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Factors associated with diarrheal disease among under five children in Godawari Municipality of Nepal: A cross-sectional study

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Abstract

Introduction: Water, Sanitation and Hygiene (WASH) are the basic need for all, especially for children. The WASH related matter is still burning issue in the context of developing countries like Nepal. This article is aimed to assess the factors associated with diarrheal diseases among under five children in Godawari Municipality of Nepal.
Methods: A cross-sectional study was conducted in a sample of 742 households from Godawari Municipality. A random sampling technique was applied for data collection. Households with at least one under-five year child were included in the study. Data was analyzed using SPSS Statistics version 20. Univariate and multivariate analysis were carried to determine the relationships between the potential associated factors and diarrheal diseases.
Results: Households with piped water supply for drinking purpose were 98.2%, with improved sanitation 99.5%, no open defecation 100% and 95.1% of households used soap and water for hand-washing. The prevalence of diarrhea among children under the age of 5 years was 50%. Family type (aOR= 0.62, *P* = 0.008), number of children in household (aOR= 0.13, *P* = 0.003], occupation as housewife (aOR=1.69, *P* = 0.02), ethnicity (aOR= 0.23, *P* = 0.004), location of water source (aOR= 1.95, *P* = 0.04), sharing of toilet (aOR= 0.56, *P* = 0.001), critical hand washing before feeding child (aOR= 2.46, *P* = 0.05) and location of hand washing facility (aOR= 0.26, *P* = 0.008) were significantly associated factors with the occurrence of childhood diarrheal diseases.
Discussion and Conclusion: Childhood diarrhea remains the most common health problem in the study area despite the good WASH situation of Godawari Municipality as compared to national indicators. This study implies the policymakers and local government authority to investigate and launch more awareness program for the reduction of children's diarrheal disease in the study area.

KEY WORDS: Diarrhea, hygiene; Nepal; sanitation; under five children; water.

INTRODUCTION

The basic needs for children's survival and development are safe clean water, sanitation, and good hygiene practices [1]. The impact of diarrheal diseases due to poor sanitation, poor hygiene, or unsafe drinking water on child mortality rates is devastating [2–4] with more than 297,000 children under five who die annually [5]. The observed diarrhea prevalence in under five children was found different in various districts of Nepal with an average national prevalence of 5.76% in 2016 [6] and major cause was bacterial contamination of coliform and salmonella [7]. Water, Sanitation and Hygiene (WASH) are the basic need for all, especially for children. Thus, around 10% of the global burden of disease worldwide could be prevented with improvements in WASH [8]. The poor WASH condition has not only a substantial impact on diarrhea and child health, but it makes also a significant contribution to women's dignity and safety [9]. Though WASH is essential to life, it is often an under-valued issue; its more comprehensive benefits (life, health, education, economic development, and others) have been ignored [10]. Data from the Department of Water Supply and Sewerage Management of Nepal [11] shows that about 97% of the entire populations have access to basic sanitation facilities and 87% have access to a basic water supply facility. By the end of 2018, 63 out of 77 districts of Nepal achieved the status of 'Open Free Defecation' zones. Sanitation coverage is more than 95% in six provinces; however, in Province 2 it is below 90% [12].

The WASH-related matter is still a burning issue in developing countries like Nepal, as many of these WASH-related diseases can lead to a high number of deaths [13]. The Nepal Demographic and Health Survey [14] showed that diarrheal prevalence within two weeks varied geographically across the country, ranging from 3.7% to 9.0% in different provinces. According to the Department of Health Services, Epidemiology and Disease Control Division (EDCD), diarrhea is still a

TAKE-HOME MESSAGE

In this Nepal-based study, parental occupation, family type, the number of children in the family, hand washing in critical times, location of water source, toilet sharing and hand washing facility played significant roles in diarrhea among under-five children.

Competing interests - none declared.

