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Open defecation free status and its determinants in rural Uganda: a cross-sectional survey

Moses Ntaro[1,2*], John Bosco Isunju[3], Edgar Mulogo[2] and John C. Ssempebwa[3]

Abstract

Introduction Globally, the progress to attain the open defecation free (ODF) environment has remained very slow. This study examined context specific factors influencing household open defecation free status in Uganda.

Methods A cross-sectional study was conducted in Kabale district in southwestern Uganda and 492 participants were randomly selected at household level. Data was obtained through conducting a face-to-face interview using the mobile data collection software KoBoCollect v2021.3.4 installed on tablet devices. Using the Firth's penalized logistic regression, bivariate and multivariate analysis was conducted to determine if there existed significant associations between the outcome Household Open Defecation (HODF) status and independent variables. Variables with $P < 0.2$ at bivariate analysis comprised the global model for the multivariate analysis.

Results The average age of the participants was 49 (SD 23.4) years. Most (67.68%) of the study participants, were females while 144 (29.27%) of the participants had no formal education. The households that were open defecation free were as few as 15 (3%). At multivariable analysis, gender of the participants, remembering handwashing, latrine and household cleanliness factors were significantly association with HODF status. Male participants had more odds of having open defecation free households (aOR: 3.89; 95% CI: 1.26–12.06) compared to female participants. Households with clean compounds, with latrines not having their holes soiled with feces and where respondents always remembered to wash hands after visiting latrine had high odds of being open defecation free (aOR: 3.15; 95% CI: 1.03–9.66, aOR: 10.56; 95% CI: 1.87–59.63 and aOR: 3.96; 95% CI: 1.24–12.68, respectively).

Conclusion The prevalence of HODF was very low and factors associated with it were; the gender of the participants, the latrine and household cleanliness and the behavioral factor of remembering handwashing. We propose behavioral change interventions that empower communities to adapt improved sanitation behavior, such as Community Led Total Sanitation and Hygiene (CLTSH) in order to increase households with the Open Defecation Free status.

Keywords Household open defecation free (HODF) status, Determinants, Open defecation (OD), CLTSH

*Correspondence:
Moses Ntaro
ntaro2001@gmail.com
[1]School of Public Health, College of Health Sciences, Makerere University, Kampala P.O.Box 7072, Uganda
[2]Department of Community Health, Faculty of Medicine, Mbarara University of Science and Technology, Mbarara P.O. Box 1410, Uganda
[3]Department of Disease Control and Environmental Health, School of Public Health, College of Health Sciences, Makerere University, Kampala P.O.Box 7072, Uganda

Background

The world is on the verge of failing to achieve Sustainable Developmental Goals (SDG) target 6.2 of access to adequate and equitable sanitation and hygiene for all and ending open defecation by 2030. It would require four times the current rate of progress in safely managed human excreta and basic hygiene services to attain this goal [1]. Despite the reduction in the number of open defecators, 494 million people still practice open defecation, and the population with handwashing facilities increased only by 4% from 2015 to 2020 [1]. In Sub-Sahara Africa, open defecation is widespread with South Sudan, Chad and Niger having more than 60% of the population practicing open defecation.

Many countries for decades have invested significantly and increased latrine coverage, yet rural open defecation remains high [2, 3]. This exposes their populations to the risk of oral-fecal diseases as the practice of OD leads to contamination of the environment with oral-fecal bacterial and parasitic pathogens. Studies have showed that merely increasing access to basic sanitation services does not lead into oral-fecal diseases reduction among children [4–6]. However, disease reduction and improved child health has been seen in communities that attain the Open Defecation-Free (ODF) status [7]. The ODF status is defined as the creation of all barriers for feacal oral transmission by; elimination of faeces scattered in the open, consistence use of latrines with fly proof devices, and having no faeces on the hands through washing hands with water and soap or ash after using the latrine [8]. Abebe and Tucho [7] showed that the prevalence of diarrhea significantly reduced in open defecation free (ODF) villages compared to those that were still practicing OD. Clasen, Boisson [9] also established that when household and community members are not living in an ODF environment, it has negative effect on the health of a child.

