

STASTICAL ANALYSIS PLAN AND RESULTS

Project Title: Reducing Spread of COVID-19 in a University Community Setting:
Role of a Low-Cost Reusable Form-Fitting Fabric Mask

NCT Number: NCT04979858

STATISTICAL ANALYSIS PLAN

The proposed statistical analysis will include the use of single-factor ANOVA test to assess the importance of the various factors associated with the design of the Focal Mask (the Treatment) that would impact its performance in reducing the spread of COVID-19, which is caused by the SARS-CoV-2 virus. The Bonferroni t-test will be conducted *post hoc* to assess the statistical significance of the various factors.

RESULTS OF THE STATISTICAL ANALYSIS

We present the details of the statistical analysis of the 200 post-study survey responses received at the end of the clinical trial. A copy of the survey is given in Appendix I.

As shown in the post-study instrument in Appendix I, the subjects were asked to identify all the devices used during the six-week study, viz., surgical mask, N95, KN95, fabric mask, and Focal Mask (the Low-Cost Reusable Form-Fitting Fabric Mask given only to those in the Treatment group). All the subjects were then asked to rank their experiences with each of these devices during the study based on specific characteristics reflecting the key user requirements for a mask defined in earlier research and shown in Table 1 (Park and Jayaraman, 2020¹).

¹ Park, S., and Jayaraman, S., (2020) From containment to harm reduction from SARS-CoV-2: a fabric mask for enhanced effectiveness, comfort, and compliance, [The Journal of The Textile Institute](#), 112:7, 1144-1158, DOI: [10.1080/00405000.2020.1805971](https://doi.org/10.1080/00405000.2020.1805971).

Table 1. Performance requirements for masks

Functionality	<ul style="list-style-type: none"> Provide a barrier against transfer of <ul style="list-style-type: none"> Microorganisms Body Fluids Particulate Material
Usability	<ul style="list-style-type: none"> Breathable Odor-free Ease of Donning and Doffing Minimal Impact on Job Performance Does not impair communication
Wearability	<ul style="list-style-type: none"> Lightweight Comfortable Soft on Skin
Shape Conformability	<ul style="list-style-type: none"> Conform to Desired Facial Shape Customizable Dimensional Stability even after Multiple Launderings
Durability	<ul style="list-style-type: none"> Reusable Multiple Times Strong Does not Tear
Maintainability	<ul style="list-style-type: none"> Ease of Care including Ease of Decontamination Ease of Laundering
Manufacturability	<ul style="list-style-type: none"> Ease of Fabrication Compatible with Standard Sewing Machines
Affordability	<ul style="list-style-type: none"> Material Cost Homemade (so, manufacturing cost is not considered)
Aesthetics	<ul style="list-style-type: none"> Aesthetically Pleasing Multiple Colors and Designs

These user requirements drove the design and development of the Focal Mask. As seen in Table 1, the most important user need is that the mask must serve as a barrier against the transfer of microorganisms, body fluids (e.g., saliva, mucus), and particulate materials from the wearer to the outside. The mask must be breathable so that the user is comfortable during extended use. The mask must be odor-free because it will be worn for long periods of time. Since the mask is intended for public use including children and the elderly, it must be easy to don and doff and not require any special training to learn to use. When used in a workplace setting, it should not impair the wearer's communication, which might impact job performance. If it muffles or muzzles the sound from going out during speaking, the wearer will remove the mask from the mouth thereby defeating the very reason for wearing a mask. The mask must be lightweight, soft, and conform to the wearer's facial profile. It must be easy to decontaminate at home by laundering so that it can be reused. It should have dimensional stability, i.e., retain its shape and

size, after multiple launderings so that it remains effective. Masks are becoming an essential accessory in everyone's wardrobe. Individuals express themselves through their clothing – the designs, colors, fit, style, and so on. Therefore, the masks should be aesthetically pleasing so that individuals are less self-conscious when wearing them.

The 200 post-study responses from the subjects were analyzed along the following lines:

- Features of the masks including Focal Mask
- Impact of masks on performance/interactions in school and/or at work
- Impact of masks on social life and interactions
- Opinions on masking practices
- Recommendations on improving the Focal mask

Features of the Masks including Focal Mask

For each question, e.g., “The mask was breathable,” the response data was aggregated for each mask type based on the ranking assigned by the subject on a 1-5 scale (1 – best and 5 – worst). The next step was to carry out statistical analysis to test whether the rankings by the subjects shown were indeed statistically different. Therefore, a single factor ANOVA test was carried out on the data to see if there were any significant differences in the responses for all the masks used.

