

## Determinants of diarrhea in children under the age of five in Afghanistan: a secondary analysis of the Afghanistan Demographic and Health Survey 2015

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### ABSTRACT

Diarrhea is the second leading cause of under-five mortality and globally accounts for 526,000 child deaths every year. Afghanistan, with 33,000 child deaths in 2012, was ranked 8<sup>th</sup> among nations, with the highest under-five deaths being from pneumonia and diarrhea. This study aimed to identify the determinants of diarrhea in children under the age of five in Afghanistan. A secondary data analysis of the Afghanistan Demographic and Health Survey (AfDHS) 2015 was focused on diarrhea in children under the age of five. The dataset of the AfDHS 2015 was used for the analysis. The subjects for this study were 30,238 under-five children. A logistic regression model was applied to examine the determinants of childhood diarrhea. This study found that 7,921 (26.2%) out of 30,238 under-five children had diarrhea within the two weeks preceding the survey. Higher maternal education accompanied a lower risk of childhood diarrhea with an adjusted odds ratio (AOR) of 0.70 ( $P < 0.01$ ) than did no education. Flush toilets (AOR=0.84,  $P < 0.01$ ) and traditional dry vaults (AOR=0.83,  $P < 0.001$ ) were less likely associated with diarrhea compared with pit latrines. Tube wells, public taps, and unprotected wells and springs were sources of drinking water with a higher risk of diarrhea than piped water. This study identified that the type of toilet facility, source of drinking water, age of the child, and maternal education were important determinants of under-five diarrhea. Intervention programs concerning improved sanitation facilities, sources of drinking water, and raising women's level of education and health awareness are important.

Keywords: Afghanistan, determinants, diarrhea, children

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### INTRODUCTION

Diarrhea is the second-leading cause of death in children under the age of five worldwide, accounting for nearly 9% of all under-five deaths in 2015. It was estimated that every year roughly 526,000 children die due to diarrheal diseases. In 2015, more than 90% of the under-

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five mortality due to diarrhea was concentrated in low and lower-middle income countries, and regionally, South Asia and sub-Saharan Africa accounted for 88% of all diarrhea deaths among under-five children. Nevertheless, a decline of about 57% in under-five diarrhea mortality was observed between 2000 and 2015.<sup>1</sup> Since childhood diarrhea is primarily associated with undernutrition and a shortage of access to improved drinking water and toilet facilities, it has been known as a disease of poverty.<sup>2</sup>

In Afghanistan, as per the recent global estimates, annually there are almost 94,000 deaths among children younger than five years of age. In 2012, the country was ranked 18<sup>th</sup> in the world in terms of overall under-five mortality rate. Similarly, with 33,000 child deaths, Afghanistan was listed 8<sup>th</sup> among nations with the highest under-five deaths from pneumonia and diarrhea. India topped the list, and Nigeria, Pakistan, and China were ranked 2<sup>nd</sup>, 4<sup>th</sup>, and 6<sup>th</sup>, respectively.<sup>3</sup> Not surprisingly, diarrhea and pneumonia are the two most prevalent health problems claiming the lives of under-five Afghan children.<sup>4</sup> However, Afghanistan made remarkable progress in reducing the under-five mortality from 137 deaths per 1,000 live births in 2000<sup>3</sup> to 55 per 1,000 live births in 2015.<sup>5</sup>

Worldwide, nearly 2.4 billion people are living without adequate sanitation and 663 million lack access to improved water sources.<sup>6</sup> According to the Afghanistan Living Conditions Survey 2016–17, about 41% of Afghans have access to improved sanitation facilities and almost 64% of them are using improved drinking water sources. However, nearly 58% of households' drinking water sources and 77% of home drinking water are infected with *E. coli*, indicating contamination in the source, handling, and storage of water.<sup>7</sup>

There are several socio-demographic and environmental factors contributing to under-five diarrheal morbidity. Maternal education, child age, lack of access to clean water and improved sanitation, poor hygiene practices, improper waste disposal, unsanitary feeding practice, and housing conditions have been found to be associated with the occurrence of under-five diarrhea.<sup>1,8,9</sup> In a systematic analysis study in 2016, childhood wasting, unsafe drinking water, and unsafe sanitation were found to be the primary risk factors for under-five diarrheal morbidity and mortality.<sup>10</sup> An analysis of intervention coverage scenarios using the Lives Saved Tool (LiST) in Afghanistan indicated that by striving to scale up interventions (e.g., improved sanitation and drinking water, hygiene practice, breastfeeding, and vaccination), there could be an 85% decline in under-five diarrhea deaths between 2016 and 2020.<sup>4</sup> A decreased risk of childhood diarrhea by water and sanitation extension program intervention was found in a case-control study done in Pakistan.<sup>11</sup> Another study found that by 2025 up to 95% of diarrheal cases could be prevented if large-scale interventions to improve hand washing practice, the water supply (improved sources of water, improved distribution, or both), and sanitation were undertaken.<sup>12</sup>

