater the impact of initiatives like those related to BCC will probably be. A higher level of education, for example, would make it easier for the local populace to adopt already-existing, straightforward changes (like those in sanitation) that could save their children's lives.[59] Equally crucial is that decision-makers refrain from prioritising easier-to-reach regions, which are typically non-poor and non-rural regions, as this can lead to ineffective policymaking.[59]

Generally, governments must play a crucial role in promoting sanitation and controlling harmful defecation practices.[61,62] This is demonstrated by initiatives like the Swachh Bharat Mission (SBM) of the Indian government. However, the strategies and tools governments could use to intervene successfully also matter. Even though India's SBM hygiene programme reduced rural open defecation to 45% from 70% in some states, it was a top-down approach in which rural people were frequently forced to build latrines with little attention paid to latrine usage or impending faecal sludge management.[63] Due to the type and degree of force used beneath the SBM, it poses a threat to the sustainability of OD reductions. Additionally, because rural women's concerns regarding latrine pits and pit emptying were not considered, unsafe latrine pit emptying has resulted in a decline in toilet uptake.[63]

Such insights from Indian government programmes could help countries like Ghana, which is having trouble planning interventions that will address OD in rural Ghana and sustain results from the intended interventions.

To eliminate OD and increase demand for latrines, it would be imperative that the Community-Led Total Sanitation (CLTS) programme be extended to reach all rural communities in Ghana. This strategy, widely recognised for enhancing sanitation in rural settings, focuses on bottom-up behaviour change that is sparked by psycho-social mechanisms and group action.[64] The primary goal is to achieve 'open defecation-free' (ODF) status for communities, characterised by a substantial

proportion of households possessing and utilising individual toilets, with no visible signs of open defecation.[65] Despite its promotion in Ghana, previous CLTS efforts have been limited in scope and faced challenges such as limited skilled facilitators, ineffective post-triggering follow-ups, limited resource allocation, and poor institutional coordination.[66,67] To improve the effectiveness of CLTS in Ghana, it would be critical to expand the programme to all rural areas in the country. Moreover, targeted subsidies can play a critical role in accelerating latrine adoption among the poorest. Evidence from studies in India[34,68] and the urban sanitation interventions in Ghana have shown that providing pro-poor subsidies for improved sanitation technologies to households in the bottom wealth quintiles can lead to a substantial increase in latrine ownership and use. This targeted approach ensures that financial barriers are removed for those who need it most, ultimately contributing to faster progress towards ODF communities. Furthermore, for CLTS to be more effective, active involvement of communities in the process, building their capacity for latrine construction and management, and tailoring behaviour change interventions to local contexts has been shown to be more impactful. Additionally, establishing a robust monitoring and evaluation framework is vital for identifying challenges, adapting interventions, and tracking progress towards ODF goals. A rigorous monitoring system that tracks key indicators like latrine ownership and use, community knowledge and attitudes, and behaviour change over time can provide valuable insights for adapting and refining the CLTS approach as needed. This approach ensures that resources are used effectively and that interventions are continually optimised for maximum impact.

## Conclusion

The study assessed the prevalence and contributing factors of open defecation among rural women aged 15 to 49 in Ghana. Open defecation was significantly correlated with factors such as formal educational attainment, wealth status, religion, access to mass media, partner's education, and zone of residence. In rural Ghana, the prevalence of open defecation is disproportionately pro-poor, which indicates that impoverished rural women are more likely to perform it. We recommend that the Ghana's Ministry of Health should develop a basic sanitation and hygiene programme with an emphasis on savannah zone residents, women without formal education, and rural communities. It is important to increase public access to media and education. Public health initiatives should also aim to close the rich-poor divide in OD practice among rural women.

## Strengths and Limitations

The study's use of a nationally representative dataset to assess the factors influencing open defecation among rural Ghanaian women is one of its strengths. Additionally, using a large sample size is often important in cross-sectional studies, which has improved the validity of the study results. By outlining sanitation requirements, this study will assist Ghana in more efficiently allocating its sanitation and hygiene resources. However, one limitation of this study may be recall bias, which could result from the possibility that women may give socially acceptable answers and have trouble remembering earlier events. Culture also has an impact on open defecation. When a father-in-law and daughter-in-law share a restroom, it may be considered improper in some cultures, resulting in open defecation. These cultural traits, however, could not be included in the analysis since they were not found in the dataset. Also, using purely a quantitative approach provides information on drivers of open defecation, but it is limited, especially when considering interrelated variables. Further studies would benefit from a mixed-method approach, perhaps with interview data and qualitative studies to enhance the conclusions drawn.

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## Author Contributions

Conceptualisation, FA, EAE, KB, TS and KBN; methodology, FA; validation, FA, JODF, GB, KB TS, EAE and GAD; formal analysis, FA; investigation: FA, EAE, KB, and TS; data curation, FA; original draft preparation, FA, JODF, GB, KB, TS, EAE and GAD; review & editing, FA, JODF, GB, KB, TS, EAE and GAD; visualisation, GAD; supervision, FA; project administration, KBN, FA and EAE.

## Data Availability Statement

The datasets are publicly available at the Measure DHS dataset repository and can be downloaded at www.measuredhs.org.

## Informed Consent Statement

The present study utilised an existing dataset. Therefore, the authors of this study had no hand in all fieldwork and activities that led to the generation of the datasets used in the study. As such, ethical principles applicable to the study involving human participants did not apply to this study. However, the datasets were requested from the measure DHS platform and downloaded after access to the datasets were granted. However, the measure DHS anonymised the dataset before making it public.

## ORCID iDs

Eugene Appiah-Effah https://orcid.org/0000-0002-8010-3944
Godwin Armstrong Duku https://orcid.org/0000-0002-3454-2313

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