Usually, the ODF status is certified at a village level following a thorough inspection of the [4] community including household premises and latrine facilities within the community. Standard indicators for measuring ODF status have been developed and used at community and household level [8, 10]. Tyndale-Biscoe, Bond [10] examined the ODF indicators in three countries that included Uganda, and established that 8% of households that had functional latrines still had signs of faeces around the house. Households which had latrines with hand washing facilities having water and soap or ash, were 25%. The coverage of latrines with lids covering the drop hole was 19%. In this same study, the overall rate of households with ODF status was 8%.

In Uganda, the population practicing open defecation in rural areas is at 23.6% while that in the urban areas is at 10.3% [11]. This current status is as a result of people failing to upgrade from unimproved sanitation facilities. In addition, in some areas, these sanitation facilities are susceptible to damage by the effects of extreme weather like heavy rains. When these unimproved sanitation facilities fill up or get damaged by heavy rains, households are usually reluctant or unable to build new ones. In 2021, hand washing with soap increased by 6.7%, from 38% reported the year before to 44.7%. This increase was attributed to the COVID-19 response measures on hand washing. Overall, in slightly more than 100 districts in Uganda receiving the District Sanitation and Hygiene Conditional Grant annually from the government of Uganda, less than 19% of the village in these districts have attained the ODF status [11, 12].

Globally, the slow progress to attainment of the ODF environment has been attributed to the population increase. However, other researchers emphasize the need of exploring other underlying factors. For example, Abubakar [13] states that future research should examine national level elements influencing OD if elimination of OD is to be accelerated in sub-Saharan Africa. Odo and Mekonnen [14] established household factors of high status of wealth, education and having an improved latrine facility to be associated with presence of handwashing facility at the household. Authors in the same study, suggested the need to investigate structural factors such as psychosocial and traditional norms since they influence handwashing at the community level. To address this gap, several studies [13, 15–18], have demonstrated the influence of structural and behavioral factors on different indicators of the ODF status. Some of these factors identified include; type of latrine facility, accessibility, privacy, unpleasantness of the toilet, locational, demographic and household characteristics.

Although ODF status has been associated with reduction in diarrhea prevalence, its attainment has remained significantly lower despite sanitation improvement campaigns. Therefore, investigating factors associated to ODF status is paramount for identifying strategies to increase households and villages that are ODF. Therefore, this study addressed the gap of understanding the determinants of the household ODF status rather than individual indicators of the ODF status in Rubaya and Buhara subcounties in Kabale District in South Western Uganda. The findings of this study will further guide sanitation promotion stakeholders to focus on context specific intervention to improve the household ODF situation.

Methods

This cross-sectional study was conducted in two rural sub-counties of Rubaya and Buhara in Kabale district in Uganda.

Study context

The study was conducted in two sub counties having the poorest sanitation and hygiene indicators in Kabale district in south western Uganda. In the Uganda decentralized government system, the district and sub-county have both political authority and financial autonomy [19]. However, the subcounty local governments are supervised and supported by the district local governments [19]. Rubaya subcounty local government has a population of 27,727 with a total of 6,050 households while Buhara subcounty local government has a population 12,300 males and 14,000 females with a total 5,233 households. According to the health sub-district report, both subcounties have low handwashing coverage with Rubaya having the least at 7% [20].

Recruitment and participants

We performed simple random sampling [21] of households using the household lists provided by village health workers from the randomly selected 50 villages. All households in the selected study villages were numbered and using a random number generator, ten households were selected in each village. Village health workers led the research assistants to the randomly sampled households. The study participants were obtained from these sampled households within the two sub counties, and participants comprised heads of households or their spouses. A total of 492 participants were recruited based on a sample size calculation [22]. Of these, 249 were from Rubaya and 243 from Buhara subcounty.

Criteria for inclusion and exclusion

Inclusion criteria: All selected families with the heads of the household or their spouses present during the household data collection were included in the study. Only individuals who provided consent participated in the study.

Exclusion criteria: Households with elderly heads or spouses incapable of responding to the questionnaire were excluded from participation in the study. Furthermore, any eligible participant considered mentally unfit owing to illness or substance influence was eliminated from the study.

