

Association of new coronavirus (COVID-19) with hand hygiene score

Coronavirus (Covid-19) with hand hygiene score

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Abstract

Aim: In this study, we aimed to investigate the interaction between the COVID-19 pandemic and hand hygiene.

Material and Methods: This study was planned as a descriptive cross-sectional involving 856 people living in Turkey between March 22 and April 5, 2020. The difference-in-differences-type design was used to investigate the effect of COVID-19 disease on hand hygiene.

Results: Accordingly, the participants' average hand hygiene scores before, during, and after COVID-19 were $\bar{X} = 3.350234 \pm 1.092372$, $\bar{X} = 4.603353 \pm .4628307$, and $\bar{X} = 3.365169 \pm 1.557933$. The average age of the participants was $\bar{X} = 28.68 \pm 9.34$ years. According to education level, the scores obtained from the individuals' hand hygiene score showed a statistical difference ($p < 0.05$). According to the difference-in-differences-type design prediction results, the coefficient (16.65898 ± 3.685992) of $D^{Tr} \times D^{Post}$ interaction gave us the effect of the COVID-19 pandemic disease on the hand hygiene scores of individuals. Accordingly, it can be stated that the COVID-19 disease increased 17 points of the hand hygiene score of individuals by approximately 7.1%.

Discussion: It was seen that hand hygiene gained significant importance during periods of infectious disease outbreaks.

Keywords

COVID-19; Hand hygiene; Infectious diseases; Pandemics

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Introduction

It is stated that 80% of the world's population health is threatened due to insufficient hand hygiene practices (available at: <http://bit.do/FLFYS>, <http://bit.do/FLFYX>). Various authors consider hand hygiene as a very important preventive tool that eliminates infections and viruses' infectiousness and prevents infectiousness [1,2]. In the light of the findings obtained from some scientific studies, it has been found that good hand hygiene reduces the risk of diarrheal diseases by 23%- 48% and respiratory infections by 21% to 23% [1,3]. It is stated that water and soap are two vital ingredients for individuals' hand hygiene (available at: <http://bit.do/FLFYS>, <http://bit.do/FLFZc>). These two sources of life are considered as individual hygiene measures [4]. It is stated that providing hand hygiene is extremely important in protecting and improving general public health during the COVID-19 pandemic (available at: <http://bit.do/FLFZj>).

In daily life, the hands are the most polluted part of the body. Hand washing, also called hand hygiene, is one of the most influential and inexpensive ways to prevent all kinds of infectious diseases at home, at work, in hospitals, in school, etc. (available at: <http://bit.do/FLFZq>, <http://bit.do/FLFZu>, <http://bit.do/FLFZP>). In some scientific studies, it has been reported that hand hygiene practice is the most effective method of fighting infections and viruses (available at: <http://bit.do/FLFYX>, <http://bit.do/FLFZE>, <http://bit.do/FLFZY>).

All measures taken to protect and maintain health are called hygiene. All practices that individuals make to keep their body clean and healthy are defined as personal hygiene. Personal hygiene is crucial to solve health problems and prevent many diseases, especially infectious diseases (available at: <http://bit.do/FLFZE>).

