MARMARA
MEDICAL JOURNAL

Original Article

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Prevalence of correct face mask usage among general public during COVID-19 pandemic in Denizli, Turkey

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Submitted: 27.02.2022 **Accepted:** 17.04.2022

ABSTRACT

Objective: Objective: We aimed to evaluate correct facemask usage prevalence among the general public in marketplaces in Denizli, Turkey and also aimed to determine the effects of the announcement of asymptomatic coronavirus disease 2019 (COVID-19) cases and curfew decisions on compliance rates of appropriate mask use.

Materials and Methods: In this population-based study, a total of 6749 observations were made in the 8 different marketplaces between 22 November – 3 December 2020. Multiple logistic regression analysis was used to assess the effect of age, gender, observation time, and intervention type (announcement of asymptomatic COVID-19 case numbers and, announcement of nationwide curfew decisions) on correct facemask use prevalence.

Results: Correct facemask usage prevalence in customers and sellers was 84.3% and 46.3%, respectively. The announcement of the number of asymptomatic COVID-19 cases had no statistically significant effect on correct facemask usage prevalence both among customers and sellers ($p>0.05$). After the announcement of the curfew decisions, correct facemask usage prevalence increased among customers (OR:1.24 (1.02-1.52)) and sellers (OR:1.64 (1.32-2.03)).

Conclusion: The correct use of facemasks is not sufficient, especially among sellers. The announcement of curfew decisions has increased the correct use of masks although, the announcement of asymptomatic COVID-19 case numbers has no effect.

Keywords: COVID-19, Correct facemask use, Marketplaces, Turkey.

1. INTRODUCTION

Since, the beginning of the coronavirus disease 2019 (COVID-19) pandemic, several non-pharmaceutical public health interventions have been implemented to prevent the spread of the disease [1]. One of these interventions was to wear a facemask to prevent transmission through droplets.

There have been opposing views about who should and should not use masks, and there have been different examples of practices between countries. According to the recommendation issued by World Health Organization (WHO) on December 1, 2020; it is recommended that everyone use masks in public settings such as crowded open-air markets, schools, mosques, and hospitals where there is an increased risk of widespread transmission and social distancing cannot be maintained [2].

From the start of the COVID-19 outbreak in Turkey, different applications have been made between provinces on this issue. As of May 11, 2020, by the decision of the Denizli Provincial Public Health Council, it has been decided that facemask usage in all kinds of areas is mandatory in Denizli for all citizens [3].

If at least 80% of the population uses facemasks regularly in public, this could help eliminate the pandemic [4]. Pandemics can be prevented by determining whether society complies with compulsory mask use and related factors. Apart from individual factors, wide-ranging decisions by health authorities and governments can be much more effective in adherence to mask use. Revealing the effects of public health implementation decisions taken by authorities through scientific research will provide a basis for making decisions to be taken more quickly

How to cite this article: Uzun SU, Sevinc O, Ergin A. Prevalence of correct face mask usage among general public during COVID-19 pandemic in Denizli, Turkey. Marmara Med J 2022; 35(3): 343-349, doi: 10.5472/marumj.1191644

ISSN: 1309-9469

http://doi.org/10.5472/marumj.1191644
Marmara Med J 2022;35(3): 343-349

to prevent rapidly developing public health problems such as communicable diseases. One of the methods to be used in the evaluation of public health practices is the evidence to be obtained from natural intervention research.

The objectives of this study were to (i) determine correct facemask usage prevalence and related factors in marketplaces in the city center of Denizli and (ii) to evaluate the effect of the announcement of asymptomatic COVID-19 case numbers and the effect of the announcement of nationwide curfew decisions on mask use status.