Data collection

Data was obtained through research assistants conducting a face-to-face interviews with participants and recording observations on the compound and latrine based on ODF parameters. These research assistants received a 4-day training on the research protocol with a focus on objectives, method, questionnaire and field interviewing techniques. Since they were familiar to the environment they could easily recognize the human feces. They familiarized themselves with the questionnaire by reviewing each question and seeking for understanding from the first author and lead researcher. They further conducted role-plays and mock interviews between themselves in order to gain more understanding on how to administer the questionnaire and use the tablet data collection tool. Finally, research assistants pretested the data collection tool in a village close to the study villages where each research assistant visited at least one household.

Face-to face interviews with household heads or their spouses took place at their homes from March to early April 2021. To establish the Open Defecation Free Status and the ODF status determinants, an observation checklist and structured questionnaire was adopted from survey tools used in Water Sanitation and Hygiene studies [23, 24]. The questionnaire was translated from English into the local language, Rukiga. The translated questionnaire was used during interviewer training and reviewed by the first author and interviewers to ensure the meaning of the questions is not altered. The interviewers pretested the questionnaire in non-study areas among 11 households to ensure content validity, language appropriateness and question comprehensibility. The survey was implemented using the mobile data collection software KoBoCollect v2021.3.4 [25] installed on tablet devices and lasted about 45–60 min.

Dependent variables

The dependent variable was the proportion of households with Open Defecation Free status (HODF). A household was considered to have attained the ODF status if it was observed to have had the following;

(i) absence of feaces around and near the household: This could be observed during the compound and latrine inspection and recorded using observation checklist.
(ii) Presence of functioning latrine having a superstructure and latrine lid/cover: This was measured based on respondents' report followed by observation for presence of a latrine with superstructure and a latrine lid/cover,
(iii) Latrine use at household level was measured by observing visible fresh feces in the latrine using a flash light and,
(iv) presence of a functional handwashing facility with water and soap or ash together with evidence of use: This was measured by direct observation for presence of a handwashing facility, water, soap or ash and a trodden pathway as evidence for its usage. Observation were recorded either as yes or no.

Independent variables

Contextual social factors such as economic status of the households was estimated by collecting information on household effects such as ownership of a radio, television, type of latrine owned and household size. The personal contextual independent variables were: age, educational level attained, and marital status. Finally, the physical contextual factors considered were; household ownership of latrine, cleanliness of latrine, cleanliness of compound, status of latrine, distance of latrine, distance to water source and type of water source.

The behavior factors of the RANAS psychosocial model were also considered as independent variables explaining ODF status. The standardized behavior change MODEL tool; risks, attitudes, norms, abilities, and self-regulation (RANAS) tool was adapted [24] and incorporated in questionnaire. Most of the responses were "Yes" or "No" where "no" was scored as 0 and "Yes" scored as 1. For example, for the question, 'Do you feel there is a risk that you can contract diarrhea if you never wash your hands with soap and water after contact with stool?' (0 = No and 1 = Yes). During the coding of variables, the higher values were allocated to favorable behavior. To quantitatively measure most of the behavior factors, a single question was used.

Data analysis

During the data analysis, observations recorded on ODF status were combined to generate a new variable ODF status. The responses to all observations had to be yes accept for presence of feces around the compound that was no for the categorical composite ODF status variable to be yes. Data on households' contextual and behavioral factors were summarized using frequency distribution tables.

The "svyset" command in STATA/BE 17 was utilized to address unequal selection probability, non-response rates, and village clustering of outcome. Using the Firth's penalized logistic regression, bivariate and multivariate analysis was conducted to determine if there existed significant associations between the outcome (HODF) and independent variables. Variables with $P < 0.2$ at bivariate analysis comprised the global model for the multivariate analysis. Starting with the global model, the backward elimination algorithm of variable selection was performed and a model of best fit developed [26]. The results were presented as adjusted odds ratios (AORs), at 95% confidence intervals (CIs) with independent variables with $p < 0.05$ and with a confidence interval that does not overlap to be considered statistically significant.

Results

Socio-demographic characteristics, sanitation and hygiene practices among the households

A total of 492 households were included in this study. The average age of the participants from the two subcounties was about 49 years (SD = 23.42) years. Most (67.68%) of the study participants, were females and 144 (29.27%) of the participants had no formal education. Among the total (492) households, about three quarters (75.41%) had compounds littered with waste, slightly more (13.73%) than 10% did not have a latrine, and 217 (44.11%) practiced open defecation [Table 1].