COVID-19, which was detected in Wuhan city of Hubei province in China at the end of 2019 and spread worldwide in a short time, has caused a significant and urgent public health problem [3]. With the worldwide spread of the new type of coronavirus (COVID-19) pandemic, the importance of personal cleaning habits is emphasized primarily by the World Health Organization, heads of state, health ministers, and experts [5]. There is no vaccine developed against the COVID-19 virus yet. The most important way to prevent disease is not to be exposed to the virus (available at: <http://bit.do/FLFZj>, <http://bit.do/FLFZP>, <http://bit.do/FLFZY>). According to available evidence, the SARS-CoV-2 virus is transmitted by droplet and contact among humans. Effective methods to prevent transmission of the COVID-19 virus are frequent hand washing with soap and water for at least 20 seconds (available at: <http://bit.do/FLFZc>, <http://bit.do/FLFZj>, <http://bit.do/FLFZP>, <http://bit.do/FLFZY>). Hand washing is very useful in killing viruses likely to be found (available at: <http://bit.do/FLFZE>). Washing hands is very important, primarily in public places or when contacting other people. When water and soap cannot be reached, it is recommended to use hand disinfectants containing at least 60% alcohol (available at: <http://bit.do/FLFZj>, <http://bit.do/FLFZu>). In addition to hand hygiene, it should be paid attention to keeping hands away from face, eyes, and mouth during the day (available at: <http://bit.do/FLFYS>, <http://bit.do/FLFYX>, <http://bit.do/FLFZc>, <http://bit.do/FLFZj>, <http://bit.do/FLFZu>, <http://bit.do/FLFZY>). Hands can

efficiently mediate the transmission of the virus. Contact with organs such as the face, eyes, and mouth can cause the virus to enter the body and develop the disease (available at: <http://bit.do/FLFZc>).

Hospital-based studies have shown that non-compliance with hand hygiene recommendations is associated with health-related infections and the spread of highly resistant organisms and contributes significantly to outbreaks. Studies have also shown that the prevalence of health-related diseases decreases as hand hygiene measures increase [1,5-8].

This study investigates the interaction between the COVID-19 pandemic, which is called the new coronavirus by WHO, and hand hygiene score, and examines whether disease caused by the COVID-19 virus affects hand hygiene score.

Material and Methods

Study type and sample size

This study was planned as a descriptive cross-sectional, which was conducted with 856 people living in Turkey between March 22, 2020 and April 5, 2020.

Data collection tools

The questionnaire created for this study was provided with two data collection tools. One is the Descriptive Information Form, and the other is the Combine of Hand Hygiene Belief Scale and Hand Hygiene Practices Inventory.

The Descriptive Information Form is a 6-question form that includes the participants' characteristics such as age, gender, marital status, education, tobacco use, and employment status. Combine of the Hand Hygiene Belief Scale and the Hand Hygiene Practices Inventory questionnaire has been prepared for COVID-19 as a combination of the Hand Hygiene Belief Scale and Hand Hygiene Practices Inventory scales, which were developed by Karadağ et al. [9]. Combine of the Hand Hygiene Belief Scale and the Hand Hygiene Practices Inventory is a 16-items scale prepared in a 5-point Likert type. The higher the score, the higher the hand hygiene score.

Before and after COVID-19 and control group

To measure the effectiveness of any policy, intervention, or treatment, the difference between the scores obtained before and after the policy, intervention, or treatment is examined [10]. The difference-in-differences estimation design was used to minimize the effect of time effect and other unobservable factors [11-13]. In this estimation design, two groups are used to compare those exposed to the policy or practice and those who do not, to eliminate problems arising from the classical pre-post-assessment design [10, 14-16].

Outcome measures

Three different scores were determined for the outcome measures. The first is the hand hygiene score of the participants before COVID-19, this measurement is shown with the variable "Pre". The second is the hand hygiene score of the participants throughout the COVID-19 period, this measurement is shown by the variable "During". The third is the hand hygiene score of the participants after COVID-19, this measurement is shown by the variable "Post". Average scores of each participant from all three different scores were calculated. At the end of these calculations, the variables (Pre, During, and Post) were scored between 1 and 5. If these values are 3.5 and above, it can be

said that the participant's hand hygiene score is good. For all three variables, we re-represented the participants' hand hygiene scores using a dummy variable. These dummy variables (D^{Pre} , D^{During} , D^{Post}) take 1 if the participant's hand hygiene score is 3.5 and above, or 0 if not. Thus, the interaction between these dummy variables will show the impact of the COVID-19 outbreak on hand hygiene.

