

## Research Article

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## Open defecation free: where do we need to focus ?

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### Abstract

#### Background

Despite major national and international efforts, many households in Nepal (as in other low-income and middle-income countries) still lack toilets. This paper assesses various determinants that act as main contributing factors because of which households in Nepal still do not have toilets.

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#### Methods

Data from the Nepal Demographic and Health Survey (NDHS) 2016 was used for this study. Bivariate analysis was done to assess the association between dependent variables (toilet status- having and not having toilets in the household) and independent variables (demographic, socio-economic and geographical characteristics) using Chi-square test. Then, a multivariate logistic regression model was used to assess significant predictors for a household not having a toilet after controlling other variables.

#### Results

Out of the total number of sampled households (11040), nearly a fifth (18%) belonged to province no. 2, where nearly half of the households (49%) did not have toilet facilities. Similarly, households in rural areas were found to be less likely to have toilets than households in urban areas (aOR=1.56, CI1.35-1.80). In the Terai, households were almost ten times as likely not to have toilets (aOR=9.65, CI6.56-14.19) as compared to households in the mountain region. Furthermore, there is a strong positive association between households with toilets and their economic status. Poorest (aOR=15.19, CI11.26-20.47), poorer (aOR=8.75, CI6.89-11.11) and middle-income (aOR=5.12, CI4.15-6.32) households were less likely to have a toilet than richer or richest households.

#### Conclusions

Despite some real achievements and progress in Open Defecation Free (ODF) status, Nepal still has a large number of residences without a toilet. Thus, it is crucial to address all the multifaceted factors such as geographical, provincial and economic when considering sustainable ODF programming.

**Keywords:** Open Defecation Free (ODF), Sanitation, Nepal, Sustainable Development

**Tweetable Abstract:** Despite some progress in ODF status, Nepal still has residences without a toilet. So the question is where we need to focus.

### Background

If not managed properly, human faeces can cause various kinds of communicable diseases, from viral and bacterial to protozoan. Hygienic and proper use of toilets is a step forward in managing those diseases. The burden of these faeco-oral diseases is high in low and middle-income countries (LMICs) like Nepal, where not having access to toilets is considered a major determinant of public health problems, including risk of diarrheal and other water borne diseases [1]. Toilets are a primary barrier to faeco-oral disease transmission and better sanitation practice is recognized as an important parameter for a healthy, dignified and developed society. The goal of achieving adequate and equitable sanitation has been agreed globally, and eliminating Open Defecation (OD) world wide by 2030 is included in the Sustainable Development Goal number six [2]. Despite this, 2.4 billion people around the world lack adequate

sanitation and practice open defecation [3,4].

In the context of Nepal, the Constitution has declared access to safe water and sanitation a fundamental right of citizens [5]. The government of Nepal has set a target for universal access to improved sanitation by 2017, for better hygiene, health and environment [6]. Unfortunately, we still have houses, offices and schools without toilets or with poor utilization of toilets. A sanitation promotion program was started in Nepal in the early 1990s as an integral component of water supply projects and since then it has been a working area for governmental and non-governmental agencies. Till date some innovative ideas and concepts have been adopted for sanitation and hygiene, for instance, Open Defecation Free communities, Community Led Total Sanitation [7], school led total sanitation [8], basic sanitation package, school sanitation and hygiene education, national sanitation week [9], global handwash-

ing day, world toilet day, Nepal water sanitation and hygiene [6] and much more. All of these have helped achieve the current status where 85 percent of household have toilets (as at the end of 2018) [10]. Households without toilets have various common factors, ranging from socio-culture norms [11] to economic status [12] of the people, creating further challenges for the effectiveness of these programs. Furthermore, despite huge government efforts, a lack of public awareness, human resource constraints, and a lack of proper planning act as obstacles to achieving total sanitation [6,13]. In order to meet government targets, there was national trend for declaring Open Defecation Free (ODF) areas, but some evidence shows inability of those areas to maintain their ODF status; for example, village development committees previously declared ODF were found to be unable to maintain minimum requirements of an ODF area afterwards [14]. Furthermore, although people have constructed toilets with the help of subsidy provided by the government, they do not always use them because of entrenched ethnic and cultural taboos [15], traditional beliefs [16] etc. For example, in some cultures there is a belief that an in-law and a daughter-in-law cannot use the same toilet. There still are communities where menstruating women cannot use the toilet because of a belief that they are untouchable during their days of menstruation. Similarly, unmanaged urbanization resulting in tightly clustered settlements, lack of space for building toilets, lack of technical support, and poor behavioral attitudes are major challenges for ODF sustainability. The poor, disadvantaged and high-risk groups are outside of the sanitation mainstream, undermining equity, ownership and participation. This acts as a further obstacle to full toilet coverage. Though there has been a shift of approach from the conventional awareness raising approach towards a behavior change approach in pursuit of sustainable ODF, there still is lots of room for improvement, from the individual to the policy making level.