Breathability

We use “breathability” to explain the statistical analysis methodology in detail. Table 2 shows the summary of responses for the breathability question.

Table 2. Summary of Responses for Breathability of Mask

Breathability	Mask Type				
	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	155	23	43	134
Average	1.9	1.8	2.6	2.4	2.3
Mode	2	1	3	3	3
Median	2	2	3	2	2
SD	0.85	0.83	1.16	1.14	1.05

In the table, count represents the number of responses ranking that specific mask. For instance, since the Focal mask was given only to the 100 subjects in the Treatment group, the count is 100. The count of 155 in surgical mask represents the number of subjects who used the surgical mask

during the six-week study. Likewise, 23 subjects reported using N95, 43 using KN95, and 134 using fabric mask, respectively. The average represents the computed average of the individual ranks assigned by the subjects for each mask. On the 1-5 scale rating, the lower the number better the perceived performance. For instance, in Table 2, the surgical mask scored 1.8 in comparison to the Focal Mask with a score of 1.9, N95 with a score of 2.6, KN95 with 2.4, and fabric mask with 2.3, respectively. The mode and median rankings for each mask are also shown in the table. Figure 1 shows a graphical representation of the ranking of responses for the different masks in Table 2.

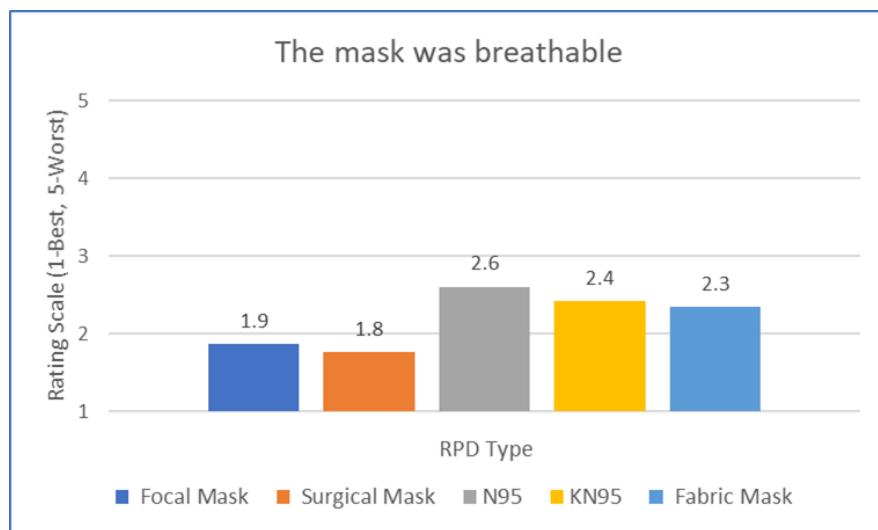


Figure 1. Ranking of Breathability of Masks Used by Subjects in the Study

Statistical Analysis: The next step was to test whether the rankings by the subjects shown in the figure (and table) were indeed statistically different. Therefore, a single factor ANOVA test was carried out on the data to see if there were any significant differences in the responses for all the masks used. Table 3 shows the result of the ANOVA test.

Table 3. Summary of Single Factor ANOVA Test for Breathability of Masks

ANOVA: Single Factor					
SUMMARY					
Groups	Count	Sum	Average	Variance	
Focal Mask	100	187	1.87	0.72030303	
Surgical Mask	155	274	1.7677419	0.685965647	
N95	23	60	2.6086957	1.339920949	
KN95	43	104	2.4186047	1.296788483	
Fabric Mask	134	314	2.3432836	1.099315453	

ANOVA						Significant
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	40.0506063	4	10.012652	11.0677516	1.43228E-08	2.391758
Within Groups	407.101042		450	0.904669		
Total	447.1516484		454			

A comparison of the F and F_{crit} values in Table 3 shows that the difference is significant since F is greater than F_{crit} . Therefore, a post-hoc Bonferroni t-test was performed using a correction factor of 0.005 assuming equal variances in the two types (e.g., Focal Mask and surgical mask) for all mask types using the following two hypotheses:

Null hypothesis: There is no significant difference in the assessment of that specific performance parameter, e.g., breathability in this example, between the two different masks.