Statistical analysis

We created dummy variables with hand hygiene scores obtained in this descriptive cross-sectional study. We tried to estimate these dummy variables' interactions with each other using regression analysis and the pure effect of the COVID-19 outbreak on hand hygiene.

We used the difference-in-differences analysis, a semi-experimental study design, to determine the association between individuals' hand hygiene scores and the COVID-19 outbreak and to determine the effect attributed to the COVID-19 outbreak on individuals' hand hygiene scores [11].

The association between COVID-19 and individuals' hand hygiene beliefs and practices was identified by the difference between pre-COVID-19, during-COVID-19, and post-COVID-19 scores. The interaction term of these three variables was the predictor of the difference between the differences. The coefficient of this interaction estimated the magnitude of the relationship between the COVID-19 outbreak and the dependent variable hand hygiene score.

It was also analyzed whether individuals' hand hygiene scores differed in three different time periods, according to age, gender, marital status, education, tobacco use, and working status. For the statistical analysis, the Stata / SE 14.0 version was used with a p-value=0.05 ve 95% confidence interval (available at: <http://bit.do/fLF2r>).

Results

Descriptive analysis

These are the results of the participants' hand hygiene beliefs and practices in three different periods. Accordingly, the average of hand hygiene beliefs and practices scores of the participants before COVID-19 was $\bar{X} = 3.350234 \pm 1.092372$, the average of hand hygiene beliefs and practices scores during COVID-19 was $\bar{X} = 4.603353 \pm .4628307$, and the average of hand hygiene beliefs and practices scores after COVID-19 was $\bar{X} = 3.365169 \pm 1.557933$. Also, the average age of the participants was $\bar{X} = 28.68 \pm 9.34$ years.

Among the participants, 56.78% (n=486) were women, and 43.22% (n=370) were men; 51.75% (n=443) of the participants had a job at the study time, while 48.25% (n=413) of the participants were not working at the study time; 41.12% of the participants used at least one tobacco product during the study, while 58.88% did not use any tobacco at the study time. The percentages of the participants according to the level of education were as follows:

Primary-secondary school: 7.01% (n=60), high school: 5.96% (n=51), associate degree: 10.86% (n=93), graduate: 51.40% (n=440) and postgraduate: 24.77% (n=212). Among the participants, 49.53% (n=424) were single, 50.47% (n=432) were married.

Analysis of differences in hand hygiene scores according to descriptive variables

According to demographic data, the difference between the participants' three different hand hygiene scores was examined. Accordingly, in terms of education level, only during the COVID-19 outbreak, hand hygiene scores of the participants differed statistically ($p < 0.05$). However, no statistical difference ($p > 0.05$) was found for all other hand hygiene scores according to demographic data. The Bonferroni test, one of the post hoc tests, was conducted to determine which groups showed differences in the hand hygiene scores during COVID-19 according to the level of education. Accordingly, it was observed that participants with different educational levels differed from each other in hand hygiene scores during COVID-19. Mainly, hand hygiene scores of COVID-19 participants with an associate education level were statistically significantly higher than all other groups.

Regression analysis with difference-in-differences (diff-in-diff) approach

We used the difference-in-differences (diff-in-diff) approach to determine the interaction between the hand hygiene score and the COVID-19 outbreak. The difference-in-differences (diff-in-diff) approach is expressed as a quasi-experimental research method used to determine the effect of any policy, intervention, or treatment [11].

The regression model applied to explain the interaction between COVID-19 and individuals' hand hygiene scores and definitions of the model's abbreviations are shown below.

Control= Not exposed to COVID-19; Tr=Was exposed to COVID-19; Pre=Measure before COVID-19; During= Measurement during COVID-19; Post= Measure after COVID-19; DD=Difference in Differences. See Table 1 and Equation 2.