## Methodology

### Study Area and Data collection

This paper uses data from the Nepal Demographic and Health Survey, 2016, a nationally representative sample survey. The primary objective of the 2016 NDHS is to provide up-to-date estimates of basic demographic and health indicators. The information collected through the 2016 NDHS is intended to assist policy makers and program managers in the Ministry of Health and other organizations in designing and evaluating programs and strategies for improving the health of the country's population. The study protocol was approved by the Nepal Health Research Council and the ICF Macro Institutional Review Board in Calverton, Maryland, USA. The sampling frame used for the 2016 NDHS is an updated version of the frame from the 2011 National Population and Housing Census (NPHC). The 2016 NDHS sample was stratified and selected in two stages in rural areas and three stages in urban areas. In rural areas, wards were selected as primary sampling units (PSU), and households were selected from the sample PSUs. In urban areas, wards were selected as PSUs, one enumeration area (EA) was selected from each PSU, and then households were selected from the sample EAs. A total of 11,040 household were sampled. Data was collected via interview, yielding a response rate of 99%. The NDHS report details the methodology used in the survey (MoH, 2017).

### Study Variables

Dependent variables: toilet status is categorized into two different categories; '1' for having toilets and '0' for not having toilets.

Independent variables: demographic, socio-economic, and geographical characteristics (As listed in Table 1)

### Statistical Analysis

The weighted percentage was calculated. Association between dependent variable (toilet status—having and not having a toilet in the household) of households and independent variables (demographic, socio-economic, and geographical characteristics) was assessed via bivariate analysis using a Chi-square test. Then, a multivariate logistic regression model was used to assess significant predictors for not having a toilet in the household, after controlling for other variables. All the variables were included in the same model and analyzed. Multi-co-linearity between the variables was assessed before analyzing in logistic analysis. The acceptance level of co-linearity was below 0.7. The analysis found that two variables 'Development regions' and 'Province' were highly correlated ( $r=0.97$ ). Therefore, 'Development regions' was removed from the logistic regression model. The Statistical Package for Social Science (SPSS 20.0 for Windows) software was used to analyze the data.

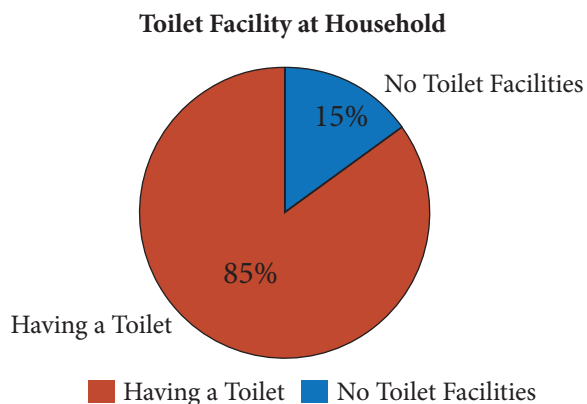
## Results

Out of the total sampled households (11,040) 85% of them had toilet in their household (Figure 1). Nearly fourth of the respondents belonged to province number 3, more than three-fifths (61%), were urban residents. Respondents were almost equally distributed among different wealth quintiles (Table 1).