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leading cause of mortality and morbidity in under-five children and several cholera outbreaks had been reported in different regions of the country including Kathmandu valley in 2013, 2015 and 2016 [15]. Nepal is at high risk of waterborne diseases. Hence, the Government of Nepal has set a major development goal to 'Improve public health and living standard of people of Nepal through safe, sufficient, accessible, acceptable, and affordable water, sanitation and hygiene services any time, everyone and everywhere' [16]. WASH shows an improving pattern in Nepal over the years with significantly increased of sanitation coverage from 6% in1990 to 87.3% in 2016 and increased of water supply coverage from 46% in 1990 to 87% in 2016 [17], however data on access to drinking water supply, sanitation, and hygiene facilities are limited. The WASH situation of Nepal has not been well documented so far. Therefore, this study aims to explore the situation of WASH in Godawari Municipality and to determine the predisposing factors to diarrhea among under five children.

METHODS

Study design and procedure

This cross-sectional study was conducted in Godawari Municipality, in Bagmati Province of Nepal, from May to August 2018. Wards are the basic administrative unit within municipalities in Nepal. The municipality is divided into 14 wards and covers a land area of 96.1 square km. The population of this Municipality is 80,376 with 4,993 under-five children living in 17,814 households [18].

Random sampling method was applied for the selection of households. Households with at least one under-five children in each ward were surveyed with the help of Female Community Health Volunteers (FCHVs). Households were numbered accordingly and with the help of lottery method, were selected for data collection. For the calculation of the sample size, key indicators were used. The following formula was used to estimate the required sample size for indicator [19].

$$N = [\frac{4(r)(1-r)\left(f\right)\left(1.05\right)}{(0.12r)\text{^}2(P)(n)}]\text{Eq (1)}$$

Where N = the required sample size, expressed as number of households

r = the predicted or anticipated value of the indicator, expressed in the form of a proportion

Non-response rate is 5%, which may be considered the factor necessary to raise the sample size by five percent for the expected non-responses

f = symbol for design effect 1.5

r = the margin of error to be tolerated at the 95 percent level of confidence, defined as 10 percent of r (relative margin of error of r)

p = the proportion of the total population upon which the indicator 'r' is based

n = the average household size (number of persons per household)

Therefore, the total sample size surveyed was of 742 households.

Study participants

Households with at least one under-five child were selected for the study. The principal respondents to questionnaires were the mothers. In some cases (when the mother was not available), information was collected from the caregiver.

Study instruments and measures

To collect information from the respondents, a semi-structured pretested questionnaire was used. The questionnaire was adapted from "Core questions on drinking-water and sanitation for household surveys" developed by the WHO and UNICEF [20]. This questionnaire was pretested and necessary changes were made. After pretesting, necessary changes were made in the questionnaire. There were 100 questions in the Nepali language that covered the following topics: 1) socio-demographic information; 2) socio-economic indicators; 3) water access; 4) sanitation, personal and children's hygiene. Enumerators were selected and two days of orientation training were given to them regarding water sample

collection and data collection. Each interview took about 30–40 minutes. Drinking water samples were collected from the main water vessel for each household by the presence-absence vial (P/A) for Coliform test [21].

Study variables

Diarrhea was the only dependent variable in this study. It was measured as the occurrence (yes/no) of loose or watery diarrhea at least three times per day in the previous 2 weeks, as reported by the mother/caretaker of the child [22, 23]. The independent variables were socio-demographic characteristics of participants such as parents' occupation, income, education, children's age and sex. Furthermore, other independent variables were environmental and hygienic factors including the source of water, improved /unimproved sanitation, water quality and water treatment or boiling before drinking, critical hand washing and presence of toilet at home.

Ethical aspects

Written consent was obtained from all respondents prior to the interview. The Institutional Review Committee of the Institute of Medicine at the Tribhuvan University, Kathmandu (study registration number: 369(6-11-E) 4014/075) granted ethical approval for this study. Before conducting the questionnaire survey, permission was taken from the local authority including the Godawari Municipality office and ward office.

