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

Abu Sayeed  
Patuakhali Science and Technology University  [https://orcid.org/0000-0003-0745-1755](https://orcid.org/0000-0003-0745-1755)

Fahad Ahmed  
University of Queensland

Mohammad Raihan Tariq  
Patuakhali Science and Technology University

Faujbia Rahman  
Patuakhali Science and Technology University

Md. Tarikul Islam Joy  
Patuakhali Science and Technology University

Mohammad Tazrian Abid  
Patuakhali Science and Technology University

Md Hafizur Rahman ([hafiz.rahman@icddrb.org](mailto:hafiz.rahman@icddrb.org))  
[https://orcid.org/0000-0002-2742-049X](https://orcid.org/0000-0002-2742-049X)

---

**Short report**

**Keywords:** Water loss, handwashing, COVID-19, Bangladesh

**DOI:** [https://doi.org/10.21203/rs.3.rs-36956/v1](https://doi.org/10.21203/rs.3.rs-36956/v1)

**License:** This work is licensed under a Creative Commons Attribution 4.0 International License.  
[Read Full License](#)
Abstract

Hand washing is an important measure of public health to prevent COVID-19 pandemic from speared. But the increase in hand washing causes tremendous pressure on overstretched water resources, as the loss of water during handwashing increases. As there is no previous study to evaluate water loss during hand washing, the study aimed to determine the water loss during the COVID-19 pandemic during hand washing. Sociodemographic data were collected using a web based survey tool and an experiment was conducted to estimate the amount of water wasted during hand washing.

77.9% of participants washed their hands regularly after returning home from outside. 4 of the 7 participants generally did not turn off their tap when washing their hands. A single participant, who kept their tap on throughout the hand washing process, wasted approximately 14.88 L of water per day.

The loss of water during hand washing is an alarming but less attentional issue. Hand washing is necessary during the COVID-19 situation, but behavioral adjustments are required to shut down the faucet at times when water is not being used.

Introduction

Hand hygiene is often considered the synonymous of handwashing which is the single most important factor in preventing nosocomial infections by preventing contact and fecal-oral transmission of pathogens (Widmer 2000; Boyce and Pittet 2002). 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 means 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 actions to reduce the spread to infection (CDC 2020; UNICEF 2020; WHO 2020). In addition to that, WHO and UNICEF also recommended to switch the faucet/tap off while lathering hand with soap and scrubbing for at least 20 seconds to prevent the water loss.

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). In addition, 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). Hence, this increased demand of water poses another thinkable problem of water loss during hand washing.

This increase in demand will bring tremendous pressure on overstretched water resources to fill existing shortages in the water supply. This situation will be further worsened in summer when sources of water supply run dry. Although the loss of water during hand washing is a serious issue, there is no previous...
study to evaluate water loss during hand washing globally. Therefore, the aim of the study was to determine the water loss during handwashing during the COVID-19 pandemic.

**Methods**

**Setting and participants**

A prospective cross-sectional web-based survey was conducted among the general population of Bangladesh to assess handwashing practices from May to June 2020. As a community-based national sampling survey during this time was not feasible, data was collected through online. The authors distributed the survey link in all divisions of Bangladesh via social media using snowball sampling. To improve the participation rate, reminder requests were sent at 2-week intervals for a total of three times. The survey questionnaire was sent to 1100 participants and 990 of them from almost all the divisions of the country aged between 18 to 47 years completed the questionnaire. Eligibility criteria included the ability to read Bangla and residence in Bangladesh.

**Data collection**

A survey tool was developed considering the pattern of handwashing practice and facility during the COVID-19 pandemic. The survey consisted of 13-close ended queries, which took about 3–4 minutes to finish. Sociodemographic data were collected on age, gender, educational status, location of residence. Besides, the survey included questions on the frequency of handwashing, duration of lathering hand with soap and, scrubbing, whether they keep their faucet on during the lathering and scrubbing time.

The survey tool was piloted with a small online user group to test its clarity. 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.

**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 567 participants who did not shut of tap during hand washing to attend the experiment voluntarily. A total of 14 participants among them agreed and participated in the experiment session and each used 1 domicile hand washing faucet. All the participant took part in this experiment were trained through online video conference. Each faucet and participant took part in 9 experiments. A total of 126 experiments were conducted setting the faucet at minimum (42 experiments), medium (42 experiments), and maximum speed (42 experiments) arbitrarily. Then water was collected in a water bottle marked with liter measurement.
counted and noted the time in seconds required to fill 1 liter of water for each experiment. Then it was calculated for 17.95 seconds (table-2).

**Data collection analysis**

Descriptive statistics were calculated for sociodemographic characteristics. Experimental data was calculated using Excel 2013. Statistical analysis were performed using SPSS Statistic 21.0 (IBM SPSS Statistics, New York, United States).