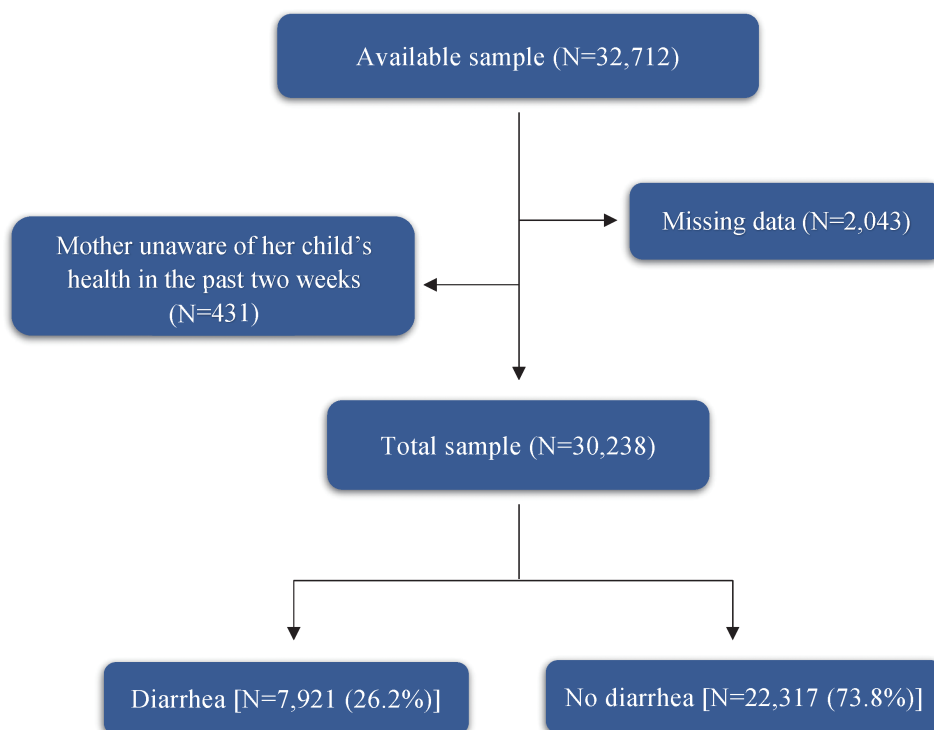
Considering the serious effects of diarrhea on child nutrition, development, and survival, understanding the background characteristics of diarrhea is very important.<sup>13</sup> In Afghanistan, apart from a limited number of studies, there is no adequate information about the actual burden and predictors of diarrhea, especially among those younger than five years of age. More importantly, a nation-wide study assessing the socio-demographic and environmental characteristics of childhood diarrhea is currently lacking. Regarding these challenges along with the high rate of under-five mortality in the country, there is an obvious need to identify the risk factors of under-five diarrhea and effective measures to control the problem. The fact that Afghanistan is a resource-limited country with diminished after-war infrastructures indicates the need to conduct studies to discover the determinants of childhood diarrhea.<sup>14</sup> Therefore, this study aimed to analyze the Afghanistan Demographic and Health Survey (AfDHS) 2015 data to explore the socio-economic, demographic, and environmental factors associated with the occurrence of diarrhea in children under five years of age in Afghanistan.