Alternate hypothesis: There is a significant difference in the assessment of that specific performance parameter, e.g., breathability in this example, between the two different masks.

Table 4 provides a summary of the post-hoc Bonferroni t-test for breathability.

Table 4. Summary of Bonferroni Post Hoc t-test for Breathability

Bonferroni Post Hoc Test (t-test)		Bonferroni correction: 0.005			
t-Test: Two-Sample Assuming Equal Variances					
Comparison	p Value	Hypothesis			
Focal Mask vs Surgical Mask	0.341347658	Null			
Focal Mask vs N95	0.000652144	Alternate			
Focal Mask vs KN95	0.001780898	Alternate			
Focal Mask vs Fabric Mask	0.000270484	Alternate			
Surgical Mask vs N95	2.8793E-05	Alternate			
Surgical Mask vs KN95	4.42331E-05	Alternate			
Surgical Mask vs Fabric Mask	3.63761E-07	Alternate			
N95 vs KN95	0.522832795	Null			
N95 vs Fabric Mask	0.271069012	Null			
KN95 vs Fabric Mask	0.688674797	Null			

The table shows the applicable hypothesis (Null or Alternate) for each comparison based on the p value indicating whether the difference in breathability is statistically significant or not. Since the null hypothesis is applicable, there is no significant difference between the breathability of the Focal Mask and the surgical mask. However, the Focal Mask is significantly better than that of all the other mask types because the Alternate hypothesis is applicable. The breathability of the surgical mask is also significantly better than that of the other masks.

In a similar manner, the responses for the other questions (from Q2 through Q12 in the post-study survey) were analyzed. The results from the statistical analysis along the lines of Tables 2 through 4 are shown in Appendix II.

Table 5 shows the summary of the hypotheses applicable to each parameter assessed for all the masks used by the subjects in the post-study survey. It shows the assessment of the Focal Mask in comparison to the other masks used by the subjects during the study. It is important to note that the Focal Mask was given only to the 100 subjects in the Treatment group.

Table 5. Assessment of Focal Mask with respect to the other masks used by the subjects

Comparison	Focal Mask vs Surgical Mask	Focal Mask vs N95	Focal Mask vs KN95	Focal Mask vs Fabric Mask	Surgical Mask vs N95	Surgical Mask vs KN95	Surgical Mask vs Fabric Mask	N95 vs KN95	N95 vs Fabric	KN95 vs Fabric
Q1. The mask was breathable	Null	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Null	Null	Null
Q2. The mask conformed to the shape of my face to prevent leakage	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Null	Null	Alternate
Q3. The mask stayed in place when speaking to others	Alternate	Alternate	Alternate	Alternate	Null	Null	Null	Null	Null	Null
Q4. The mask did not require me to speak louder to others for them to hear me	Null	Alternate	Alternate	Alternate	Null	Alternate	Alternate	Null	Null	Null
Q5. The mask was easy to put on	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Null	Null	Null
Q6. The mask was easy to take off	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Alternate	Null	Null	Null
Q7. The mask was comfortable to wear	Null	Null	Null	Null	Alternate	Null	Null	Null	Alternate	Null
Q8. The mask was soft on my skin	Alternate	Alternate	Alternate	Alternate	Null	Null	Alternate	Null	Alternate	Alternate
Q9. The mask did not cause rashes on my face	Null									
Q10. The mask did not leave traces or marks on my face during continuous use	Alternate	Null	Null	Alternate	Alternate	Alternate	Null	Null	Alternate	Alternate
Q11. The mask stayed away from my lips when I had it on	Alternate	Null	Null	Alternate	Null	Alternate	Null	Null	Null	Alternate
Q12. The mask did not have an odor to it when I wore it	Null	Null	Null	Alternate	Null	Null	Alternate	Null	Null	Null

RESULTS AND ANALYSIS PERTAINING TO THE PRIMARY AIM

The primary aim of the study has been to test the role of the newly developed reusable form-fitting fabric mask, viz., the Focal Mask, in reducing the spread of COVID-19 in a community setting comprising undergraduate students living in dormitories at Georgia Tech.

Simulating a “Real” Community Setting: One of the key features of the study has been to simulate a “real” community setting in which individual behaviors cannot be specified, monitored, or controlled. Therefore, regular health diagnostic testing for COVID-19 was not mandated for the subjects in the study. In this effort to simulate a real community setting, it is acknowledged that subjects who became infected, but were asymptomatic, would not have been tested; as a result, there was a potential for undercounting the number of positive cases during the study. Likewise, during the study, instead of being required to wear a specific type of mask, the subjects were free to use the type of mask they preferred except for those selected to be in the Treatment group in which case they were required to use the Focal Mask (the Low-Cost Reusable Form-Fitting Fabric Mask) during the two-week Treatment phase.