**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:29/05/2020:03).

**Results And Discussion**

**Demographic information**

Table 1 represents the characteristics of the participants. Of the 990 participants, 64.7% were female, 78.4% were a student. The majority of the participant has completed their graduation (63.1%). Although most of the respondents were from the Dhaka division (39.5%), respondents from all 8 divisions of the country participated in the study.
### Table 1:
Demographic characteristic of the participants.

| Variables                     | N   | %   | 95% CI    |
|-------------------------------|-----|-----|-----------|
| Gender                        |     |     |           |
| Female                        | 349 | 35.3| 32.1-38.1 |
| Male                          | 641 | 64.7| 62.1-67.6 |
| Education                     |     |     |           |
| No Schooling                  | 9   | .9  | .5-1.3    |
| Primary                       | 3   | .3  | .0-.77    |
| SSC                           | 56  | 5.7 | 4.3-7.0   |
| HSC                           | 199 | 20.1| 17.7-22.6 |
| Graduate                      | 625 | 63.1| 59.7-66.6 |
| Post-graduate or Higher       | 98  | 9.9 | 8.1-11.4  |
| Occupation                    |     |     |           |
| Business                      | 28  | 2.8 | 2.0-3.6   |
| Employer                      | 82  | 8.3 | 6.9-9.7   |
| Health professional           | 11  | 1.1 | .6-1.6    |
| House wife                    | 31  | 3.1 | 2.2-4.0   |
| Students                      | 778 | 78.4| 75.8-81.1 |
| Un-employed                   | 51  | 5.2 | 3.9-6.5   |
| Others                        | 11  | 1.1 | .6-1.6    |
| Division                      |     |     |           |
| Barisal                       | 217 | 21.9| 19.4-24.6 |
| Chattogram                    | 129 | 13.0| 11.0-15.3 |
| Dhaka                         | 391 | 39.5| 36.7-42.2 |
| Khulna                        | 142 | 14.3| 12.3-16.4 |
| Maymensingh                   | 22  | 2.2 | 1.5-3.1   |
| Rajshahi                      | 56  | 5.7 | 4.3-7.0   |
| Rangpur                       | 18  | 1.8 | 1.1-2.5   |
| Sylhet                        | 15  | 1.5 | .9-2.2    |
| Hand washing after returning home from outside |   |   |   |
|---------------------------------------------|---|---|---|
| No                                          | 16 | 1.6 | 1.0-2.3 |
| Regularly                                   | 771 | 77.9 | 75.5-80.3 |
| Sometimes                                   | 104 | 10.5 | 8.7-12.3 |
| Use hand sanitizer                          | 99  | 10.0 | 8.4-11.7 |

| Hand washing after sneezing |   |   |   |
|------------------------------|---|---|---|
| No                           | 147 | 14.8 | 12.7-17.0 |
| Regularly                   | 367 | 37.1 | 34.0-40.1 |
| Sometimes                   | 309 | 31.2 | 28.5-34.1 |
| Use hand sanitizer          | 167 | 16.9 | 14.8-19.1 |

| Hand washing facility       |   |   |   |
|------------------------------|---|---|---|
| Tube well water             | 82  | 8.3  | 6.8-10.0 |
| Tap water                   | 823 | 83.1 | 80.7-85.4 |
| Stored water-Balti/Mog      | 43  | 4.3  | 3.1-5.7  |
| Pond water                  | 18  | 1.8  | 1.1-2.5  |
| Others                      | 24  | 2.4  | 1.7-3.2  |

| Types of Tap                |   |   |   |
|------------------------------|---|---|---|
| Automatic                   | 6  | 0.6 | 0.36-0.78 |
| Don't use Tap               | 167 | 17.07 | 15.1-19.3 |
| Manual                      | 817 | 82.52 | 80.2-85.5 |

| Shut off Tap                |   |   |   |
|------------------------------|---|---|---|
| Yes                         | 256 | 25.85 | 23.4-28.6 |
| No                          | 567 | 57.27 | 54.4-60.2 |
| Not Applicable              | 167 | 17.07 | 15.1-19.3 |

| Variables                   | N  | Mean | SD  |
|------------------------------|----|------|-----|
| Age                         | 990 | 23.29 | 3.94  |
| Number of hand wash per day | 990 | 8.93  | 5.86  |
| Duration of hand scrubbing with soup | 990 | 17.73 | 8.84  |
Table 2:
Average water waste due to keeping the faucet on.

| Speed of the Faucet | Total No. of Faucet | Average Water Waste$^a$ per Second (mLSD) | Average Water Waste$^a$ in 17.95 Second$^b$ (mLSD) |
|---------------------|---------------------|------------------------------------------|-----------------------------------------------|
| Minimum Speed       | 42                  | 39.41017.178                             | 707.417308.322                                |
| Medium Speed        | 42                  | 84.16634.738                             | 1510.785623.556                               |
| Maximum Speed       | 42                  | 161.33951.591                            | 2896.031926.063                               |
| Total               | 126                 | 94.97234.502                             | 1704.744619.313                               |