## MATERIALS AND METHODS

*Study design and subjects*

A secondary data analysis of the AfDHS 2015 was focused on diarrhea in children under the age of five. Afghanistan DHS is a cross-sectional nationally representative population-based survey. The AfDHS 2015 was implemented by the Central Statistics Organization (CSO) and the Ministry of Public Health (MoPH) throughout the country, including all 34 provinces, in both rural and urban areas of Afghanistan in 2015. The samples were collected using a stratified two-phase design. The first phase was the selection of 950 clusters (sample points) from the previously available 25,974 enumeration areas (EAs). An EA is a place containing a number of residential units that serves as a counting unit for the census. However, among the total 950 clusters, 690 were from rural areas and 260 from urban areas. The second phase was the selection of 27 households per cluster by an equal probability systematic sampling method. Eventually, a total of 25,650 households were selected as the sample size for the survey. Data collection was done between June 15, 2015, and February 23, 2016. The data collection method is explained in detail in the main report of AfDHS 2015.<sup>5</sup>

The subjects for this study were children under the age of five (N=30,238). Children whose mothers did not know whether they had diarrhea within the past two weeks and those whose data were missing were excluded from the sample.



**Fig. 1** Summary of the study subjects and results of reported diarrhea among under-five children during the two weeks before the survey in Afghanistan, 2015

### *Study measures*

To explore the determinants of diarrhea among children under five years of age in Afghanistan, data were obtained from the AfDHS 2015 dataset. More specifically, women and children recodes were merged, cleaned, recoded, and utilized for the analysis. The primary outcome variable was the presence of diarrhea in the two weeks before the survey interview. Diarrhea is defined by the WHO as having three or more loose or liquid stools over a 24-hour period as reported by the mother or caregiver of the child. Two main categories of independent variables were assessed to determine the outcome. Socio-economic and demographic factors included the sex and age of the child, residence, household size, number of under-five children in a household, wealth status, and mother's education level. Environmental factors included information about the types of toilet facilities, methods of child's stool disposal, and sources of drinking water in Afghanistan. Safe child's stool disposal methods include using a toilet, putting or rinsing stool in a toilet, and burying it. Unsafe stool disposal methods include putting the stool into a drain or ditch, throwing it into the garbage, and leaving it in an open field or not disposing of it.

### *Statistical analysis*

Descriptive statistics were calculated by a chi-square test to summarize the study variables. To assess the associations between the determinant factors and outcome, crude and adjusted (for all variables) odds ratio (OR) with the 95% confidence interval (CI) were estimated in a logistic regression model. A *P*-value of less than 0.05 was considered statistically significant. The Statistical Package for Social Sciences (SPSS) version 25.0 (IBM SPSS Inc.) was used for the analysis.

### *Ethical issues*

The protocol of AfDHS 2015 was approved by the Institutional Review Board of the MoPH, ICF International Inc. (The DHS Program), and the CSO. The information acquired for this study was based on public use data without any recognizable information about the survey participants, households, and sample communities. Hence, further ethical approval was not obtained.

## RESULTS

The total number of under-five children was 32,712. Of these, 431 (1.3%) children whose mothers were not aware whether they had diarrhea within the past two weeks, and 2,043 (6.2%) children whose mothers did not answer all questions of the survey (all missing data) were excluded. Therefore, a total of 30,238 under-five children were included in the analysis.

The socio-economic and demographic characteristics of these 30,238 under-five children are summarized in Table 1. The populations of males (51.9%, N=15,690) and females (48.1%, N=14,548) were roughly equal. Almost three-quarters of the under-five children were residing in rural areas (75.9%). More than half of the households (55.9%) had nine or more members. The proportions of children living in households with poor, middle, and rich wealth status were 41.5%, 22.4%, and 36.1%, respectively. Considering the education levels of the mothers, a large majority (85.8%) of them had never attended school, whereas only 1.4% of the under-five children had highly educated mothers.

Table 2 shows the availability of toilet and drinking water and the methods of child stool disposal according to the presence of diarrhea during the two weeks before the survey in Afghanistan. The results showed that more than one-fourth of the under-five children (26.2%, N=7,921) had diarrhea during the two weeks preceding the survey. More than half of the

under-five children (53.3%, N=16,123) were living in households with traditional toilet facilities (dry vault), while pit latrines and toilet facilities with flush (to sewer, septic tank, or pit latrine) made up 14.4% and 11.0%, respectively. However, the remaining households were using other types of toilet facilities (20.6%). In terms of disposing of children's stool, 57.2% of the stool disposal methods were unsafe or inappropriate. The most common source of drinking water was protected wells and springs (24.5%), followed by unprotected wells and springs (23.8%), public taps (16.2%), tube wells (12.9%), surface water (10.1%), piped water (4.8%), and others (7.0%).

The unadjusted analysis showed that the age of the child, place of residence, household size, number of under-five children, wealth status, mother's education level, type of toilet facility, child stool disposal method, and source of drinking water were significantly associated with diarrhea in children under the age of five.