Data analysis

Statistical analysis was performed using SPSS Statistics version 20. We conducted cross-tabulation to explore frequencies. A descriptive analysis and Chi square test was used to identify significant associations between the risk factors of WASH and diarrhea. Variables with p values < 0.2 were retained for logistic regression models. We estimated crude odds ratios (cORs) and adjusted odds ratios (aORs) and the associations were considered statistically significant if p-value < 0.05.

RESULTS

Socio-demographic characteristics

Table 1 provides an overview of the socio-demographic characteristics of the households. The total number of household surveyed with under-five children was 742. The respondents' mean age was 29 years. Participants had one or two children under the age of five. In Godawari Municipality, Janajati (56.7%) was the most represented ethnic group and Hinduism was the most frequent religion among participants (79.5%). The most frequent occupation was housewives (28.3%), followed by self-employed (20%) and farmers (16.6%).
The prevalence of diarrhea cases among under-five children was 50% (n = 371). Among the Janajati ethnic group, diarrhea cases were higher (56.7%), though the water supply coverage was good with 98.2% piped water supply and 99.5% improved sanitation coverage in the study area. The prevalence of diarrhea was the lowest (43.1%) in the Buddhist community and among office workers (34.8%) and the highest among self-employed groups (55 %). There was no difference in diarrhea cases among the level of education (P = 0.146). The cases of diarrhea were seen higher (63.6%) in the 5th wealth quintile while comparatively lower (44.1%) in the 4th wealth quintile (P = 0.01).

WASH situation

With regard to water availability, piped water (98.2%) was the most common source of drinking water used by households. Only 17 households (2.3%) used unimproved water source, of which;12 (70.5%) households used unprotected spring water. Those households with a water fetching distance of less than 30 minutes were 588 (79.2%). Diarrhea cases were less frequent among households with improved water source 364 (50.2%).
Among 742 households, only 430 (58%) practiced water treatment. The most common water treatment method was boiling (52.6%), followed by filtration (39.1%). Households (42%) who did not use any treatment

methods believed that the water source was safe. Even those households where water treatment was practiced had a higher rate of diarrhea (52.5%). The households with water storage container were 85.1%, and 83.2% used to cover the water container. Among those households who used water container, the most (71.4%) cleaned it daily, while 8.8% once a week.

The water collected from the households was tested for coliform. Of all the water samples collected, 45.6% were coliform positive and 54.4% were without coliform. Even samples of boiled water (31.3%) were coliform positive. Among 742 households, 738 (99.5%) used improved sanitation. 29.2% of households shared the toilet facilities, 68% of mothers or caregivers practiced toilet defecation for their children while 27.5% used potty. 93.1% of the households had a hand washing facility. All four type of critical hand-washing was well adopted by households as follows: 1) critical hand washing after defecation (98.8%); 2) critical hand washing before feeding child (95.4%); 3) critical hand washing after defecating child (98.5%); 4) critical hand washing before food preparation (82.5%). Hand-washing with soap and water was observed in 95.1% households. In 92% of households, soap was available in the hand washing facilities (Table 2).

Pre-disposing factors for diarrhea

Table 3 presents the association of risk factors with diarrhea. Our study showed that factors such as type of occupation of the households, ethnicity, were significantly associated with diarrhea among under-five children. Respondents who were self-employed or housewives were 1.76 [aOR = 1.76; 95% Confidential Interval, (95% CI) 1.07 to 2.9] and 1.69 (aOR = 1.69; 95% CI 1.05 to 2.73) times more likely to have diarrhea than other occupations. There was no increased risk of diarrhea disease by ethnic group. Children living in joint family were more protected than those living in the nuclear family (aOR = 0.62; 95% CI 0.44 to 0.88). Children from households with less than five children were at lower odds of having diarrhea (aOR = 0.13; 95% CI 0.03 to 0.49). Children from households with a water source within houses had twice better protection (aOR = 1.95; 95% CI 1.02 to 3.73) than the water source located at a far distance. Those with no-shared or individual toilets had lower chances of having diarrhea (aOR = 0.56; 95% CI 0.40 to 0.79). The households with hand washing facility had significantly lower odds of diarrhea cases among children (aOR = 0.26; 95% CI 0.09 to 0.70).