Household open defecation free status (HODF)

The households that were open defecation free were 15 (3%). Most (373 (75.80%)) households did not have feces littered around them and almost all (440 (89.40%) had latrines with superstructure. About three-quarters (366 (74.39%)) of the households showed evidence of latrine use while 73 (14.80%) of the latrines had hole/latrine covers. Only 83 (16.90%) households had latrines with handwashing stations with about a half (44 (53.01%)) having handwashing materials, most (69 (83.13%)) having water and about three-fifths (51 (61.45%)) showing evidence of using them.

Factors associated with open defecation free status households

Bivariate and multivariable logistic regression analysis of factors associated with open defecation free status was conducted. All variables that had a p-value < 0.20 in the bivariable analysis (Table 2: Crude Odds Ratios) were included the global model for the multivariable analysis. Starting with the global model, the backward elimination algorithm of variable selection was used to develop the model of best fit [Table 2: Adjusted Odds Ratios].

In the final model, the personal contextual variable of sex of the participant, the physical contexual factor of compound cleaniliness and the behavioral factor of remembering handwashing had a significant association with Household open defecation free (HODF) status.

Specifically, male participants had a higher odds of having open defecation free households (aOR: 3.89; 95% CI: 1.26–12.06) compared to female participants. Households with clean compounds, with latrines not having their holes soiled with feces and where respondents always remembered to wash hands after visiting latrine had a higher odds of being open defecation free (aOR: 3.15; 95% CI: 1.03–9.66, aOR: 10.56; 95% CI: 1.87–59.63 and aOR: 3.96; 95% CI: 1.24–12.68 respectively). Although, our results indicate that households that incurred US dollars above 17 to build a latrine was not significantly associated HODF status (aOR: 15.26; 95%

Table 1 Household socio demographics, sanitation and hygiene characteristics

Variables	Categories	Frequency (%) *n* = 492
Age of participants (years)	Mean	48.89 (SD 23.4)
sex of participants	Female	333 (67.3%)
	Male	159 (32.3%)
Marital Status	Single	55 (11.2%)
	Married	437 (88.8%)
Education level	None	144 (29.3%)
	Primary	270 (54.9%)
	Secondary	63 (12.8%)
	Tertiary	15 (3.1%)
Own radio	No	184 (37.4%)
	Yes	308 (62.6%)
Own television	No	459 (93.3%)
	Yes	33 (6.7%)
years lived in community		25.53 (SD 21.28)
Time to water source (minutes)		19.76 (SD 30.42)
waiting at water source (minutes)		12.23 (SD 28.17)
water at source	sometimes water not at source	75(15.2%)
	always water at source	417 (84.8%)
Latrine sharing between households	Latrine sharing	67 (13.7%)
	No latrine sharing	421(86.3%)
Latrine status during rainy season	latrine unsuable	49 (10.0%)
	latrine usable	439(90.0%)
Children Under 5 years in household	Present	210(42.7%)
	Absent	282(57.3%)
compound cleanliness status	Waste present around the yard	371 (75.4%)
	Waste absent around the yard	121(24.6%)
cost of building latrine	No amount	87(17.7%)
	Less than USD 15.65	187 (38.0%)
	More than USD 15.65	218 (44.3%)
Presence of latrine	No	67(13.7%)
	Yes	421 (86.3%)
Hygiene education provided	No	154 (31.3%)
	Yes	338 (68.7%)
Latrine user privacy	User visible	104 (21.1%)
	User almost visible	106(21.6%)
	User not visible	282(57.3%)
Latrine hole cleanliness	smeared with shit	241(49.0%)
	Not smeared with shit	251(51.0%)
self-reported consistent handwashing practice	No	376 (76.4%)
	Yes	116 (23.6%)

CI: 0.86–272.33), due its importance it has been included in the final model.