2. MATERIALS and METHODS

Type of Study

A population-based cross-sectional study was designed to determine the prevalence of correct face mask usage in the marketplaces in Denizli. The study was conducted between 22 November and 3 December 2020. After the data collection began, on 25 November 2020, the Ministry of Health of Turkey began to announce the number of asymptomatic COVID-19 cases for the first time since July 2020. Turkish Minister of Health admitted that they did not include asymptomatic COVID-19 cases in the daily announced tally since July 29, 2020 [5]. This practice ended on November 25, 2020. The Ministry of Health of Turkey began to announce the number of asymptomatic COVID-19 cases [6]. Also a curfew was announced on 30 November 2020. A nationwide partial curfew during the week (between 9 p.m. – 5 a.m.) and a weekend-long curfew (from Friday at 9 p.m. to Monday at 5 a.m.) were decided to be imposed in Turkey. Implementation of the weekend-long curfew started on 4 December 2020. So, this study is also a natural intervention study in which the effect of the announcement of the number of asymptomatic COVID-19 cases and the effect of the announcement of curfew decisions on the usage of facial masks is evaluated.

Study setting

Denizli is an industrial city with textile production and exports, It is a tourism destination in the southwestern part of Turkey due to the various types of thermal waters such as world heritage site Pamukkale and Karahayıt. According to the census of 2021, the population of Denizli is 1.051.056 [7]. Denizli is one of the warmest cities in Turkey, it has semi-humid climate with warm winter, very hot and dry summer.

Data Collection, Sample Size and Sampling Method

An observational data collection method was employed in order not to increase the risk of COVID-19 disease for both participants and observers. Also, observing participants' behaviors provides more reliable data as self-report data may create biases such as social desirability bias. The data were collected between 22 November – 3 December 2020. There are 48 marketplaces in the city center of Denizli [8]. Eight different marketplaces were selected by simple random sampling from these 48 marketplaces. Marketplaces were visited between the opening and closing hours of markets. The Hawthorne effect is a change in behavior as a response to observation [9]. It was important for participants to be unaware that they were being observed, so observations were performed by different students every hour in order to minimize the Hawthorne effect (especially for market sellers). For these observations, 6th-grade medical faculty students were trained before data collection. Students received a two-hour training from an associate professor (researcher O.S.) on the topic and substance of the research, how to make observations and how to fill in the observation forms, and possible problems they may encounter. Monitoring and evaluation of students' data collection were conducted by the supervisors. An observation form prepared by the researchers was used as data collection tool. This form was used for recording the data which includes the observee's gender, estimated age group (recorded as <10 years, 10-17 years, 18-64 years, and ≥65 years), the situation of using a mask (yes/no) and in/appropriate use of mask, type of mask (surgical mask, cloth mask, filtered mask) and information about whether they are a customer or a seller. Correct use of masks was evaluated according to WHO recommendations [10]. Appropriate mask usage was defined as if the mask covers the mouth and nose correctly. Inappropriate mask usage was defined as if the mask was under the nose and chin or on the hand. Since, the number of people using filter masks is low, those who use filter masks and those who use surgical masks were combined in the analysis.

The prevalence of facemask usage in different countries during the COVID-19 epidemic varied between 80-95% [11–16]. Based on these previous studies, the prevalence of facemask usage was estimated to be 80%. Considering α=0.05, p=0.80, and d=0.01, the required minimum sample size was found to be 6147 for this study.

Permissions and Ethics

The required permissions for conducting the research were obtained from the Turkey Ministry of Health's COVID-19 Scientific Research Platform, and the relevant municipalities (from both Pamukkale and Merkezefendi Metropolitan Municipality Administrations) before the study. The study was approved by Pamukkale University Ethics Committee (decision date: 13.10.2020, approval number:19).

Statistical Analysis

Statistical analysis was performed with R for Windows (version 3.6.2), and descriptive data were presented in numbers and percentages for categorical variables. Chi-square analysis was used to compare the prevalence of facemask usage according to variables. Multiple logistic regression analysis (backward LR method) was used to assess the effect of age, gender, observation time, and intervention type on correct facemask use. All comparisons were two-sided, and a p-value <0.05 was considered significant.

http://doi.org/10.5472/marumj.1191644
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3. RESULTS

In this study, a total of 6749 observations were made in the marketplaces in Denizli, and 41.0% of them (n=2270) were women. 77.7% of those observed (n=5243) were in the 18-64 years age group. 71.9% of the observed people (n=4852) were customers, and 56% of the observations were made in the afternoon. It was observed that 4.0% of the people in the marketplaces did not have any kind of mask, while 84.0% of them used surgical masks. Correct face mask usage prevalence was 73.6%. It was found that 45.0% of the observed people were wearing their masks under their chins, and 39.1% of them were wearing their masks under their noses. Table I shows the participant characteristics and the prevalence of mask usage in marketplaces in Denizli.