In Equation 2, Y is the total hand hygiene score COVID-19; D^{Post} is hand hygiene score after COVID-19 dummy ($1 = \geq 3.5$ points); D^{Tr} is hand hygiene score before COVID-19 dummy ($1 = \geq 3.5$ points); $D^{Post} D^{Tr}$ is hand hygiene score before COVID-19 X hand hygiene score after COVID-19; β_3 is the DD estimate, and X is the vector of control variables. The difference-in-differences-type design analyzed the interaction between hand hygiene scores and COVID-19. According to this analysis, a statistically significant ($p < 0.01$) interaction was detected between COVID-19 and hand hygiene score at a 95% confidence interval (Table 2). According to the difference-in-differences-type design prediction results, the coefficient (16.65898 ± 3.685992) of $D^{Tr} X D^{Post}$ interaction gave us the effect of the COVID-19 pandemic disease on the hand hygiene score of individuals. Accordingly, it can be stated that COVID-19 disease increased 17 points of hand hygiene score of individuals by approximately 7.1% (17/240).

Details regarding the model of the analysis carried out with diff-in-diff-type design are shown in Table 3. Accordingly, it can be stated that the proposed model is statistically significant in the 95% confidence interval ($F(3, 852) = 267.05, p < 0.01$). Also, the Adj R-squared value of the model was determined as = 0.4828. Accordingly, the variables included in the model explain 48% of the variance. Although this value seems surprising, it can be accepted considering the economic status of the hand hygiene score, the individuals' position, their access to water and soap, and their cultural values.

Table 1. Information for diff-in-diff regression equation

	Pre	Post
Control	$\bar{y}_{c,Pre}$	$\bar{y}_{c,Post}$
Tr	$\bar{y}_{Tr,Pre}$	$\bar{y}_{Tr,Post}$
DD=($\bar{y}_{Tr,Post} - \bar{y}_{Tr,Pre}$) - ($\bar{y}_{c,Post} - \bar{y}_{c,Pre}$)	(1)	
$Y = \beta_0 + \beta_1 D^{Post} + \beta_2 D^{Tr} + \beta_3 D^{Post} D^{Tr} + \beta_4 X + \epsilon$	(2)	

Table 2. Estimation of the total hand hygiene score with the difference-in-differences type design

THHS ¹	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
D ^{Tr}	11.72575	1.877041	6.25	0.000	8.04158 15.40991
D ^{Post}	58.27111	3.030419	152.742	0.000	52.32315 64.21908
D ^{Tr} X D ^{Post}	16.65898	3.685992	4.52	0.000	9.424288 23.89367
_cons	143.9105	4.499562	31.98	0.000	135.0789 152.742

¹THHS=Total Hand Hygiene Score (hand hygiene scores before COVID-19 + hand hygiene scores during COVID-19 + hand hygiene scores after COVID-19).

Table 3. Analysis of variance (AOV) for estimating difference-in-differences-type design

Source	SS	df	MS	Number of obs = 856
Model	407253.12	3	135751.04	F(3, 852) = 267.05 Prob > F = 0.0000
Residual	433108.279	852	508.34305	R-squared = 0.4846 Adj R-squared = 0.4828
Total	840361.399	855	982.878829	Root MSE = 22.546

Discussion

This is the first study to investigate the interaction between COVID-19, a coronavirus disease, and the Turkish people's hand hygiene score. This study is also the first study conducted with the difference-in-differences design, a semi-experimental approach, on the effect of pandemic disease on hand hygiene score. Unlike previous scientific studies conducted with the difference-in-difference design approach, this study was also conducted with scores obtained from the hand hygiene scale prepared for different times for the same people at the same time.