Discussion

This study was conducted to determine household open defecation free status and its determinants among households in southwestern Uganda. The findings in this study show that the proportion of households with the open defecation free status in South western Uganda is very low (3%). This is slightly lower than that which was established by Okolimong, Ndejjo [8] in the Eastern Uganda (6%). In this study, the presence of covers for latrine drop holes, presence of handwashing facilities, availability of water at the handwashing station, evidence of use of the handwashing facilities and presence of handwashing materials were the least observed open defecation free status components. Conversely, other components such as absence of feces around the households, presence of latrine and use were observed in most of the households, which is consistent with the increase of latrine coverage and reduction of rural open defecation reported in Uganda and globally [8, 27, 28].

Table 2 Unadjusted and adjusted factors associated to open defecation free status

Variable	*P*-value	Crude Odds Ratio - COR (95%CI)	*P*- value	Adjusted Odds Ratio- AOR (95%CI)
Age	0.587	1.01(0.98–1.03)	-	-
Gender				
Female = Ref				
Male	0.008	4.19 (1.47–11.98)	0.019	3.89(1.26–12.06)
Marital Status				
Married	0.802	1.24 (0.23–6.84)	-	-
Education level				
Primary	0.845	0.89 (0.27–2.91)		
Secondary	0.417	1.81 (0.43–7.54)		
Tertiary	0.233	3.23 (0.47–22.15)	-	-
Ownship of a television and a radio	0.690	1.42 (0.25–7.91)		
Time to water source	0.554	1.00 (0.99–1.02)	-	-
Years lived in community	0.941	1.00 (0.98–1.02)	-	-
Latrine status during rainy season				
Latrine usable				
latrine unsuable	0.911	0.91 (0.16–5.00)	-	-
Children Under 5 years in household present	0.495	0.69 (0.24–1.98)	-	-
compound cleanliness status				
Waste absent around the yard	0.003	4.75 (1.71–13.17)	0.045	3.15(1.03–9.66)
Latrine user privacy				
User almost visible	0.463	1.80 (0.37–8.65)	-	-
User not visible	0.623	1.42 (0.35–5.84		
Latrine hole cleaniliness				
Not smeared with feaces	0.008	9.79(1.81–53.08)	0.008	10.56(1.87–59.63)
Cost of building latrine				
Sh.60,000 and below	0.360	4.00(0.20-78.24)		
Above sh.60,000	0.068	13.99(0.82–238.70)	0.064	15.26(0.86-272.33)
Hygiene education provided				
Yes	0.061	14.81 (0.88 – 249.05)	-	-
Self-reported handwashing				
Yes	0.033	3.33 (1.10–10.06)	-	-
Perceived vulnerability				
Yes	0.056	0.27 (0.07–1.04)	-	-
Instrumental belief: time				
not time consuming	0.118	1.97 (0.97–11.59)	-	-
Affective belief: Disgust				
Yes	0.184	3.15 (0.58–17.14)	-	-
Descriptive norm				
all of them	0.509	1.42 (0.50–4.08)	-	-
Action self-efficacy				
Yes	0.118	1.42 (0.71–21.00)	-	-
Remembering handwashing				
always	0.044	3.11 (1.03–9.39)	0.020	3.96 (1.24–12.68)

Implementation of barriers to the oral fecal transmission of diarhoea diseases through consistent handwashing with soap/ash and house flies control through use of tight fitting squat hole covers remains a challenge as revealed in this study. This is in agreement with other studies that have shown that the squat hole covers are in some instances spoiled with fecal matter and consistent handwashing has remained low [8, 29, 30]. Therefore, sanitation and hygiene behavioral change interventions such as Community Led Total Sanitation (CLTS) focused on promoting hand hygiene and squat hole covers should be prioritized if the ODF status is be attained by most households in rural areas.

Establishing the factors related to the HODF is vital if the ODF status is be attained by most households in rural areas. Results from the present study suggest that HODF was significantly associated with the gender of the study participant, latrine and household cleanliness and the behavioral factor of remembering handwashing. To increase the very low prevalence of HODF in rural South Western Uganda, stakeholders in sanitation promotion should consider these contextual factors when developing interventions.

Our finding that households whose respondent's gender was male were more likely to have the ODF status can be explained in two ways; (1) men who accepted to participate in a sanitation survey were those that were more involved in the household sanitation and hygiene and (2), men who were found at home during the day (which commonly is not the case), were those who often spent a little more time at home to support the women in domestic house cores [31]. Our study is in line with other studies that show that the involvement of men is crucial in the sanitation and hygiene promotion in rural areas [32]. More deliberate efforts are required on how to engage men to support women if sanitation and hygiene is to improve at households [33].