Health Diagnostic Testing

Table 6 shows the health diagnostic testing for COVID-19 reported by subjects in the study during the three phases, viz., Pre-Treatment, Treatment, and Post-Treatment, respectively. This is based on the analysis of the 8,335 responses from the daily surveys from subjects enrolled in the Study. At the beginning of the study, there were 201 subjects. One subject withdrew from the study in accordance with the IRB-approved protocol for having tested positive on the seventh day of the Pre-Treatment phase of the study.

Table 6. Health Diagnostic Testing for COVID-19

Number of Subjects	Pre-Treatment		Treatment		Post-Treatment	
	Control	Treatment	Control	Treatment	Control	Treatment
Who tested at least once	69	77	72	82	61	67
Who did not test	32	23	28	18	39	33
With Symptoms	43	52	46	38	41	27
Tested with Symptoms	26	35	35	28	24	18
Without Symptoms	58	48	54	62	59	73
Tested without Symptoms	43	42	37	54	37	49
Proportion of Subjects	Pre-Treatment		Treatment		Post-Treatment	
	Control	Treatment	Control	Treatment	Control	Treatment
Who tested at least once	68%	77%	72%	82%	61%	67%
Who did not test	32%	23%	28%	18%	39%	33%
With symptoms who tested	60%	67%	76%	74%	59%	67%
Without symptoms who tested	74%	88%	69%	87%	63%	67%

As seen in the table and in Figure 2, a majority of the students in both groups (Control and Treatment) tested at least once in each phase of the three-phase study. Moreover, a majority of the students with symptoms tested in both groups in all three phases. Routine testing, i.e., testing that is voluntary and not triggered by symptoms is also high, ranging from 63% in the Post-treatment Control group to 88% in the Pre-treatment Treatment group.

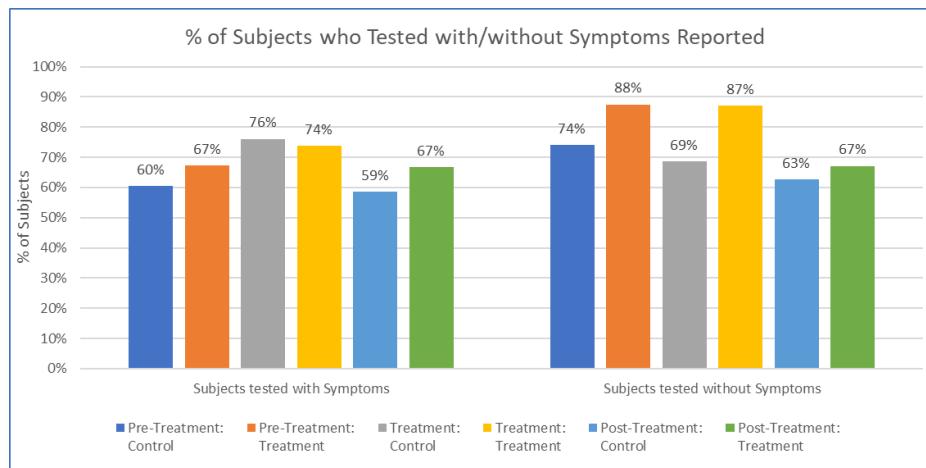


Figure 2. Symptom-driven testing and routine testing in subject population.

One of the key objectives of the study was to simulate a “real” community setting in which individual behaviors cannot be specified, monitored, or controlled. So, regular testing was not

mandated for the subjects in the study. Figures 2 and 3 show the behavior of subjects in the chosen university community setting. Overall, 91% of the subjects underwent testing during the six weeks while 9% chose not to test during the entire six weeks of the study.