Finally, there was no significant association of diarrhea with the gender of the child, age-group, nutritional status, hand washing type, water quality, water fetching distance, quantity of water used, and availability of soap.

DISCUSSION

This study presents prevalence of diarrheal disease among under-five children and the WASH situation in Godawari Municipality, Nepal. We found the WASH situation was better as compared to the Sustainable Development Goal baseline report, carried out in 2017 for purposed national target 6 [24]. According to SDG 2017, in Nepal households with access to piped water supply should be 68.4% by 2022. But in our study, 98.2% of the households had piped water supply as a common source of drinking water surmounting the national target. However, coliform risk level in household water still remains high and unsuccessful in meeting the national target (43.8%) for 2022. Indeed, 45.6% of drinking water from households was tested coliform positive in this study. The household population using latrine was 100% (improved sanitation 99.5% and unimproved 0.5%). Godawari Municipality (Lalitpur district) had been declared open defecation free (ODF) in 2018. All these findings showed a positive trend towards meeting the National SDG Target 6.2 which articulates 99% sanitation coverage, and 95% improved sanitation facility by 2030. The water supply in Godawari Municipality was 'improved type', as most of the households (98.2%) used piped water as the main source of drinking water. A similar type of findings has been found in previous rese-

Table 1. Demographic variables of the study participants (*n* = 742).

Variables	n (%)*	Diarrhea (%)**	P value based on Chi square (χ^2)
Ethnicity			
Brahmin	78(10.5)	26(33.3)	
Chhetri	223(30.1)	103(46.2)	0.002*
Janajati	390(52.5)	221(56.7)	
Dalit	34(4.6)	14(41.2)	
Others	17(2.3)	9(52.9)	
Religion			
Hindu	590(79.5)	301(51.0)	
Buddhist	116(15.6)	50(43.1)	0.265
Christian	25(3.4)	16(64.0)	
Others	11(1.5)	6(54.5)	
Education			
Illiterate	225(30.3)	110(48.9)	
Read and write	101(13.6)	43(42.6)	0.146
<10	173(23.3)	98(56.6)	
≥10	243(32.7)	122(50.2)	
Occupation			
Housewives	210(28.3)	111(53.6)	
Self employed	148(20.0)	82(55.0)	0.01*
Farmers	123(16.6)	49(39.8)	
Office workers	46(6.2)	16(34.8)	
Labor workers	78(10.5)	36(46.2)	
Others	137(18.4)	79(57.6)	
Family type			
Joint family	354(47.7)	162(45.7)	0.01*
Nuclear family	388(52.3)	211(54.38)	
Wealth quintile			
1st	164(22.1)	78(47.6)	0.01*
2nd	166(22.4)	91(54.8)	
3rd	144(19.4)	65(45.1)	
4th	161(21.7)	71(44.1)	
5th	107(14.4)	68(63.6)	

Note: * P value significant at <0.05 level * (% calculated based on N); ** (% calculated based on n)

Table 2. Situation of diarrheal disease with respect to WASH (*n* = 742).

