Water Loss During the Handwashing During COVID-19 Pandemic in Bangladesh

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Water loss during the handwashing: A concern amid COVID-19 pandemic in Bangladesh

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Abstract

Handwashing is one of the vital public health measures to prevent COVID-19 pandemic from spread. However, water loss from excessive handwashing may put enormous pressure on the already overstretched groundwater resources and households' economic well-being. Therefore, this study aimed to determine the water loss during handwashing amid the COVID-19 pandemic with an emphasis on the waste of groundwater from essential hygiene activities at domestic scale. Sociodemographic data were collected using a web-based survey tool among 1980 participants and an experiment was conducted among 126 voluntarily interested participants to estimate the amount of water wasted during handwashing. A total of 80% of the participants washed their hands regularly after returning home from outside. About 57.27% participants generally did not turn off their tap when washing their hands. A single participant, who keeps his tap on throughout the handwashing process, wasted approximately 1.7 L of water per handwash and 14.9 L of water per day. Handwashing when a tap is on, raised the water loss at 13-fold during this pandemic compared to the non-pandemic situation which cost extra 224.95 BDT (2.65$) per day for 1980 participants. A large number (57.27%) of people keep their faucet on during lathering hands with soap and scrubbing, thus wasting a considerable amount of water (1179% more compared to pre COVID-19 situation). The loss of water during handwashing is an alarming but less attentional issue. Behavioral change interventions are needed to aware people to shut off the faucet at periods when water is not being used.

Kew words: Water loss, handwashing, COVID-19, Bangladesh

1. Introduction

Hand hygiene is often considered as the synonymous of handwashing which is the most important factor in preventing nosocomial infections by preventing contact and fecal-oral transmission of pathogens (Boyce and Pittet, 2002; Widmer, 2000). Hand hygiene is an important public health measure (Burton et al., 2011; Tao et al., 2013) and it has long been recognized to be a convenient, effective, and also cost-effective mean of preventing infectious diseases (Tao et al., 2013). During the COVID-19 pandemic, frequent handwashing with soap and water was considered as one of the most effective measure to reduce the spread to infection (CDC, 2020; UNICEF, 2020; WHO, 2020a). In addition to that, WHO and UNICEF also recommended switching the faucet/tap off while lathering hand with soap and scrubbing for at least 20 seconds to prevent the water loss (WHO, 2020b).

Many countries around the world, including Bangladesh utilize groundwater as the main source of drinking water and daily domestic activities. Evidence suggests that the frequency of handwashing increased during a pandemic situation (Park et al., 2010). The outbreak of Ebola in West Africa in 2014-16 has also raised the demand for clean water for prevention and treatment (Conversation, 2020). Therefore, the frequency of handwashing has also reported being increased during the co-current COVID-19 pandemic. The water demand raised by 20 to 25% in India during this COVID-19 pandemic due to the tap open during handwashing (Rohilla, 2020). Besides, a water sector official in Jordan, recently claimed that water demand has increased by 40% after the government ordered people to stay home as part of a nationwide curfew (Conversation, 2020).

This increase in demand will bring tremendous pressure on overstretched water resources to fill existing shortages in the water supply in a limited resource country like Bangladesh. This situation will be further worsened in the country in summer when sources of water supply run dry. Basically, all developments such as agricultural production, energy usage and economic activity involve water and/or affect water. But the water resource is not growing (Lundqvist, 2009). So, the loss of water during handwashing is a serious issue, but there is no previous study to evaluate water loss during handwashing globally. Therefore, the study aimed to determine the water loss during handwashing during the COVID-19 pandemic in Bangladesh.

2. Methods

2.1 Setting and participants

A prospective cross-sectional web-based survey was conducted among the general population of Bangladesh to assess handwashing practices from May 21st to June 3rd, 2020. As a community-based face to face survey was not feasible during this COVID-19 pandemic situation, data was collected through online from all divisions (states) of Bangladesh. The authors distributed the survey link in all divisions of Bangladesh via social media among rural and urban people who use tap water or dug wells water. Snowball sampling method was used to recruit the participants. To improve the participation rate, reminder requests were sent thorough social media at 2-week intervals for a total of three times. The survey questionnaire was sent to more than 2500 participants and 1980 of them from all the divisions of the country aged between 18 to 67 years completed the questionnaire. Eligibility criteria included the ability to read Bangla, residence in Bangladesh during the pandemic, and having access to the internet.

2.2 Data collection

A survey tool was developed considering the regular pattern of handwashing practice and facility during the COVID-19 pandemic. The survey consisted of 14-close ended queries, which took about 3-4 minutes to finish. Sociodemographic data were collected on age, gender, educational status, location of residence. Besides that, the survey included questions on the frequency of handwashing, duration of lathering hand with soap and, scrubbing, whether they keep their faucet on or off during the lathering and scrubbing time.

The survey tool was piloted with a small online user group to test its clarity & consistency. The survey included a short overview of the study context, purpose, procedures, confidentiality agreement, and consent. This study complied with the most recent revision of the Helsinki Declaration (Williams, 2008) and followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines (Eysenbach, 2004). Descriptive statistics were performed to define the fundamental characteristics of the data in the participants.