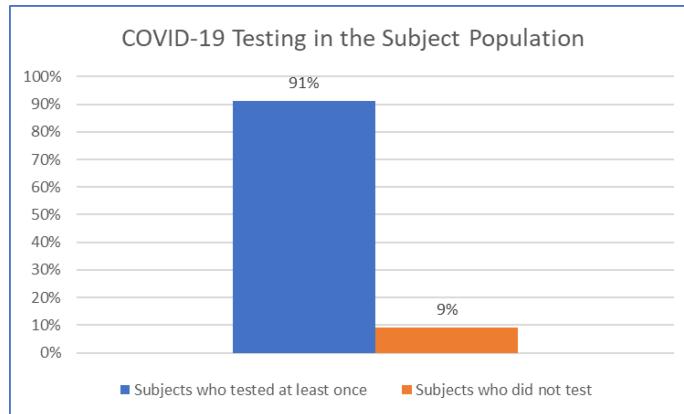


Figure 3. COVID-19 Testing in Subject Population during Six Weeks of Study

COVID-19 Infections during Study Period: Georgia Tech and Subject Population

Table 7 shows the results of COVID-19 saliva tests conducted on campus in the Georgia Tech population during the six weeks of the study. The days corresponding to the three phases of the study (Pre-Treatment, Treatment, and Post-Treatment) are highlighted in different colors.

Table 7. Georgia Tech COVID-19 Test Data

Day in Study	Date	Number of Positive Individuals	Number of Tests Conducted	Positivity by Location		
				Greek House	Residence Hall	Off-Campus Student
1	9/10/2021	29	3019	2	12	13
2	9/11/2021	15	1412	2	7	5
3	9/12/2021	2	0	0	1	0
4	9/13/2021	2	585	0	0	0
5	9/14/2021	7	1423	1	1	3
6	9/15/2021	5	1842	0	1	1
7	9/16/2021	13	1484	1	6	4
8	9/17/2021	5	1666	0	2	1
9	9/18/2021	10	932	1	4	4
10	9/19/2021	1	1	0	0	1
11	9/20/2021	4	598	0	1	1
12	9/21/2021	7	979	0	2	4

13	9/22/2021	5	1954	1	2	2
14	9/23/2021	8	1395	0	1	4
15	9/24/2021	1	43	0	0	1
16	9/25/2021	12	2365	1	4	4
17	9/26/2021	2	1	0	1	0
18	9/27/2021	6	592	0	2	3
19	9/28/2021	7	973	1	1	3
20	9/29/2021	2	2126	1	0	1
21	9/30/2021	5	1389	0	1	4
22	10/1/2021	4	778	0	0	3
23	10/2/2021	5	960	0	2	2
24	10/3/2021	2	0	0	0	0
25	10/4/2021	3	541	0	2	0
26	10/5/2021	4	1014	0	2	1
27	10/6/2021	6	1554	0	1	2
28	10/7/2021	1	1376	0	1	0
29	10/8/2021	2	281	0	0	0
30	10/9/2021	0	1932	0	0	0
31	10/10/2021	6	51	0	2	2
32	10/11/2021	2	51	0	0	1
33	10/12/2021	0	495	0	0	0
34	10/13/2021	3	577	1	0	1
35	10/14/2021	2	1852	0	0	2
36	10/15/2021	6	1891	1	0	4
37	10/16/2021	1	47	0	0	1
38	10/17/2021	0	0	0	0	0
39	10/18/2021	0	557	0	0	0
40	10/19/2021	1	960	0	0	1
41	10/20/2021	5	1470	0	1	4
42	10/21/2021	0	1171	0	0	0

As seen in the table, while the number of positive cases in the general campus population is low, individuals are testing positive for COVID-19. It is important to note that no data was collected on the masking practices of the Georgia Tech population that got tested during the period. In contrast, none of the subjects reported testing positive in the daily surveys during the six weeks of the study. Typically when subjects experienced symptoms, they got tested (Figure 2). However, subjects who were infected, but were asymptomatic, did not get tested because testing was not mandatory for participation in the study since one of the goals was to simulate a “real” community setting. It is acknowledged that there was a potential for undercounting the number of positive cases in the subject population during the study.