Table 1. *Demographic characteristic and frequency of facemask use among general population observed in marketplaces in Denizli*

	n	%
Total number of observations	6749	100
Gender		
Female	2770	41.0
Male	3979	59.0
Age group		
<10 years	212	3.1
10-17 years	311	4.6
18-64 years	5243	77.7
≥65 years	983	14.6
Observation time		
a.m.	2960	43.9
p.m.	3789	56.1
Observed person		
Customer	4852	71.9
Seller	1897	28.1
Intervention type		
Before any intervention (22-25 November)	2096	31.1
Announcement of the number of asymptomatic coronavirus cases (26-30 November)	1678	24.9
Announcement of the curfew decisions (1-3 December)	2975	44.1
Facemask practice		
Yes	6476	96.0
No	273	4.0
Mask type		
Surgical mask	5670	84.0
Cloth mask	749	11.1
Filtered mask	57	0.9
No mask	273	4.0
Mask usage		
Correct Use	4968	73.6
Incorrect Use + No Mask	1781	26.4
Form of incorrect facemask usage (n=1781)		
Under the nose	697	39.1
Under the chin	801	45.0
In her/his hand	10	0.6
No mask	273	15.3

The correct mask usage prevalence was 84.3% among 4852 customers observed in the marketplaces in Denizli. The correct use of mask prevalence was found to be higher in female customers (90.9%) than in men (77.9%) (p<0.001). It has been observed that correct mask use increases as age increases (trend p <0.001) and the highest correct facemask usage prevalence was among customers over the age of 65 and was 87.9%. It was observed that the correct mask use prevalence was higher in customers who visited the marketplace in the morning than in the afternoon (86.1% vs 82.9%, p<0.001). When analyzed according to the type of intervention, it was found that the correct facemask usage prevalence in customers increased after the curfew decisions were announced (p<0.001). Post-hoc analysis showed that the decrease in correct mask use after the announcement of the number of asymptomatic COVID-19 cases was not statistically significant. Table II shows correct facemask usage prevalence among customers.

Table 2. *Correct facemask usage prevalence among customers observed in marketplaces in Denizli, Turkey*

	Incorrect Mask Usage + No Mask n (%)	Correct Mask Usage n (%)	p value
Total (n=4852)	762 (15.7)	4090 (84.3)	-
Gender			
Female	216 (9.1)	2161 (90.9)	**<0.001**
Male	546 (22.1)	1929 (77.9)	
Age group			
<10 years	77 (39.3)	119 (60.7)	**<0.001**
10-17 years	37 (18.7)	161 (81.3)	
18-64 years	547 (15.1)	3075 (84.9)	
≥65 years	101 (12.1)	735 (87.9)	
Observation time			
a.m.	292 (13.9)	1804 (86.1)	**0.003**
p.m.	470 (17.1)	2286 (82.9)	
Intervention type			
Before any intervention (22-25 November)	235 (16.8)	1163 (83.2)	**<0.001**
Announcement of the number of asymptomatic coronavirus cases (26-30 November)	260 (19.7)	1057 (80.3)	
Announcement of the curfew decisions (1-3 December)	267 (12.5)	1870 (87.5)	
Mask type			
Surgical+Filtered mask	518 (12.3)	3681 (87.7)	**<0.001**
Cloth mask	125 (23.4)	409 (76.6)	
No mask	119 (100)	0 (0)	
Form of incorrect facemask usage (n=762)			
Under the nose	348 (45.7)	-	-
Under the chin	289 (37.9)		
In her/his hand	6 (0.8)		
No mask	119 (15.6)		