Variables	n (%)*	Diarrhea (%)**	P value based on Chi square (χ^2)
Improved water source	725 (98.4)	364(50.2)	0.11
Piped water	712 (98.2)	354(49.72)	
Unimproved water source	17(2.3)	11(64.71)	0.22
Unprotected spring	12(70.5)	9(75.0)	
Fetching distance (< 30 min)	588(79.2)	286(48.64)	0.20
Water treatment			
Yes	430(58.0)	226(52.5)	0.24
No	312(42.0)	147(47.1)	
Methods of water treatment	(n = 430)		
Boil	226(52.6)	120(53.10)	
Filter	168(39.1)	88(52.38)	0.07
Strain through cloth	22(5.1)	13(59.09)	
Others	14(3.2)	5(35.7)	
Water quality			
With coliform bacteria	338(45.6)	165(48.82)	0.46
Without coliform bacteria	404(54.4)	208(51.49)	
Improved sanitation	738(99.5)	372(50.41)	
Flushed to septic tank	469(63.2)	247(59.06)	0.01*
Pit latrine with slab	139(18.7)	52(37.41)	
Flushed to pit latrine	93(12.5)	52(55.91)	
Shared toilet facilities			
Yes	217(29.2)	128(58.99)	0.001*
No	525(70.8)	245(46.67)	
Hand washing facilities	688(92.7)	351(51.02)	0.14
Critical hand washing			
1. After defecation	733(98.8)	369(50.34)	0.725
2. Before feeding child	708(95.4)	347(49.01)	0.002*
3. After defecating child	731(98.5)	364(49.79)	0.03*
4. Before food preparation	612(82.5)	299(48.86)	0.09
Hand washing with soap and water	705(95.1)	344(48.79)	0.001*

Notes: * P value significant at <0.05 level * (% calculated based on N); ** (% calculated based on n).

Table 3. Factors associated with diarrheal disease in under five years children (*n* = 742).

Variables	N	Diarrhea	cOR(95%CI)	P value	aOR(95%CI)	P value
Age of the child						
<2.5 years	280	154	0.73(0.54-0.99)	0.04	1.11(0.79-1.57)	0.52
>2.5 years	462	219	1		1	
Family Type						
Joint family	354	162	1.14(1.05-1.88)	0.023	0.62(0.44-0.88)	0.008*
Nuclear family	388	211	1		1	
No. of children in Household						
<5	719	354	4.6(1.55-13.84)	0.04	0.13(0.03-0.49)	0.003*
>5	23	18	1		1	
MUAC of child						
Normal	484	229	0.71(0.52-0.96)	0.02	0.81(0.56-1.18)	0.29
Undernourished	258	144	1		1	
Occupation						
Housewife	210	111	1.73(1.1-2.72)	0.01	1.69(1.05-2.73)	0.02*
Self-employed	148	82	1.85(1.13-3.0)	0.01	1.76(1.07-2.9)	0.02*
Labor workers	78	36	1.29(0.73-2.29)	0.37	1.18(0.64-2.16)	0.58
Farmers	123	49	1		1	
Ethnicity						
Brahmin	78	26	0.31(0.17-0.57)	0.0	0.23(0.12-0.45)	0.0*
Chhetri	223	103	0.53(0.33-0.85)	0.09	0.48(0.29-0.79)	0.004*
Dalit	34	14	0.43(0.20-0.96)	0.04	0.34(0.15-0.79)	0.01*
Janajati	390	221	1		1	
Location of water source						
Within house	85	53	1.2(0.74-2.19)	0.37	1.95(1.02-3.73)	0.04*
Inside premises	501	232	0.66(0.46-0.95)	0.02	0.78(0.50-1.23)	0.29
Other places	156	88	1		1	
Quantity of water use						
<100L	605	296	0.74(0.51-1.08)		1.05(0.67-1.64)	0.81
>100L	137	77	1		1	
Share toilet						
Yes	217	128	1.71(1.24-2.37)	0.001	0.56(0.40-0.79)	0.001*
No	525	245	1		1	
Critical hand washing (Before feeding child)						
Yes	708	347	0.29(0.13-0.66)	0.002	2.46(0.96-6.29)	0.05*
No	34	26	1		1	
Location of handwashing facility						
Inside Toilet	433	184	0.25(0.11-0.58)	0.001	0.26(0.09-0.70)	0.008*
Inside kitchen	74	43	0.48(0.19-1.22)	0.12	0.49(0.16-1.48)	0.20
Within courtyard	156	106	0.73(0.30-1.76)	0.49	0.61(0.22-1.68)	0.34
Others	31	23	1		1	