CONCLUSIONS

We draw on the preceding findings and analysis to present the following major conclusions from the study:

- An IRB-approved clinical trial to test the effectiveness of a prototype low-cost reusable form-fitting fabric mask (Focal Mask) to reduce infectious disease spread, i.e., COVID-19, through respiratory secretions in undergraduate students living in dormitories at Georgia Tech was completely successfully. This subject population (201) was chosen due to the significant person-to-person contact that occurs in residences, classes, and social activities among university students.
- To simulate a “real” community setting in which individual behaviors cannot be specified, monitored, or controlled, regular health diagnostic testing for COVID-19 during the study was not mandated for the subjects.
 - In this effort to simulate a real community setting, it is acknowledged that subjects who became infected, but were asymptomatic, would not have been tested; as a result, there is a potential for undercounting the number of reported positive cases during the study.
 - Likewise, during the study, instead of being required to wear a specific type of mask, the subjects were free to use the type of mask they preferred except for those selected to be in the Treatment group in which case they were required to use the Focal Mask during the two-week Treatment phase.
- Apart from the one positive COVID-19 transmission reported by a subject on Day Seven of the study (Pre-Treatment phase), no confirmed positive COVID-19 transmission was reported during the six weeks of the study. The subject who reported testing positive had been quarantining from Day One of the study due to exposure to an infected individual; the subject withdrew in accordance with the IRB-approved study protocol.
- In contrast, during the same six-week period of the study, Georgia Tech’s COVID-19 testing data showed positive COVID-19 cases in the student population. It is important to note that no data was collected on the masking practices of the Georgia Tech population that got tested during the period.
- All the subjects reported that they wore their masks when in public during the day, which is one of the key preventative measures to reduce the spread of COVID-19.
- Despite the high degrees of interaction reported by the subjects (in residence halls, in classes, during group meetings, during dining, and in social settings), the use of masks, including the Focal Mask, could have served as one of the preventative measures to prevent the spread of COVID-19 in the subject population. It is important to reiterate that regular testing for COVID-19 was not mandated for the subjects

during the study; consequently, subjects who were infected, but were asymptomatic, would not have been counted.

- The design and structure of the Focal Mask, including having a built-in filter, have been validated from the viewpoint of the various user requirements including breathability, shape conformability, speech intelligibility, and comfort, among others.

In closing, wearing a mask, such as the prototype Focal Mask, could be an effective tool as one of the preventative measures to prevent the spread of infectious diseases, such as COVID-19, through respiratory secretion in a community setting with a high degree of interaction among individuals living in university residence halls. The overwhelming willingness of the subject population to wear masks as a means to control the spread of infection was an important factor in the transmission rates observed in the study population.

Appendix I: Post-Study Survey

Post-Study Questionnaire Treatment

Start of Block: Intro

1 Thank you for your diligent participation in this important Study! This is the last Survey!!

We want to learn about your experience with masks you have used during the Study. We also want to learn about your views on using masks in public and in social settings. We want you to reflect on your total experience during the Study and complete this Survey.

Please complete this Survey by **4:59 p.m. on Tuesday, October 26th.**

End of Block: Intro

Start of Block: Post-Study Survey

Select all masks you used during the Study:

- Focal Fabric Mask (5)
- Surgical Mask (1)
- N-95 Respirator (2)
- KN-95 Respirator (3)
- Fabric Mask (4)