$^a$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

**Handwashing practice during COVID-19 pandemic**

Regular handwashing practice after returning home from outside was 77.9%. This finding is lower than the study in Bangladesh by Hauque (95.45%) (Haque et al. 2020) and Wadood (89.5%) (Wadood et al. 2020). On contrast, regular handwashing practice after sneezing was poor (37.1%). The average number of hand washing practice per day among the participants was 8.93 (± 5.86 SD). 82.52% of the participants use manual tap regularly for hand washing. The average duration of lathering hand with soap and scrubbing was 17.73 seconds per time among all the participants (Table 1).

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

Of all the respondents, 567 (57.27%) or about 4 out of 7 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 seconds and average frequency of handwashing was 8.73 times in a day. To put table 2 into perspective, a single hand wash wasted 1704.744 mL of water and 14882.415 mL of water in a day by a single participant. Then if we calculate this water loss for 567 participants, it will be a huge amount of (8437 L) of water loss per day where we had only 990 participants.

**Limitation**

Loading [MathJax]/jax/output/CommonHTML/jax.js
The speed of the tap was set by the judgment of the experimenter. Therefore, the number of participants for the experiment is not so big. However, it still gives a reasonable representation.

**Conclusion**

A great number of people keep their faucet on during lathering hands with soap and scrubbing, thus wasting a considerable amount of water. One of the first things that we need to address is to reduce the amount of water coming out of the tap every minute. That would save some water 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 aware people to shut off the faucet at periods when water is not being used.

**Declarations**

**Availability of data and materials:** The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Competing interest**

The authors declare that they have no competing interests

**Funding**

None

**Authors Contribution**

Abu Sayeed: conceptualization, original draft writing, review & editing, Project administration; Mohammad Raihan Tariq, Mohammad TazrianAbid, Faujia Rahman, Md. Tarikul Islam Joy: Data collection and helped designing and implementing the experiment; Md Hafizur Rahman: original draft writing, data analysis, review & editing, supervision. Each author approved the submitted version and agreed both for the author’s own contributions and ensured that questions related to the accuracy or integrity of any part of the work.

**Acknowledgment**

The authors thank the all participants especially them who attended the experiment.

**References**

1. Boyce JM, Pittet D (2002) Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA
Hand Hygiene Task Force. Infect Control Hosp Epidemiol 23:S3–S40

2. Burton M, Cobb E, Donachie P et al (2011) The effect of handwashing with water or soap on bacterial contamination of hands. Int J Environ Res Public Health 8:97–104

3. CDC (2020) Prevent getting sick. Available at. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html

4. Conversation (2020) Coronavirus: what might more hand washing mean in countries with water shortages?. Available at: https://theconversation.com/coronavirus-what-might-more-hand-washing-mean-in-countries-with-water-shortages-134625

5. Eysenbach G (2004) Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res 6:e34

6. Haque T, Hossain KM, Bhuiyan MMR et al (2020) Knowledge, attitude and practices (KAP) towards COVID-19 and assessment of risks of infection by SARS-CoV-2 among the Bangladeshi population: An online cross sectional survey

7. Park J-H, Cheong H-K, Son D-Y et al (2010) Perceptions and behaviors related to hand hygiene for the prevention of H1N1 influenza transmission among Korean university students during the peak pandemic period. BMC Infect Dis 10:222

8. Rohilla SK (2020) COVID-19 outbreak: More hand washing can increase India’s water woes. Available at: https://www.downtoearth.org.in/blog/water/covid-19-outbreak-more-hand-washing-can-increase-india-s-water-woes-69900

9. Tao SY, Cheng YL, Lu Y et al (2013) Handwashing behaviour among Chinese adults: a cross-sectional study in five provinces. Public Health 127:620–628

10. UNICEF (2020) Everything you need to know about washing your hands to protect against coronavirus (COVID-19). Available at: https://www.unicef.org/bangladesh/en/everything-you-need-know-about-washing-your-hands-protect-against-coronavirus-covid-19

11. Wadood MA, Marmun A, Rafi MA et al (2020) Knowledge, attitude, practice and perception regarding COVID-19 among students in Bangladesh: Survey in Rajshahi University. medRxiv

12. WHO (2020) Guideline of Handwash during COVID-19. Available at. https://apps.who.int/iris/bitstream/handle/10665/331846/WHO-2019-nCoV-IPC_WASH-2020.3-eng.pdf?ua=1

13. Widmer AF (2000) Replace hand washing with use of a waterless alcohol hand rub? Clin Infect Dis 31:136–143

14. Williams JR (2008) The Declaration of Helsinki and public health. Bull World Health Organ 86:650–652