It is known that the vital role of hand hygiene in infectious diseases was the subject of study in the early 19th century [17,18-21]. It has been reported in various scientific studies that hand hygiene is a straightforward but very effective weapon against the transmission of viruses. Accordingly, it is reported that viruses die when hand hygiene is provided [3]. When hand hygiene is supplied with soap and water, since the structure of 100% of the viruses deteriorates, the infectiousness of the virus is stopped and it does no harm [1,21]. In an empirical study, the ebola virus's effect on hand hygiene was determined [22]. By increasing the number of people with clean hands in the community by only 10%, the transmission rate of infectious disease can be slowed by 37%. Besides, by increasing individuals' motivation to deal with hand hygiene, a possible pandemic's infectiousness can be inhibited by 24% - 69% [23]. It is stated that the health of approximately 80% of the world's population can be protected by providing hand hygiene (available at: <http://bit.do/FLFYS>, <http://bit.do/FLFYX>).

Hands are the most actively used organ. Therefore, the probability of contamination of the hands is much higher than that of other organs. Microorganisms, viruses, etc. on contaminated hands cause infectious diseases to spread when they are infected or unconsciously enter the mouth, ear, eyes, and nose (available at: <http://bit.do/FLFYX>, <http://bit.do/FLFZE>). However, it is stated that frequent hand washing for at least 20 seconds, or in the absence of water and soap, hands disinfection with cologne or alcoholic disinfectant containing at least 60% alcohol prevents viruses from entering the body from the hands (available at: <http://bit.do/FLFZq>, <http://bit.do/FLFZu>, <http://bit.do/FLFZE>).

Maintaining personal hand hygiene is stated to be crucial, especially to stop the spread of viruses and prevent disease or to infect existing diseases (available at: <http://bit.do/FLFZE>, <http://bit.do/FLFZY>). The participants' hand hygiene scores were reported, respectively, for three different times as follows: average hand hygiene score for Pre-COVID-19=3.350234±1.092372, average hand hygiene score for During-COVID-19=4.603353±.4628307, average hand hygiene score for Post-COVID-19=3.365169±.4628307. Accordingly, it was determined that especially hand hygiene scores of the participants increased with COVID-19. These findings are similar to the results of previous studies [22]. It is stated that the importance given to hand hygiene has increased with the increase of education years [24]. In this study, we found a difference in hand hygiene scores according to education. According to this, mainly, hand hygiene scores of COVID-19 participants with associate's education level were statistically significantly higher than all other groups. In the light of these data, it can be said that the effect of the education variable on the hand hygiene score varies up to a certain level of education, but the difference, which is not significant between the undergraduate and graduate levels, significantly decreases the effect of the education variable on hand hygiene after a certain level.

In a study by Liu et al. [25] to determine risk factors of COVID-19 disease, smoking was a serious risk factor for the progression of COVID-19 disease (OR = 14.28; 95% CI: 1.58–25.00; p = 0.018). In this study, unlike previous studies, it was found that the use of tobacco products, which are the risk factors for COVID-19 disease, did not affect hand hygiene score. This is an exciting result because smoking was a significant risk factor for disease progression, smokers who wanted to protect themselves from this risk would be expected to pay more attention to hand hygiene. However, this exciting result is thought to be caused by smokers who are unaware that smoking is a severe risk in the progression of COVID-19 disease.

According to the findings obtained from this study, in which we investigated the effect of COVID-19 effect on hand hygiene score, it was observed that COVID-19 disease increased the hand hygiene score by approximately 17 points; that is, approximately 7% of the hand hygiene scores were attributed to the effect of COVID-19 disease. This result is significant because, when the COVID-19 disease has emerged, hand hygiene has become the most emphasized by public health professionals, health ministers of the states, and related authorities. On the other hand, these warnings and recommendations are thought to

change people's handwashing habits and provide more hand hygiene scores.

As a result, it was seen that hand hygiene gained significant importance in the periods of infectious disease outbreaks. Training programs that emphasize the vital importance of hand hygiene should be provided. Although pandemic diseases such as COVID-19 have serious disadvantages, it is in our hands to turn this into an opportunity for public health. Therefore, it should be known that the importance of hand hygiene should be increased through training or campaigns, the most important work that should be taken to the agendas of the authorities and those who practice in this field in the practical life.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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