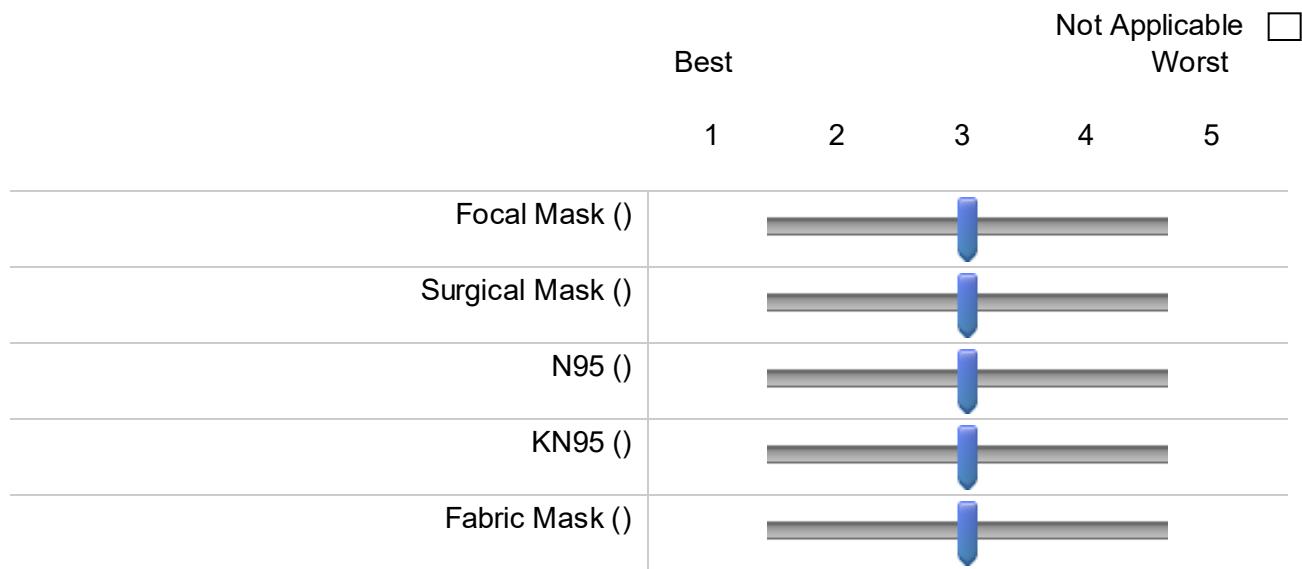
Page Break

Rate the performance of each mask you used in the following categories.

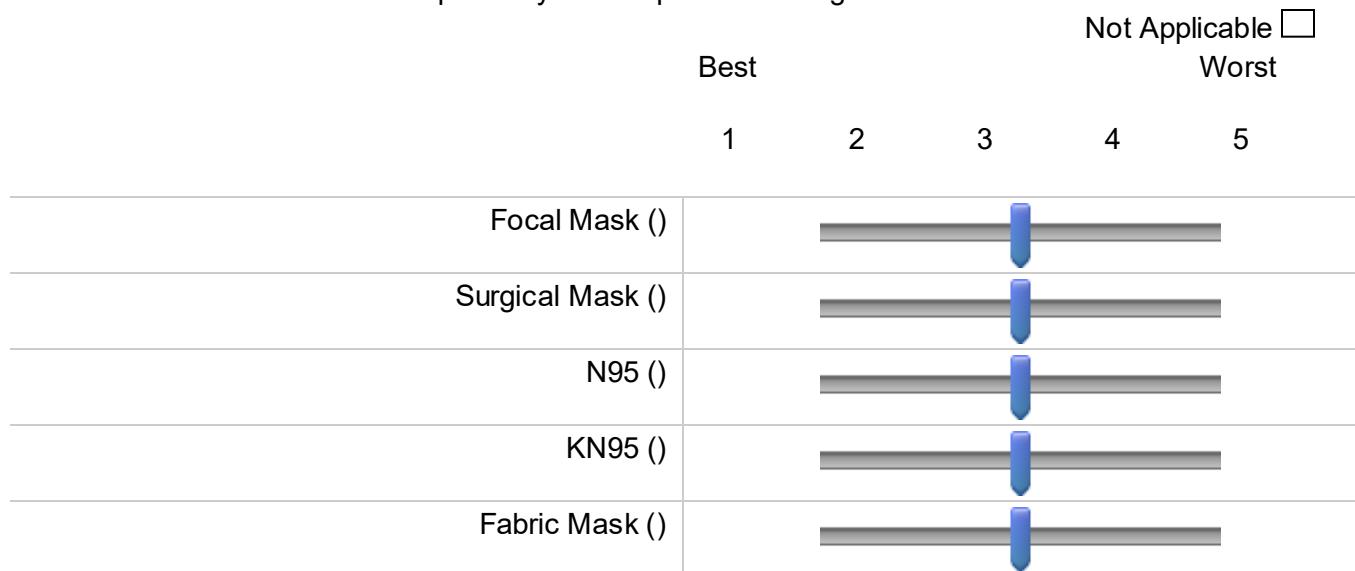
Scale: 1 - best; 5 - worst.

If the performance is similar, you can provide the same rating. Check "Not Applicable" if you did not use that mask.

The mask was breathable.