**Table 1 Characteristics of sampled household**

Characteristics	%	N
<b>Province</b>		
Province 1	18.2	2004
Province 2	18.2	2014
Province 3	22.8	2521
Province 4	10.6	1173
Province 5	16.2	1793
Province 6	5.6	619
Province 7	8.3	916
<b>Place of residence</b>		
Urban	61.4	6781
Rural	38.6	4259
<b>Development region</b>		
Eastern	23.5	2590
Central	35.8	3949
Western	20.3	2245
Mid-western	12.1	1339
Far-western	8.3	915
<b>Ecological zones</b>		
Mountain	7.1	781
Hill	46.5	5134

Terai	46.4	5125
<b>Wealth Index</b>		
Poorest	20.2	2234
Poorer	20.2	2225
Middle	18.7	2065
Richer	20.3	2240
Richest	20.6	2276
<b>Place for hand washing</b>		
Hand washing station was mobile	19.1	2104
Hand washing station is fixed	80.9	8936
<b>Presence of water at hand washing place</b>		
Water not available	22.7	2503
Water is available	77.3	8508
<b>Time to get to water source</b>		
On premises	68.9	7608
Upto 15 minutes	22.9	2529
16-30 minutes	6.2	685
More than half an hour	2.0	217
<b>Distance to reach nearest health facility</b>		
Less than 30 minutes	49.3	5446
30-59 minutes	25.9	2855
1-2 hours	22.2	2452
More than 2 hours	2.6	286
<b>Sex of head of Household</b>		
Male	68.7	7581
Female	31.3	3459
<b>Age of Household head</b>		
Less than 25 years	5.7	625
25-34 years	20.3	2240
35-49 years	33.8	3732
50 or more	40.2	4442
<b>Has radio</b>		
No	70.7	7811
Yes	29.3	3229
<b>Has television</b>		
No	48.4	5346
Yes	51.6	5694
<b>Source of drinking water</b>		
Protected source	95.5	10541
Unprotected source	4.5	499
<b>Any household member migrated in past 10 years</b>		
No	53.5	5911
Yes	46.5	5129
<b>Total</b>	<b>100.0</b>	<b>11040</b>



**Figure 1: Toilet Facilities at household**

Table 2 shows toilet distribution according to the household characteristics. Nearly half (49%) of households in province number 2 had no toilet facility. The proportion of households without toilet was significantly higher in rural areas (21%) and Terai region (27%) as compared to their respective counterparts. Almost a quarter of respondents belonging to middle and poorer wealth index had no toilet facility in the household. (Table2).

**Table 2 Toilet facility according to household characteristics**

Characteristics	Toilet Facility		Total N
	Having toilet facility	No Toilet facility	
<b>Province ***</b>			
Province 1	90.0	10.0	2004
Province 2	51.0	49.0	2014
Province 3	94.8	5.2	2521
Province 4	96.9	3.1	1173
Province 5	89.3	10.7	1793
Province 6	95.6	4.4	619
Province 7	94.7	5.3	915
<b>Place of residence ***</b>			
Urban	89.2	10.8	6781
Rural	79.1	20.9	4259
<b>Development region ***</b>			
Eastern	83.0	17.0	2590
Central	77.8	22.2	3949
Western	92.0	8.0	2245
Mid-western	94.3	5.7	1339
Far-western	94.7	5.3	915
<b>Ecological zones ***</b>			
Mountain	94.2	5.8	781
Hill	96.1	3.9	5134
Terai	73.1	26.9	5125
<b>Wealth Index ***</b>			
Poorest	84.2	15.8	2234
Poorer	75.4	24.6	2225