2.3 Procedure

The average duration of lathering hand with soap and scrubbing was 17.95 seconds among the participants who usually keep their tap on throughout the handwashing process. An experiment was designed to estimate the amount of water wasted during that time. We invited 1134 participants (57.27% of total participants) who did not shut off tap during handwashing to attend

the experiment voluntarily. A total of 126 participants (6.36% of total participants) among them agreed and participated in the experiment session from their house and each used 1 domicile handwashing faucet. The participants' inclusion criteria for the experiment of determining flow rate was to have the experimental tools such as stopwatch, milliliter jug etc. All the participant took part in this experiment were trained through online video conference. We divided them into 14 groups, with nine participants in each group during the training session. Each participant used one faucet from his/her home and took part in 3 experiments at three different speeds of the faucet. For the better measurement of flow rate a total of 378 experiments were conducted setting the faucet at minimum (average = 39.41 mL/s; 126 experiments), medium (average= 84.16mL/s; 126 experiments), and maximum speed (average = 161.33 mL/s; 126 experiments) arbitrarily. The flow rate is the volume of water (mL) per unit time (s) which flows through area of tap. Then water was collected in a water bottle marked with milliliter measurement. Participants counted and noted the time in seconds required to fill 1 liter of water for each experiment. Then amount of loosed water was calculated for 17.95 seconds (Table-2). The test procedure was based on Green Venture website: how to conduct a flow rate test, 2007 (Venture, 2007). This test procedure was also used in a previous study in China for determining the flow rate of water (Lu and Smout, 2008).

2.4 Data analysis

Descriptive statistics were calculated for sociodemographic characteristics. Experimental data were calculated using Excel 2013. Statistical analyses were performed using SPSS version 24 (IBM SPSS Statistics, New York, United States).

2.5 Ethics

The research protocol was reviewed and approved by the Research Ethical Committee (REC) of the Department of Food Microbiology, Patuakhali Science and Technology University, Bangladesh (Approval No: FMB:29/05/2020:06).

3. Results and discussion

3.1 Demographic information

Table 1 represents the characteristics of the participants. Of the 1980 participants, 55% were male, 29% were employers and 35% were graduates. More than 27% participants only completed their 10^{th} class or less. Although most of the respondents were from the Dhaka division (19.09 %), also respondents from all 8 divisions of the country participated in the study.

3.2 Handwashing practice during COVID-19 pandemic

Regular handwashing practice after returning home from outside was 77.9% during the pandemic. This finding is lower than the study in Bangladesh by Hauque el al. (2020) (95.45%) and Wadood et al. (2020) (89.5%). In contrast, regular handwashing practice after sneezing was poor (37.1%). During the COVID-19 pandemic, 88.4% participants washed their hands more compared to the non-pandemic situation as mentioned/stated by the participants. The average number of handwashing practices per day among the participants was 8.93(±5.86 SD). 82.52% of the participants use manual tap regularly for handwashing. The average duration of lathering hand with soap and scrubbing was 17.73 seconds per time among all the participants (Table 1).

3.3 Water waste due to leaving the faucet on while leathering and scrubbing the hand with soap

Of all the respondents, 57.27% reported that they keep their faucet on during lathering hand with soap and scrubbing. Among those who keep their tap on throughout the handwashing process, the average duration of lathering hand with soap and scrubbing was 17.95 and 4.39 seconds and the average frequency of handwashing was 8.73 and 2.79 times in a day during and before the COVID-19 pandemic. To put Table 2 into perspective, a single handwash wasted 1704.744 mL of water and 14882.415 mL of water in a day by a single participant during the COVID-19 pandemic whereas only 416.92 mL and 1163.20 mL of water was lost by a single handwash and a day respectively before the pandemic situation. Then if we calculate this water loss for 1134 participants who keep their faucet on during handwashing, it will be 1179% or 12.79 times of (16876 L vs 1319 L) of water loss per day when we had only 1980 participants during this pandemic than the non-pandemic situation. 1134 participant's loss extra 15557 L of water during this pandemic for hand washing purpose which cost extra 224.95 BDT per day (14.46 BDT/per unit) (bdnews24.com, 2020). Muhit stated that enormous economic losses have occurred in Bangladesh every year due to poor sanitation and water supply, and this economic loss could increase due to the loss of water during hand washing in COVID-19.

3.4 Limitation

The speed of the tap was set by the judgment of the experimenter. The number of participants for the experiment was not large enough but from all divisions. Furthermore, we were unable to reach those participants who do not have an internet connection and throughout the experiment and we were unable to observe the participants, so the study is not without some errors. We had no better solution during the country wide lock-down situation. However, it still gives a reasonable

representation and we suggest a large-scale study with economic evaluation regarding the water loss.