In the multivariate analysis adjusting for all the variables in Table 3, the risk of diarrhea

**Table 1** Socio-economic and demographic characteristics of subjects in Afghanistan, 2015 (N=30,238)

Characteristics	Male		Female		Total	
	N	(%)	N	(%)	N	(%)
Total	15,690	(100)	14,548	(100)	30,238	(100)
<b>Age of child (months)</b>						
<6	1,674	(10.7)	1,514	(10.4)	3,188	(10.5)
6–11	1,346	(8.6)	1,250	(8.6)	2,596	(8.6)
12–23	2,913	(18.5)	2,802	(19.3)	5,715	(18.9)
24–59	9,757	(62.2)	8,982	(61.7)	18,739	(62.0)
<b>Residence</b>						
Urban	3,741	(23.8)	3,557	(24.5)	7,298	(24.1)
Rural	11,949	(76.2)	10,991	(75.5)	22,940	(75.9)
<b>Household size</b>						
<6	2,133	(13.6)	1,913	(13.1)	4,046	(13.4)
6–8	4,772	(30.4)	4,509	(31.0)	9,281	(30.7)
≥9	8,785	(56.0)	8,126	(55.9)	16,911	(55.9)
<b>Number of children &lt;5 years</b>						
≤2	8,523	(54.3)	7,734	(53.2)	16,257	(53.8)
3–4	5,318	(33.9)	5,068	(34.8)	10,386	(34.3)
≥5	1,849	(11.8)	1,746	(12.0)	3,595	(11.9)
<b>Wealth status<sup>a)</sup></b>						
Poor	6,516	(41.5)	6,042	(41.5)	12,558	(41.5)
Middle	3,505	(22.4)	3,251	(22.4)	6,756	(22.4)
Rich	5,669	(36.1)	5,255	(36.1)	10,924	(36.1)
<b>Mother's education level</b>						
Never attended school	13,462	(85.8)	12,475	(85.8)	25,937	(85.8)
Primary	1,084	(6.9)	993	(6.8)	2,077	(6.9)
Secondary	933	(5.9)	867	(6.0)	1,800	(5.9)
Higher education	211	(1.4)	213	(1.4)	424	(1.4)

<sup>a)</sup> Is detailed information on household characteristics and access to a range of consumer goods and services, and assets, which is consistent with income and consumption measures. Based on individuals' household scores, five rankings were assigned for wealth quintiles such as quintile one and two for poorest and poorer (recoded as poor), quintile three for middle, and quintile four and five for richer and richest (recoded as rich).

**Table 2** Availability of toilet and drinking water, and method of child stool disposal according to the presence of diarrhea during the two weeks before the survey in Afghanistan, 2015 (N=30,238)

Characteristics	Diarrhea		No diarrhea		Total	
	N	(%)	N	(%)	N	(%)
Total	7,921	(100)	22,317	(100)	30,238	(100)
<b>Type of toilet facility</b>						
Pit latrine <sup>a)</sup>	1,263	(15.9)	3,102	(13.9)	4,365	(14.4)
Flush <sup>b)</sup>	871	(11.0)	2,446	(11.0)	3,317	(11.0)
Traditional dry vault	3,999	(50.5)	12,124	(54.3)	16,123	(53.3)
No facility/others	1,726	(21.8)	4,496	(20.1)	6,222	(20.6)
Not usual residents <sup>c)</sup>	62	(0.8)	149	(0.7)	211	(0.7)
<b>Stool disposal of child &lt;5 years</b>						
Safe	3,121	(39.4)	8,928	(40.0)	12,049	(39.9)
Not safe	4,676	(59.0)	12,626	(56.6)	17,302	(57.2)
Others	124	(1.6)	763	(3.4)	887	(2.9)
<b>Source of drinking water</b>						
Piped <sup>d)</sup>	364	(4.6)	1,101	(4.9)	1,465	(4.8)
Public tap/standpipe	1,385	(17.5)	3,499	(15.7)	4,884	(16.2)
Protected well/spring	1,777	(22.4)	5,617	(25.2)	7,394	(24.5)
Unprotected well/spring	1,933	(24.4)	5,261	(23.6)	7,194	(23.8)
Tub well/borehole	1,168	(14.7)	2,744	(12.3)	3,912	(12.9)
Surface water	710	(9.0)	2,345	(10.5)	3,055	(10.1)
Others	522	(6.6)	1,601	(7.1)	2,123	(7.0)
Not usual residents <sup>c)</sup>	62	(0.8)	149	(0.7)	211	(0.7)

<sup>a)</sup> Ventilation improved pit, pit latrine with slab and without slab.