Middle	73.4	26.6	2065
Richer	92.5	7.5	2240
Richest	99.8	0.2	2276
<b>Place for hand washing ***</b>			
Place for hand washing was mobile	69.0	31.0	2104
Place for hand washing station is fixed	89.2	10.8	8936
<b>Presence of water at hand washing place ***</b>			
Water not available	71.0	29.0	2503
Water is available	89.5	10.5	8508
<b>Time to get to water source ***</b>			
On premises	86.8	13.2	7608
Up to 15 minutes	79.5	20.5	2529
16-30 minutes	89.3	10.7	685
More than half an hour	86.6	13.4	217
<b>Distance to reach nearest health facility ***</b>			
Less than 30 minutes	84.7	15.3	5446
30-59 minutes	84.4	15.6	2855
1-2 hours	86.8	13.2	2452
More than 2 hours	92.9	7.1	286
<b>Sex of head of Household (ns)</b>			
Male	85.2	14.8	7581
Female	85.7	14.3	3459
<b>Age of Household head (ns)</b>			
Less than 25 years	86.0	14.0	625
25-34 years	84.7	15.3	2240
35-49 years	86.0	14.0	3732
50 or more	84.9	15.1	4442
<b>Has radio ***</b>			
No	82.2	17.8	7811
Yes	92.8	7.2	3229
<b>Has television ***</b>			
No	78.1	21.9	5346
Yes	92.1	7.9	5694
<b>Source of drinking water *</b>			
Protected source	85.5	14.5	10541
Unprotected source	81.8	18.2	499
<b>Any household member migrated in past 10 years *</b>			
No	86.1	13.9	5911
Yes	84.4	15.6	5129
<b>Total</b>	<b>85.3</b>	<b>14.7</b>	<b>11040</b>

Note \*\*\* Significant at  $p < 0.001$ ; \*\* =  $p < 0.01$  and \* =  $p < 0.05$ , ns=not significant

Table 3 reveals the results of a Multi variate analysis and shows that households from province 2 are five times (aOR=5.32,CI4.32-6.56)

more likely not to have toilets as compared to province 1, keeping all other variables constant in the logistic model. Similarly, as compared to urban areas, the number of households from rural area without toilets was nearly two times more (aOR=1.56,CI1.35-1.80). Based on ecological zone, households in the Terai region are almost ten times (aOR=9.65,CI6.56-14.19) more likely not to have a toilet in their houses as compared to the mountain region. Furthermore, there is a strong association of toilets with economic status of households, where poorest income households are fifteen times (aOR=15.19,CI11.26=20.47), more likely not to have a toilet than the richer / richest households. (Table3).

**Table 3: Adjusted odds ratio (aOR) and 95 % confidence interval (CI) from logistic regression model of not having toilet by Geographic, socio-economic characteristics of household**

Selected predictors	aOR	95% CI	
		Lower	Upper
<b>Province</b>			
Province 1(reference)	1.00		
Province 2	5.32***	4.32	6.56
Province 3	1.22	0.93	1.59
Province 4	0.429***	0.28	0.64
Province 5	0.81	0.64	1.02
Province 6	0.40***	0.26	0.63
Province 7	0.35***	0.25	0.49
<b>Place of residence</b>			
Urban (reference)	1.00		
Rural	1.56***	1.35	1.80
<b>Ecological zones</b>			
Mountain (reference)	1.00		
Hill	1.15	0.81	1.64
Terai	9.65***	6.56	14.19
<b>Wealth Index</b>			
Poorest	15.19***	11.26	20.47
Poorer	8.75***	6.89	11.11
Middle	5.12***	4.15	6.32
Richer/Richest (reference)	1.00		
<b>Place for hand washing</b>			
Place for hand washing was mobile	1.54***	1.22	1.93
Place for hand washing station is fixed (reference)	1.00		
<b>Presence of water at hand washing place</b>			
Water not available	1.40***	1.11	1.77
Water is available (reference)	1.00		
<b>Time to get to water source (minutes)</b>			

On premises (reference)	1.00		
Upto 15 minutes	1.14	0.96	1.36
16-30 minutes	1.16	0.82	1.64
More than half an hour	1.20	0.72	2.01
<b>Distance to reach nearest health facility</b>			
Less than 30 minutes (reference)	1.00		
30-59 minutes	1.25*	1.05	1.48
1-2 hours	1.20	0.99	1.46
More than 2 hours	0.84	0.48	1.44
<b>Sex of head of Household</b>			
Male (reference)	1.00		
Female	0.97	0.83	1.14
<b>Age of Household head</b>			
Less than 25 years	1.43*	1.04	1.97
25-34 years	1.27*	1.05	1.54
35-49 years	0.94	0.81	1.11
50 or more (reference)	1.00		
<b>Has radio</b>			
No	1.50***	1.26	1.79
Yes(reference)	1.00		
<b>Has television</b>			
No	0.65***	0.54	0.77
Yes (reference)	1.00		
<b>Source of drinking water</b>			
Protected source (reference)	1.00		
Unprotected source	1.25	0.89	1.74
<b>Any household member migrated in past 10 years</b>			
No (reference)	1.00		
Yes	0.91	0.79	1.04
Constant	0.170***		
Cox & Snell R Square	0.282		
-2 Log likelihood	5543.6		