http://doi.org/10.5472/marumj.1191644
Marmara Med J 2022;35(3): 343-349

Among sellers, the correct facemask usage prevalence was 46.3%. Correct facemask use of women was higher than men (58.3% vs 43.2%, p<0.001). As the age increases, the prevalence of correct mask use increases (trend p=0.002). Interestingly, it was found that the correct use of masks among sellers was higher in the afternoon (49.2% vs 42.8%, p<0.006). Before any intervention, correct facemask usage prevalence among sellers was 42.3%. The prevalence increased to 44.0% after the announcement of the number of asymptomatic COVID-19 cases, and to 50.6% after the curfew decisions were announced (p=0.003). Table III shows correct facemask usage prevalence among sellers.

Table 3. *Correct facemask usage prevalence among sellers observed in marketplaces in Denizli, Turkey*

	Incorrect Mask Usage + No Mask n (%)	Correct Mask Usage n (%)	p value
Total (n=1897)	1019 (53.7)	878 (46.3)	-
Gender			
Female	164 (41.7)	229 (58.3)	**<0.001**
Male	855 (56.8)	649 (43.2)	
Age group			
<10 years	12 (75.0)	4 (25.0)	
10-17 years	76 (67.3)	37 (32.7)	**0.002**
18-64 years	858 (52.9)	763 (47.1)	
≥65 years	73 (49.7)	74 (50.3)	
Observation time			
a.m.	494 (57.2)	370 (42.8)	**0.006**
p.m.	525 (50.8)	508 (49.2)	
Intervention type			
Before any intervention (22-25 November)	403 (57.7)	295 (42.3)	
Announcement of the number of asymptomatic coronavirus cases (26-30 November)	202 (56.0)	159 (44.0)	**0.003**
Announcement of the curfew decisions (1-3 December)	414 (49.4)	424 (50.6)	
Mask type			
Surgical+Filtered mask	740 (48.4)	788 (51.6)	**<0.001**
Cloth mask	125 (58.1)	90 (41.9)	
No mask	154 (100)	0(0)	
Form of incorrect facemask usage (n=762)	349 (34.3)		
Under the nose	512 (50.3)	-	-
Under the chin	4 (0.4)		
In her/his hand	154(15.0)		
No mask			

According to the results of multiple logistic regression analysis, the prevalence of correct facemask use in female customers was 2.86 times higher than male customers and 1.86 times higher among female sellers than male sellers. Although, there was no statistically significant difference between sellers, it was found that the prevalence of facemask usage among customers aged ≥65 was 4.89 times higher, 3.43 times higher for those aged between 18-64, and 3.01 times higher for those aged between 10-17 years, when the customers under 10 years of age were taken as reference. Among customers, the odds of correct facemask usage prevalence in the morning was 21% higher than in the afternoon. But among sellers, the odds of correct facemask usage prevalence in the afternoon was 50% higher than in the morning. Logistic regression analysis revealed that the announcement of the number of asymptomatic COVID-19 cases had no statistically significant effect on facemask usage prevalence both in customers and sellers, but after the announcement of the curfew decisions, correct facemask usage prevalence increased among customers (OR:1.24 (1.02-1.52)) and sellers (OR:1.64 (1.32-2.03)). The multiple logistic regression results are presented in Table IV.

Table 4. *Multiple logistic regression results of correct facemask usage prevalence among customers and sellers observed in marketplaces in Denizli, Turkey*

	Customers		Sellers	
Variables	OR (95% CI)	p value	OR (95% CI)	p value
Gender				
Male	Reference	<0.001	Reference	
Female	2.88 (2.43-3.43)		1.86 (1.48-2.34)	<0.001
Age Group				
<10 years	Reference		Reference	
10-17 years	3.01 (1.88-4.82)	<0.001	1.47 (0.44-4.95)	0.529
18-64 years	3.43 (2.50-4.71)	<0.001	2.52 (0.80-7.96)	0.114
≥65 years	4.89 (3.36-7.11)	<0.001	2.83 (0.86-9.30)	0.086
Observation Time				
a.m.	1.21 (1.02-1.43)	0.029	Reference	
p.m.	Reference		1.50 (1.24-1.83)	<0.001
Intervention Type				
Before any intervention	Reference		Reference	
Announcement of the number of asymptomatic coronavirus cases	0.88 (0.75-1.04)	0.146	1.10 (0.85-1.43)	0.443
Announcement of the curfew decisions	1.24 (1.02-1.52)	0.028	1.64 (1.32-2.03)	<0.001