<sup>b)</sup> Flush to sewer system, septic tank and pit latrine.

<sup>c)</sup> The group of people or guests who stayed in the household a night before the survey interview.

<sup>d)</sup> Piped to dwelling and plot/yard.

was 34% lower in the age group of less than 6 months (AOR=0.66,  $P<0.001$ ), and 44% and 54% higher in the age categories of 6–11 months (AOR=1.44,  $P<0.001$ ) and 12–23 months (AOR=1.54,  $P<0.001$ ), respectively, than at 24–59 months of age. Among children of educated mothers, those belong to mothers with higher education had a 30% lower risk of developing diarrhea (AOR=0.70,  $P<0.01$ ) than those of uneducated mothers. Regarding the type of toilet facilities, toilets with a flush to the septic tank, sewer, or pit latrine (AOR=0.84,  $P<0.01$ ) and traditional dry vaults (AOR=0.83,  $P<0.001$ ) were significantly associated with a lower risk (16% and 17%) of diarrhea than pit latrines. In assessing the significant differences among the sources of drinking water in developing childhood diarrhea, tube wells (AOR=1.33,  $P<0.001$ ), public taps or standpipes (AOR=1.31,  $P<0.001$ ), and unprotected wells and springs (AOR=1.17,  $P<0.05$ ) were sources with a higher probability of diarrheal morbidity in young children than piped water. Moreover, the association of childhood diarrhea with living in a rural area, and having three or more under-five children were also statistically significant.

**Table 3** Odds ratio (OR) and 95% confidence interval (CI) of diarrhea during the two weeks before the survey in Afghanistan, 2015 (N=30,238)

Variables	Unadjusted		Adjusted <sup>a)</sup>	
	OR (95% CI)		OR (95% CI)	
<b>Age of child (months)</b>				
24–59	1	(Reference)	1	(Reference)
12–23	1.53	(1.44 – 1.63)***	1.54	(1.45 – 1.65)***
6–11	1.46	(1.34 – 1.59)***	1.44	(1.32 – 1.58)***
<6	0.64	(0.58 – 0.71)***	0.66	(0.59 – 0.73)***
<b>Residence</b>				
Urban	1	(Reference)	1	(Reference)
Rural	0.92	(0.86 – 0.97)**	0.92	(0.86 – 0.99)*
<b>Household size</b>				
<6	1	(Reference)	1	(Reference)
6–8	0.92	(0.85 – 0.99)*	0.96	(0.88 – 1.04)
≥9	0.87	(0.81 – 0.94)***	0.97	(0.89 – 1.06)
<b>Number of children &lt;5 years</b>				
≤2	1	(Reference)	1	(Reference)
3–4	0.88	(0.83 – 0.93)***	0.89	(0.84 – 0.94)***
≥5	0.81	(0.74 – 0.88)***	0.82	(0.74 – 0.90)***
<b>Wealth status</b>				
Rich	1	(Reference)	1	(Reference)
Middle	0.98	(0.91 – 1.05)	0.99	(0.92 – 1.08)
Poor	0.91	(0.86 – 0.97)**	0.95	(0.88 – 1.02)
<b>Mother's education level</b>				
Never attended school	1	(Reference)	1	(Reference)
Primary	1.12	(1.08 – 1.31)**	1.15	(1.03 – 1.27)**
Secondary	0.99	(0.89 – 1.10)	0.97	(0.86 – 1.08)
Higher education	0.76	(0.60 – 0.97)*	0.70	(0.55 – 0.89)**
<b>Type of toilet facility</b>				
Pit latrine	1	(Reference)	1	(Reference)
Flush	0.87	(0.79 – 0.97)*	0.84	(0.75 – 0.94)**
Traditional dry vault	0.81	(0.75 – 0.87)***	0.83	(0.78 – 0.89)***
No facility/others	0.94	(0.86 – 1.03)	0.99	(0.90 – 1.08)
<b>Stool disposal of child &lt;5 years</b>				
Safe	1	(Reference)	1	(Reference)
Not safe	1.06	(1.01 – 1.12)*	1.05	(0.99 – 1.11)
<b>Source of drinking water</b>				
Piped	1	(Reference)	1	(Reference)
Public tap/standpipe	1.20	(1.05 – 1.37)**	1.31	(1.14 – 1.51)***
Protected well/spring	0.96	(0.84 – 1.09)	1.00	(0.88 – 1.15)
Unprotected well/spring	1.11	(0.98 – 1.27)	1.17	(1.02 – 1.35)*
Tube well/borehole	1.29	(1.12 – 1.48)***	1.33	(1.15 – 1.53)***
Surface water	0.92	(0.79 – 1.06)	0.99	(0.85 – 1.15)
Others	0.99	(0.85 – 1.15)	1.01	(0.86 – 1.18)