Note: * P < 0.05; COR: crude odds ratio; AOR: adjusted odds ratio; CI: Confidence Interval

arch in the region of Makawanpur in Nepal [25] and in Ethiopia [26]. The occurrence of diarrhea in Godawari Municipality was 50%, which is high compared to the NDHS 2016 report [27]. In the 2016 NDHS survey [27], 8% of under-five children reported diarrheal disease in the two weeks preceding the survey. However, in our study the prevalence of diarrhea was assessed within the previous three weeks and data was collected in summer/ rainy season. In another study carried out in urban slums, diarrhea prevalence was higher (40%) [28]. This showed much difference in the prevalence of diarrheal disease between different Regions in Nepal. Despite good WASH situation in community, the reported higher prevalence of diarrhea means that water, sanitation and hygiene may not have been the only risk factors for the causation of diarrhea. Even in the samples of boiled water, coliform bacteria test was positive. Most of the under-five children attend kindergarten in

Nepal. Thus, even though WASH sanitation is good at the household level, the children could have been exposed at schools or outside, through drinking water, toilets, hand washing facility and snacks and food from street vendors. Our analysis identified specific risk factors for diarrheal disease, and only a few of the variables included in our study have exhibited a strong associations with diarrheal cases. We observed a very strong association between diarrhea and children living in joint families and with less number of children in households. As seen in a study carried out in Bangladesh [29], children living-in joint families where the number of under-five children is expected to be low, should have a lower risk of having diarrhea. In our study, children whose caretakers were housewives and self-employed had lower chances of having diarrhea. Similar findings were also noted in Bangladesh [29]. In our study, we found a significant association between the location of the water source and diarrhea cases. Those households having a water source within their house had lower odds of having diarrhea. Therefore, time reduction in water fetching may provide economic as well as health benefits like a reduction in frequency of diarrheal disease [28]. Similarly, we found a strong association between the location of the hand washing facility and diarrheal cases. A hand washing facility near the kitchen or latrine may create a favorable environment for hand washing with soap [30]. In our study, 29.2% of households shared toilet facilities with more than one household. This could explain the positive relationship between sharing toilets and diarrheal episodes. Our study has also some limitations. All diarrheal cases were self-reported, which were not confirmed by a diagnostic test. Therefore, the real number of infection cases could be lower than reported. Furthermore, this study has not considered the microbial contamination of sample drinking water during collection, transport, and stored water quality within households and the children's hygiene behavior, (e.g., washing hand before eating and after every use of the toilet, whether they trim nails, the habit of nail-biting and thumb sucking, drinking water and snacks in pre-school and food brought from street vendors).

CONCLUSION

In this research half of the sample of under-five children suffered from diarrhea within three previous weeks from the study. The WASH situation observed was good with respect to Nepal's SDG 6 target. The determinants of diarrhea among under five children depends on multiple factors. Significant risk factors for diarrheal disease were parental occupation, family type, the number of children in the family, hand washing in critical times, location of water source and hand washing facility. Further, the risk of diarrhea among under-five children was lower in those households where an unshared toilet was used and the practice of proper hand washing was followed. The findings of this study have important policy implications for the improvement of WASH situation and intervention for children's diarrheal disease program. Proper water facilities and hand washing facility within house and individual toilet facilities for household are highly recommended. Despite a good WASH situation, higher prevalence of diarrhea in community and high prevalence of coliform bacteria in boiled water samples indicate that water, sanitation and hygiene are not only the risk factors for the causation of diarrhea. This implies the government to investigate and launch more awareness program for the reduction of children's diarrheal disease in Nepal.