4. Conclusion and recommendation

While lathering hands with soap and scrubbing, a large number of people keep their faucet on, thereby wasting 1179% of water during this pandemic compared to the non-pandemic situation. The water loss during handwashing is too much not to worry about. The water and economic loss can be mitigated by good practice. One of the first things that we need to address is to minimize the speed of faucet during handwashing. That would save 140% of water by them who keep their faucet on during handwashing (57.27%) at least without relying on individual behaviors. It is also recommended to use push taps that automatically switch off after a period or sensor taps that are programmed to automatically turn on when hands are under the spout and immediately stop when the hands are taken away from the tap. Furthermore, behavioral change interventions are needed to make people aware in Bangladesh and similar low income countries to shut off the faucet at periods when water is not being used considering the limited water resources and respective potential stress on economics relevance to the loss. However, from a policy point of view, it is important to know how much the losses affect both the water supplies and the economic status in order to find an effective intervention. So further studies are required not only in Bangladesh but also worldwide. New findings of this study will benefit for future research to comprehensively assess the economic impact associated with the water loss on developed and developing countries due to new hygiene rules and regulations imposed during the COVID-19 outbreak.

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Declaration of competing interest

The authors declare that they have no competing interests

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290 **Table 1: Demographic characteristic of the participants.**
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Variables	N	%	95% CI
Gender			
Female	882	44.54	32.1-38.1
Male	1098	55.45	62.1-67.6
Education			
No Schooling	112	5.65	4.5-6.3
Primary	178	8.98	7.0-9.77
SSC	286	14.44	12.3-16.1
HSC	516	26.06	24.6-27.4
Graduate	692	34.94	32.4-36.8
Post-graduate or Higher	196	9.89	8.1-10.4
Occupation			
Business	206	10.40	8.7-12.1
Employer	572	28.88	26.9-29.7
Health professional	104	5.25	4.9-6.2
Housewife	134	6.76	5.6-7.2
students	506	25.55	24.2-26.3
Un-employed	372	18.78	17.5-19.3
Others	86	4.34	3.1-5.2
Division			
Barisal	314	15.85	14.4-16.6
Chattogram	258	13.03	11.0-15.3
Dhaka	378	19.09	16.7-22.2
Khulna	328	16.56	14.3-18.4
Mymensingh	136	6.86	5.5-8.1
Rajshahi	194	9.79	7.3-10.5
Rangpur	194	9.79	7.3-10.5
Sylhet	178	8.98	7.1-10.2
Hand washing after returning home from outside			
No	32	1.6	1.0-2.3
Regularly	1542	77.9	75.5-80.3
Sometimes	208	10.5	8.7-12.3
Use hand sanitizer	198	10.0	8.4-11.7
Hand washing after sneezing			
No	294	14.8	12.7-17.0
Regularly	734	37.1	34.0-40.1
Sometimes	618	31.2	28.5-34.1
Use hand sanitizer	334	16.9	14.8-19.1
Effect of COVID-19 on hand washing			
Wash hand same as before pandemic	32	1.6	1.0-2.3
Wash hand more than before pandemic	1750	88.4	85.6-90.2
Wash hand less than before pandemic	0	0	0
Not applicable	198	10.0	8.4-11.7
Hand washing facility			
Tube well water	164	8.3	6.8-10.0
Tap water	1646	83.1	80.7-85.4
Stored water-Balti/Mug	86	4.3	3.1-5.7
Pond water	36	1.8	1.1-2.5
others	48	2.4	1.7-3.2
Types of Tap			
Automatic	12	0.6	0.36-0.78
Do not use Tap	334	17.07	15.1-19.3
Manual	1634	82.52	80.2-85.5
Shut off Tap			
Yes	512	25.85	23.4-28.6
No	1134	57.27	54.4-60.2
Not Applicable	334	17.07	15.1-19.3

Variables	N	Mean	SD
Age	1980	37.29	3.94
Number of hand wash per day during COVID-19	1980	8.93	5.86
Number of hand wash per day before COVID-19	1980	2.89	0.23
Duration of hand scrubbing with soap during COVID-19	1980	17.73	8.84
Duration of hand scrubbing with soap before COVID-19	1980	4.23	1.87

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294 **Table-2: Average water waste due to keeping the faucet on**.

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Speed of the Faucet	Total No. of Faucet	Average Water Waste[a] per Second (mL±SD)	Average Water Waste[a] in 17.95 Second[b] during COVID-19 (mL±SD)	Average Water Waste[a] in 4.39 Second[c] before COVID-19 (mL±SD)
Minimum Speed	126	39.410±17.178	707.417±308.322	173.00±13.56
Medium Speed	126	84.166±34.738	1510.785±623.556	369.46±37.36
Maximum Speed	126	161.339±51.591	2896.031±926.063	708.27±37.36
Average	378	94.972±34.502	1704.744±619.313	416.92±37.36

[a]Keeping the faucet on during lathering hand with soap and scrubbing
[b]Average duration of lathering hand with soap and scrubbing among the participants who usually keep their tap on throughout the handwashing process during COVID-19
[c]Average duration of lathering hand with soap and scrubbing among the participants who usually keep their tap on throughout the handwashing process before COVID-19

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