\*  $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ .<sup>a)</sup> Adjusted by all factors listed in the table.



## DISCUSSION

This study explored the significant determinants of diarrhea in children under the age of five in Afghanistan. Maternal education, child age, type of toilet facility, source of drinking water, living in a rural area, and having three or more under-five children were found to be significantly associated with diarrheal morbidity. The two-week prevalence of diarrhea among under-five children was 26.2% in this study, which is similar to the rate (26%) realized in a study conducted in Senegal in 2014,<sup>15</sup> and higher than that (21.3%) found in a study conducted in Iraq in 2000.<sup>16</sup>

This study found that children younger than 6 months were at a 34% lesser risk of diarrhea and those aged 6–11 months and 12–23 months had a greater chance of developing diarrhea than were older children (24–59 months). This finding is in line with a cohort study done in Kabul, Afghanistan between 2007 and 2009 that found that the incidence of diarrhea was lowest among children younger than 6 months and highest among 6–12-month-old children.<sup>17</sup> Other studies in Uganda,<sup>18</sup> Eritrea,<sup>19</sup> and Ethiopia<sup>20</sup> also obtained similar findings. The protection of under-6-month-old children against diarrhea can be attributed to breastfeeding and less contact with contaminated objects and food, whereas the increase in prevalence of diarrhea among the 6–11-month-old and 12–23-month-old age groups can be explained by the initiation of weaning (especially with the consumption of unhygienic foods) and exposure to germs (from consuming contaminated foods and unclean water, and from playing in an unsanitary environment and/or with dirty items) after the child starts crawling and walking.

Regarding maternal education, the current study showed that the children of mothers with higher education had a 30% lower risk and the children of mothers with primary educational level had a 15% higher risk of developing diarrhea than those of uneducated mothers. This finding agrees with those of studies performed in Afghanistan,<sup>17</sup> Nepal,<sup>21</sup> Brazil,<sup>22</sup> Ghana,<sup>23</sup> Uganda,<sup>18,24</sup> and Ethiopia.<sup>25-27</sup> The association of higher maternal education and lower prevalence of diarrhea in young children versus no effects of primary and secondary education on reducing diarrheal morbidity may reflect the importance of improving the quality and contents of education (e.g., including health education in the school curriculum) rather than simply increasing the level of education. Nevertheless, the protective effects of maternal education might be due to the fact that well-educated mothers have a greater awareness of basic preventive measures like water treatment, proper breastfeeding and child feeding, personal and environmental hygiene including hand washing practices, improving living conditions, and healthier childcare, including child vaccination.

In the present study, a 16% lower likelihood of diarrhea was observed in children living in houses with flushed toilets and 17% in those using traditional toilets than those with pit latrines. These findings agree with those of previous studies conducted in Afghanistan,<sup>17</sup> Ethiopia,<sup>26</sup> and Egypt.<sup>28</sup> In a recent meta-analysis, an overall 25% reduction in diarrhea risk was noted with sanitation interventions like sewer connections and improved household sanitation versus no intervention.<sup>29</sup> The higher probability of diarrheal morbidity from using pit latrines can be explained by their closer proximity to residential homes, especially in cities, which in turn increases the risk of the transmission of germs through flies, particularly in the living and dining rooms. This assumption can be supported by the findings of a study in Addis Ababa, Ethiopia.<sup>30</sup> Additionally, the closer vicinity of a latrine might lead to contamination of the household's water source and thus increase the risk of diarrhea. This hypothesis can be supported by studies done in Bangladesh<sup>31</sup> and Kenya,<sup>32</sup> which found that a closer proximity of latrines results in an augmented pollution of tube wells. Moreover, a lower risk of childhood diarrhea with the use of traditional dry vaults than with pit latrines might be because in Afghanistan they are usually constructed an adequate distance from living areas and sources of drinking water as well as because of improvements in traditional designs brought about by international humanitarian



agencies like the ICRC in the last two decades.