References

1. UNICEF. Water, Sanitation and Hygiene. 2019 [Cited 2020 September 20]. Available from: https://www.unicef.org/wash/3942_3952.html.
2. Chirico F. Avoiding the apocalypse: A call for global action. J Health Soc Sci. 2016;1(2):87–90. doi 10.19204/2016/avdn10.
3. Chirico F. The migrant nightmare: Addressing disparities is a key challenge for developed nations. J Health Soc Sci. 2016;1(3):165–172. doi: 10.19204/2016/thmg19.
4. Chirico F. Stop violence and crimes against children. J Health Soc Sci. 2018;3(2):105–108. doi 10.19204/2018/stpv1.
5. United Nations. Water, Sanitation and Hygiene [cited 2021 May 28]. Available from: https://www.unwater.org/water-facts/water-sanitation-and-hygiene/.
6. Li R, Lai Y, Feng C, Dev R, Wang Y, Hao Y. Diarrhea in Under Five Year-old Children in Nepal: A Spatiotemporal Analysis Based on Demographic and Health Survey Data. Int J Environ Res Public Health. 2020;17:2140. doi:10.3390/ijerph17062140.
7. Ansari S, Sherchand JB, Parajuli K, Mishra SK, Dahal RK, Shrestha S, et al. Bacterial Etiology of Acute Diarrhea in Children Under Five Years of Age. J Nepal Health Res Counc. 2012 Sep;10(22):218–223.
8. World Health Organization, United Nations Children's Fund. Diarrhea: Why children are still dying and what can be done. 2009 [Cited 2020 May 20]. Available from: https://apps.who.int/iris/bitstream/handle/10665/44174/9789241598415_eng.pdf;sequence=1.
9. Wolf J, Hunter PR, Freeman MC, Cumming O, Clasen T, Bartram J, et al. Impact of drinking water, sanitation and handwashing with soap on childhood diarrhoeal disease: updated meta-analysis and meta-regression. Trop Med Int Health. 2018 May; 23(5):508–525. doi: 10.1111/tmi.13051.
10. Organization for Economic co-operation development (OECD). Benefits of investing in water and sanitation. 2011 [Cited 2018 May 20]. Available from: http://www.oecd.org/berlin/47630231.pdf.
11. Mills JE, Cumming O. The impact of water, sanitation and hygiene on key health and social outcomes: review of evidence. 2016 [Cited 2020 December 12]. Available from https://www.communityledtotalsanitation.org/sites/communityledtotalsanitation.org/files/Impact_of_WASH_on_Key_Social_and_Health_Outcomes.pdf.
12. UNICEF. Situation Analysis of the Water, Sanitation and Hygiene (WASH) Sector in Relation to the Fulfillment of the Rights of Children and Women in Afghanistan.2013. [Cited 2020 May 8]. Available from: www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/WASH%20SitAn%20-%20FINAL%20-%2031_8_13.pdf.
13. DWSS. Sanitation status of Nepal: Factsheet. Government of Nepal, Ministry of Water supply and sanitation. Department of Water Supply and Sewarage (DWSS). Nepal: Environmental Sanitation Section; 2018.
14. Budhathoki C. Water Supply, Sanitation and Hygiene Situation in Nepal: A Review. J Health Promot. 2019;7:65–76.
15. Sah RK, Sah PK, Sah JK. Assessment of the Knowledge, Attitude and Practice Regarding Water, Sanitation and Hygiene among Mothers of Under-five Children in Rural Households of Saptari District. Am J Public Health Res. 2017;5(5):163–169. doi:10.12691/ajphr-5-5-5.
16. Government of Nepal. National preparedness and response plan for acute gastroenteritis/cholera outbreaks in Nepal. July 2017 to July 2022. Department of Health services, Epidemiology and disease control division. Teku Kathmandu [cited 2021 Apr 17]. Available from: http://www.edcd.gov.np/resources/download/national-preparedness-and-response-plan-for-acute-gastroenteritis-cholera-outbreaks-in-nepal.
17. Ministry of water supply and sanitation (MWSS). Water, sanitation and hygiene(WASH)sector status report 2016.Sector Efficiency improvement unit, Ministry of water supply and sanitation, Kathmandu, Nepal; 2016.
18. Godawari Municipality. Godawari Municipality: a Profile [Cited 2021 January 14]. Available from: http://

www.godawarimun.gov.np/en/content/nagar-profile.