4. DISCUSSION

This observational study was set out to investigate the correct use of facemasks of people in the marketplaces in Denizli. After the data collection began, we also had the chance to examine the

http://doi.org/10.5472/marumj.1191644
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effects of some practices implemented by the Ministry of Health on mask use. Therefore, this study is also a natural intervention study.

During the COVID-19 pandemic, facemask practice in marketplaces in Denizli was quite high (96.0%). Previous studies about mask usage were much more focused on self-report facemask practice. The number of observational studies about face mask use is limited. In observational studies conducted in different countries at different times of the pandemic, it has been found that the use of masks varies considerably (3%-99.7%) [11,12,14,15,17–19]. Mask usage behavior is multifactorial but, since this study was carried out 10 months after the outbreak started in Turkey and the use of masks has been mandatory in Denizli since May 2020, this high mask use result is expected in our study.

The rate of correct facemask use in marketplaces in Denizli was high among customers (84.3%) but quite low among sellers (46.3%). A few studies have reported the correct use of masks. Results of observational mask usage practice from an observational study conducted among pedestrians in Iran, it was found that the prevalence of correct face-mask usage was 75.6% [16]. A high proportion of acceptable facemask use (95.7%) was observed among Malaysian individuals who were visiting the wet market [12]. Mask use practice is closely related to the presence of a legal obligation. However, a previous research showed that the correct use of the mask was mostly associated with individuals' knowledge level about appropriate mask use [20]. To increase the knowledge level and correct mask use practice, educational campaigns are needed. Poor correct face mask usage among sellers in our study was a notable observation. As sellers in marketplaces are in close contact with hundreds of people throughout the day, they have the potential to be a major source of virus transmission. For this reason, besides planning extensive educational programs for sellers, rigorous controls for correct mask use compliance should be implemented by police officers.

Both in customers and sellers, women's acceptable facemask usage was higher than men. Mask use was higher among women than men in previous observational studies [13,16–18]. Women were more risk averse, which influenced their behavioral responses, and as a result, females were more likely to adopt preventive measures [21]. Also, men may have convictions related to manliness and see themselves as more resistant to diseases, so they are less likely to take preventive health steps [22].

The compliance rate of correct facemask usage in customers increased with age and children had the lowest correct facemask prevalence. Our study supported previous studies [16–18,23,24], which reported older age were associated with higher mask use. This may be the result of the fact that older people have been reported to be at higher risk of COVID-19 mortality since the beginning of the COVID-19 pandemic and also younger individuals perceive themselves as strong against COVID-19 disease.

The correct use of facemasks among customers was higher in the morning, while among sellers it was higher in the afternoon. It may be possible to explain this situation as follows: Vegetable and fruit prices are higher in the morning hours in the marketplaces, and prices decrease in the afternoon, especially after 5 p.m. For this reason, the marketplace is very crowded in the evening hours close to the closing time of the markets. Customers with higher socioeconomic status who are aware of this situation and probably customers with higher knowledge of the COVID-19 disease shop in the early hours before the marketplaces are crowded. Sellers pay more attention to the correct use of facemasks when the marketplace is crowded in the afternoon, possibly due to customers with lower knowledge of the COVID-19 and more careless about preventative measures. Therefore, in marketplaces, there is more need for correct mask use control by police officers, especially in the afternoon.