Among sources of drinking water, the probability of developing diarrhea in under-five children was significantly higher for three main sources, tube well (33%), public taps or standpipes (31%), and unprotected wells and springs (17%), than for piped water (0%). This result is consistent with the findings of several studies done in Ghana<sup>23</sup> and Ethiopia<sup>26,33</sup> that found that children who were drinking water from an unprotected source were at a greater risk of diarrhea than those whose water sources were protected. This might be due to the fact that unprotected water sources can be easily contaminated with human and animal wastes, thereby increasing the possibility of contracting diarrhea among young children. The association of a higher risk of diarrhea with public standpipe water can be explained by water contamination during transportation as well as families having to use unprotected water sources due to frequent shortages of communal standpipe water.<sup>25</sup> Meanwhile, a closer proximity of tube wells to latrines, especially in cities, might put them in a higher risk of pollution and thereby raise the risk of diarrheal morbidity. This assumption is supported by other studies.<sup>31,32</sup> Accordingly, a pooled analysis revealed that the risk of diarrhea drops with any water quality intervention compared to no intervention.<sup>34</sup>

The current study also found the unexpected result of a reduced risk of diarrhea among under-five children living in rural areas. Not surprisingly, this unfavorable finding is in line with the findings of studies conducted in Iraq,<sup>16</sup> Indonesia,<sup>35</sup> and Kenya.<sup>36</sup> This could be because rural families mostly used traditional toilets (60% roughly vs. 37% in cities) and less commonly used pit latrines than urban families (13% vs. 20%). Additionally, rapid urbanization and population congestion, together with increased informal slum residence mainly due to movements from insecure rural areas to the cities, might result in inadequate sanitation facilities and drinking water sources. Furthermore, a higher risk of under-five diarrhea was found in households where three or more under-five children were living. This finding is consistent with the finding of a study done in Senegal<sup>15</sup> and inconsistent with the findings of studies conducted in Ethiopia.<sup>20,26</sup> Indeed, when the number of under-five children in a household increases, the risk of exposure to germs increases and parents' attention and quality of care decreases. However, in Afghanistan, having more under-five children is relatively common among rich families because men get more than one wife under a better living condition.

This study has several limitations. First, the insecure districts of some provinces were not included in the survey. However, since the infrastructure and hygiene condition in the insecure districts are quite different, the exclusion of such districts might not introduce a serious bias into the estimates for the average of secured areas in Afghanistan. Second, this study was conducted from June to February and did not cover a whole year. The influences of each factor may differ by season. Third, since the prevalence of diarrhea was assessed based on the mother's perception of diarrhea and was not confirmed clinically, the possibility of bias due to social desirability might influence the study. Lastly, as it was a secondary data analysis, we were not able to include all possible factors associated with diarrheal morbidity in the study. Some predictors of diarrhea like hand washing were also missed since we faced difficulties merging the datasets for households and mothers. In addition, it should be noted that this study compared children with and without diarrhea within the two weeks before the survey and not over a longer period, which might have led to conservative ORs.

Despite these limitations, this was the first nationally representative study in Afghanistan revealing the determinants of childhood diarrhea. The findings of this study can serve as a key entry point for policymakers to design efficacious intervention programs and control strategies to tackle the burden of childhood diarrhea. Those interventions can include improving the quality of drinking water sources and toilet facility norms as well as conducting comprehensive educational programs to improve household conditions and living standards and enhance mothers' level

of awareness (including health education). Not only upgrading the level of education but also adjusting the quality and contents of school education to include health awareness as a subject in the school curriculum can be important for schoolgirls and women to learn better childcare. Further observational studies are necessary to measure the annual incidence rates of diarrhea and thereby the impact of the implemented programs and strategies.

In conclusion, this study found that the two-week prevalence of diarrhea in children under the age of five was 26.2% in Afghanistan. The type of toilet facility and source of drinking water (as primary factors) as well as child age and maternal education were identified as important determinants of diarrhea in under-five children. Additionally, a lower risk of diarrhea was observed in children living in rural areas. The findings of our study have crucial importance in designing effective health intervention programs that include the provision of improved sanitation facilities and drinking water sources in addition to conveying health education for women to reduce the burden of childhood diarrhea in the country.

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### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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