Note \*\*\* Significant at  $p < 0.001$ ; \*\* =  $p < 0.01$  and \* =  $p < 0.05$

## Discussion

This study assessed the factors responsible for not having toilets in the context of Nepal, where households that lack a toilet were measured on the basis of their geographical and socio-economic characteristics. Socio-economic and demographic factors are found to be associated with access to portable water and improved sanitation facilities [17]. Furthermore, findings from other studies support the findings of this study on income, household size and region, which are significant predictors for sanitation access

[18]. Our findings show that households in the Terai region are less likely to have toilets, which is similar to the findings of the study conducted by the Center Bureau of Statistics [14]. The same study also found that the houses with poor economic status are less likely to have toilets compared to wealthier households. Thus, construction and use of toilets is highly associated with economic status(16). The literature shows that the construction of a toilet is linked with urbanization, which is similar in our study as well, where, the proportion of households having a toilet in an urban area is double to that in rural areas [19]. A study conducted in Myagdi district, three years after it was declared ODF, shows that almost all households had a storage of water facility (98.8%) and hand washing basin near the latrine (99.2%) [15]. Whereas, our study shows that only four out of five households have a fixed place for handwashing. Studies show that the unavailability of water facilities at toilets motivates people for open defecation and disuse of toilets [20]. Similarly, use of unprotected water for drinking is considered a major factor for diarrheal disease(21). Furthermore, mass media like television, radio, print media, internet, etc. play a significant role in spreading information and raising awareness on sanitation issues [13]. They can help trigger positive changes in public opinion and behavior on matters of public health concern. However, this is in contradicts with our findings, where, households having a radio are less like to have toilets in their houses. This study has a number of strengths and some limitations in the interpretation of the results. We used a nationally representative data set that was based on a validated questionnaire and methodology. The findings can be generalized to the whole country as this survey was nationally representative. We still have some limitations that need to be taken into account when interpreting our findings from this study. Because of the survey's cross-sectional design, all of the factors analyzed in the study were measured at a single point of time. Thus, the analysis can only provide evidence of statistical association between those items and the lack of a toilet in the household at that time; it cannot show a cause-effect relationship. However, the findings of this study will be helpful for program implementers and policy makers in suggesting 'what' needs to be focused 'where', in order to develop effective ODF related programs. Furthermore, our study reflected that socio-economic status of the people is associated with the availability of toilets in their house. However, having a toilet in a house does not mean that people are using toilets, as there are cultural, political, and behavioral factors affecting not just the availability but also their utilization.

## Conclusion

Despite some real achievements and progress in trying to achieve ODF status in Nepal, there are still residences without access to adequate sanitation and toilet facilities. Province number two and the Terai region in particular need to be focused on for designing ODF programs to meet national and international sanitation goals.

## Abbreviations

aOR: Adjusted odds ratio  
 BSP: Basic sanitation package  
 CI: Confidence interval  
 EA: Enumeration Area

LMIC: Low – income and middle- income countries  
 NDHS: Nepal Demographic and Health Survey  
 NPC: National Population and Housing Census  
 NSW: National Sanitation Week  
 OD: Open defecation  
 ODF: Open defecation free  
 PSU: Primary Sampling Units  
 Ref: Reference  
 SPSS: Statistical Package for Social Science  
 WASH: Nepal Water Sanitation and Hygiene

## Declarations

### Ethical approval and consent to participate

The study protocol was approved by the Nepal Health Research Council and the ICF Macro Institutional Review Board in Calverton, Maryland, USA. All respondents had provided verbal informed consent to be interviewed prior to data collection. Therefore, an independent ethical approval was not required. For this study, we used publicly available data set from the measure DHS website

### Consent to publish

Not applicable

### Availability of data and materials

The data used are publicly available from the MEASURE DHS site.

### Competing interests

The authors declare that they have no competing interests.

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Not applicable

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