While in some related studies [34–36], socioeconomic factors such as age, level of education, household size and economic status were associated to open defecation, in this study they were not. This was also observed by Okolimong, Ndejjo [8] who established that level of education was not significantly associated to achieving HODF. However, we observed that households that had spent more in constructing latrines were more likely to be ODF. Although, this finding was not statistically significant, it still reveals that households with a little more finances to build better latrines will likely be ODF. Studies [37, 38] have shown that poor quality latrines result into households reverting open defecation practices.

Another interesting finding in our study was that households with clean latrine and environment were 4 times more likely to be ODF compared to those with a dirty environment. This finding is similar to several sanitation studies ([39–43]) that associated cleanliness of latrine environment with improved sanitation behavior. When individuals in a household are consistently engaged in maintaining the latrine and environment clean, they are able and motivated to have improved sanitation practices and behavior needed to achieve HODF. This is very important to note that achieving HODF does not necessarily require provision of handouts such as latrine covers, hand washing facilities and materials but, behavioral change interventions that empower communities to adapt improved sanitation behavior.

One's abilities to always remember to perform the behavior of handwashing, which is one of self-regulation factors of a sanitation behavior model [24] was associated to achieving HODF. Self-regulation of always remembering wash hands is essential for the ODF related behavior. Our findings are consistent with those of Seimetz, Slekiene [44], Contzen and Mosler [45]. This implies that sanitation promotion interventions with psychological aspects are needed in order to increase households with the household ODF status.

Study strength and limitation

This study assessed many different types of factors associated to household open defecation free (HODF) status unlike previous studies that focused on only a components of HODF such as handwashing, household latrine ownership and use. More so, we measured HODF through use of observational checklists, which provides better reliable information than self-reports from respondents who may be affected by social desirability biases. However, the factors associated to HODF were obtained through interviews using structured questionnaires implying that the results may have been affected by response biases among the respondents. We also acknowledge the limitation of the cross sectional study design that was used, which can only indicate the existence of an association but is limited in demonstrating the causal inference.

Conclusions

We determined the prevalence of Household Open Defeaction Free status (HODF) and its determinants in Rubaya and Buhara subcounties, Kabale district in South Western Uganda. The prevalence of HODF was 3% and factors associated with it were male gender, good latrine and household cleanliness and the behavioral factor of remembering handwashing. We propose some recommendation to focus on in order to empower and motivate communities towards attaining households with the ODF status;

- interventions are required on how to engage men to support women in household hygiene in order to increase households with the ODF status,
- stopping sanitation interventions of giving handouts such as latrine covers, hand washing facilities and materials and.
- focus on behavioral change interventions that empower communities to adapt improved sanitation behavior, such as Community Led Total Sanitation and Hygiene with focus on promoting hand hygiene and squat hole covers.

Future intervention studies should evaluate the suggested approaches for increasing the proportion of households that have attained the ODF status.

Abbreviations

AOR	Adjusted odds ratio
CLTS	Community led total sanitation
CLTSH	Community led total sanitation and hygiene
COR	Crude odds ratio
HODF	Household open defecation free
ODF	Open defecation free
LMIC	Low and middle income countries
MWE	Ministry of water and environment
VHT	Village health team

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Author contributions
MN led the data collection process. The other three of the co-authors JCS, EM, JBI participated in the development and review of the protocol and data tools. They further supervised the entire research process. Although MN also took lead in the analysis, the other authors (JBI, EM and JCS) contributed in the manuscript review process. All authors approved the final manuscript.

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Data availability
Due to restrictions set by the Makerere University, College of Health ScienceHigh Degrees Research and Ethics Committee, data are available upon request by contacting the corresponding author.

Declarations

Human ethics and consent to participate
Informed consent was obtained from all household heads or their spouses that participated in the study. The study protocol was approved by the High Degrees Research and Ethics Committee of School of Public Health, College of Health Sciences, Makerere University. The final approval and registration was done by the Uganda National Council of Science and Technology (UNCST). The research registration number of UNCST is **HS1135ES.** The Helsinki declaration ethical considerations were observed in conducting this study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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