It can be difficult to ensure compliance with public facemask wearing and especially correct mask use. Besides individual risk factors such as socio-demographic factors, COVID-19 risk perception, and trust in science and authorities, different governmental policies predict adherence to COVID-19 preventive measures [25-28]. Moreover, a study found that the scale of COVID-19 graphs used in mass media affected mask use preference [29]. So, it is very critical to understand the effect of different public health policies adopted by governments on public mask usage compliance. In this observational study, we had the chance to examine the effect of the announcement of the number of asymptomatic COVID-19 cases. We also examined the effect of the announcement of curfew decisions on the usage of the facemask. The use of facemask prevalence increased to 50.6% after the curfew decisions were announced.

Turkish Minister of Health said that the term "patients" referred to those who had tested positive for the disease and displayed symptoms. People who had a positive test but were asymptomatic were not included in the tally [5]. This practice ended on November 25, 2020. The Ministry of Health of Turkey began to announce the number of asymptomatic COVID-19 cases [6]. The announcement of asymptomatic COVID-19 cases had no statistically significant effect on the correct facemask use in both customers and sellers. In the early period of the pandemic, media reporting about COVID-19, elevated public health awareness and altered the community's behaviors and people began to take appropriate precautions such as wearing facemasks and washing their hands frequently [30]. We conducted this study in the 10th month of the outbreak in Turkey, so it is possible that people may now be desensitized to statistics and not able to understand or be less able to comprehend the severity of the COVID-19 pandemic. In the late period of the pandemic, the announcement of daily statistical parameters on mass media appeared to be ineffective in wearing the correct facemasks. However, after the announcement of the curfew decisions, correct facemask usage prevalence increased both among customers and sellers. Strict government interventions probably affect individuals' COVID-19 risk perception, and as a result, people begin to pay more attention to using proper facemasks. Previous studies showed that rather than voluntary policies, strict widespread

http://doi.org/10.5472/marumj.1191644
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governmental steps are more effective to ensure mask-wearing compliance [17,24,31]. Without government action, the general public does not follow public health recommendations [17]. It is reported that compliance with preventive measures is higher when authorities take serious control measures with laws and regulations [27,31,32]. It is critical to correctly comprehend the factors that influence compliance with public health measures and to choose the right and effective implementation strategies.

Strengths and Limitations

This study's results depended on observational data. Age and gender information were collected based on observation. Also, the assessment of correct facemask use was evaluated only based on ensuring the mask covers the mouth and nose. Other aspects of proper mask use (touching the front of the mask, taking off, discarding and re-using the mask…etc.) have not been evaluated. But in terms of measuring the participants' proper mask use, observation outperforms self-reporting. Also, observations were made by different trained medical students every hour to minimize the Hawthorne effect. Since, results from natural experimental studies are urgently needed on this issue [32], this study provides results of the effects of two different governmental decisions on public correct facemask use.

Conclusion

Although, the use of masks is high in marketplaces in Denizli, Turkey, the correct use of facemasks is not sufficient, especially among sellers, the correct mask usage prevalence is quite low. Correct use of facemasks is lower in men and the young population. While, customers pay more attention to the correct use of masks in the morning hours, sellers pay more attention in the afternoon. The announcement of curfew decisions has increased the correct use of masks although the announcement of asymptomatic COVID-19 case numbers has no effect. Since, millions of people have not been vaccinated, people should follow coronavirus precautions. It is recommended that even fully vaccinated people should also maintain preventive measures such as correct mask wearing [33]. Informative training about correct facemask use targeted at specific populations is required. We urge health authorities and policymakers to consider serious regulations such as lockdowns to be implemented for the public to adopt and implement non-pharmaceutical protective interventions necessary to take control of the COVID-19 spread. Since, the COVID-19 pandemic is still ongoing and likely to continue around the world, using the correct face mask is essential.

Compliance with the Ethical Standards

Ethical Approval: This study was approved by the Pamukkale University Ethics Committee (decision date: 13.10.2020, approval number:19).

Financial Support: The authors have no relevant financial information to close.

Conflict of Interest: The authors have no potential conflicts of interest to disclose.

Authors' Contributions: SUU and OS: Concept and design, AE: Supervision, SUU and OS: Data collection and processing, SUU, OS and AE: Data analysis and interpretation, SUU: Literature search and drafting the article, SUU, OS and AE: Critical review. All authors approved the final version of the article.

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