19. Central Bureau of Statistics. Nepal Multiple Indicator Cluster Survey 2014. Final Report. Central Bureau of Statistics and UNICEF Nepal. 2015. Available from: https://www.unicef.org/nepal/media/486/file.
20. Sobsey MD, Pfaender FK. Evaluation of the H2S Method for Detection of Fecal Contamination of Drinking Water. Water, Sanitation and Health Department of Protection and the Human Environment. Geneva: World Health Organization Geneva; 2002 [Cited 2021 January 14]. Available from: https://www.who.int/water_sanitation_health/water-quality/WSH02.08.pdf.
21. World Health Organization, United Nations Children's Fund Core questions on drinking-water and sanitation for household surveys. Geneva: WHO, UNICEF; 2006 [Cited 2021 January 14]. Available from: http://www.who.int/water_sanitation_health/monitoring/oms_brochure_core_questionsfinal24608.
22. Anteneh ZA, Andargie K, Tarekegn M. Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan District, Northwest Ethiopia, 2014. BMC Public Health. 2017;17(1):99.
23. Dagnew AB, Tewabe T, Miskir Y, Eshetu T, Kefelegn W, Zerihun K, et al. Prevalence of diarrhea and associated factors among under-five children in Bahir Dar city, Northwest Ethiopia, 2016: a cross-sectional study. BMC Infect Dis. 2019 May 14;19(1):417. doi: 10.1186/s12879-019-4030-3.
24. World Health Organization. Progress on Drinking Water, Sanitation and Hygiene—2017 Update and SDG Baselines [Cited 2018 January 14]. Available from: http://www.wipo.int/amc/en/%0Ahttp://www.who.int/about/.
25. Kafle S, Pradhan B. Situation of Water, Sanitation and Hygiene and Diarrheal Diseases After Open Defecation Free Declaration. J Nepal Health Res Counc. 2018;16(2). doi: http://dx.doi.org/10.3126/jnhrc.v16i2.20303.
26. Admasie A, Debebe A. Estimating Access to Drinking Water Supply, Sanitation, and Hygiene Facilities in Wolaita Sodo Town, Southern Ethiopia, in Reference to National Coverage. J Environ Public Health. 2016;(2016):ID 8141658, 9 pages. doi: http://dx.doi.org/10.1155/2016/8141658.
27. Ministry of Health, Nepal; New ERA; and ICF. Nepal Demographic and Health Survey 2016. Kathmandu, Nepal: Ministry of Health, Nepal; 2017. Available from: https://www.dhsprogram.com/pubs/pdf/fr336/fr336.pdf.
28. Kalakheti B, Panthee K, Jain K. Risk Factors of Diarrhea in Children Under Five Years in Urban Slums: An Epidemiological Study. J Lumbini Med Coll. 2016;4(2):94–98.
29. Khan Md SI, Al Banna Md H, Akter S, Chakma M, Begum MR, et al. Diarrheal prevalence and risk factors among under five years children in remote coastal area of Bangladesh. Asian-australas J Food Saf Secur. 2018;2(2):93–99.
30. Joshi A, Shrestha RPB. Study of viral diarrhea and associated risk factors among under five years old children in Dhulikhel hospital, Kathmandu University Hospital. Ann Clin Chem Lab Med 2012;1(2):15–22. doi: https://doi.org/10.3126/acclm.v1i2.13095.