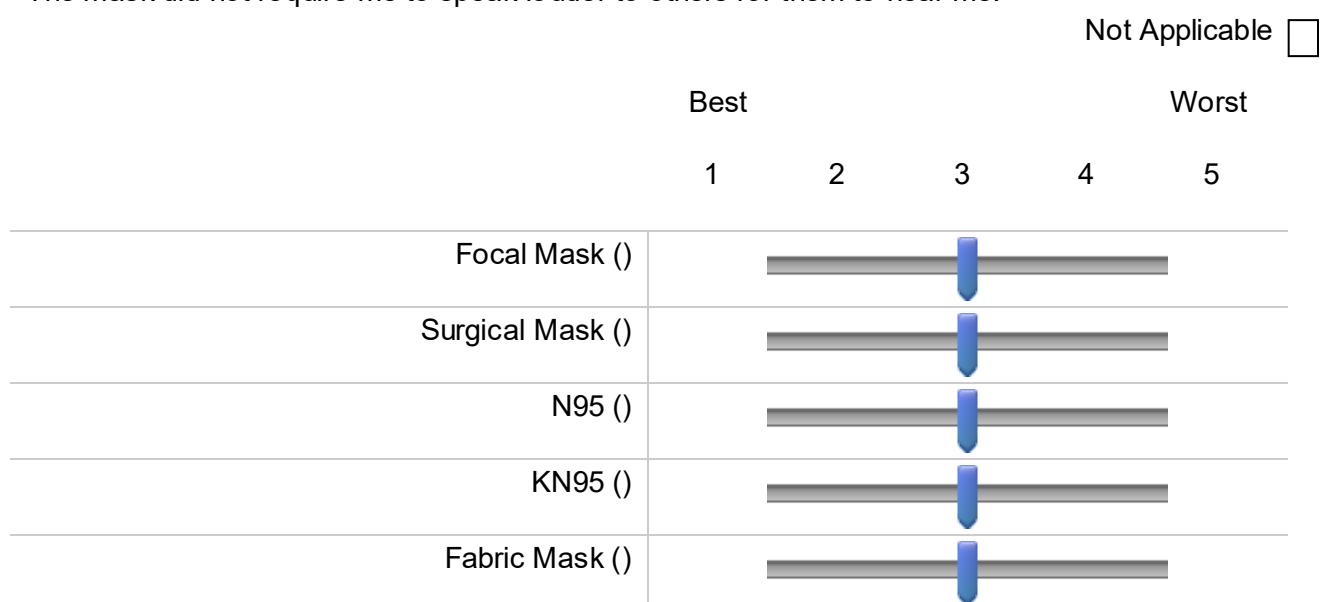
The mask conformed to the shape of my face to prevent leakage.



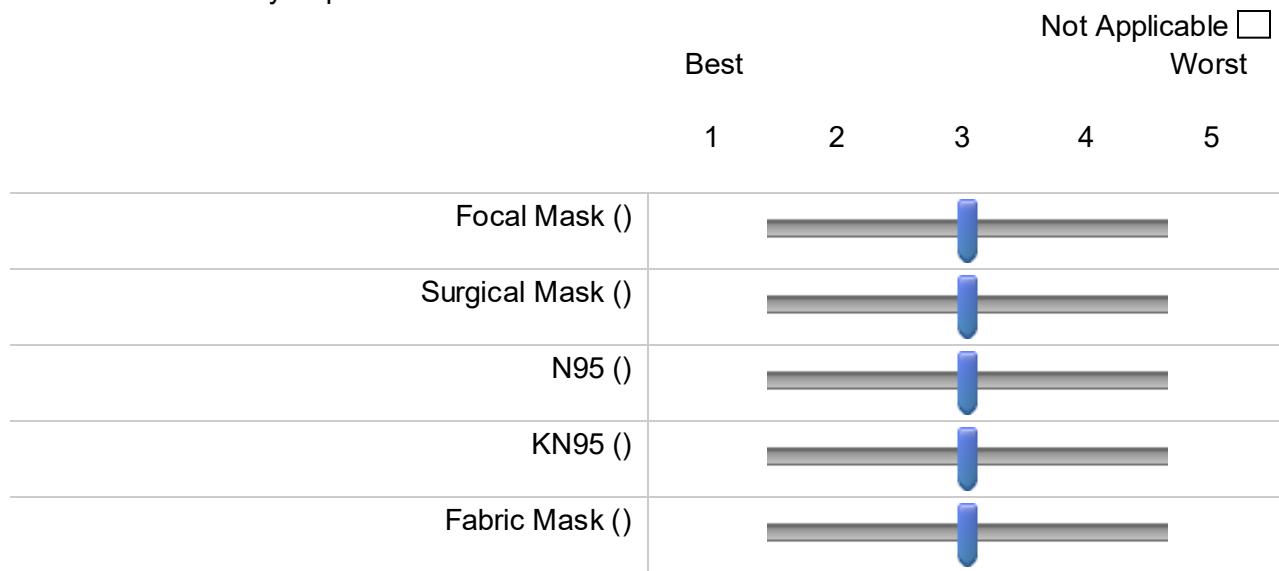
The mask stayed in place when speaking to others.



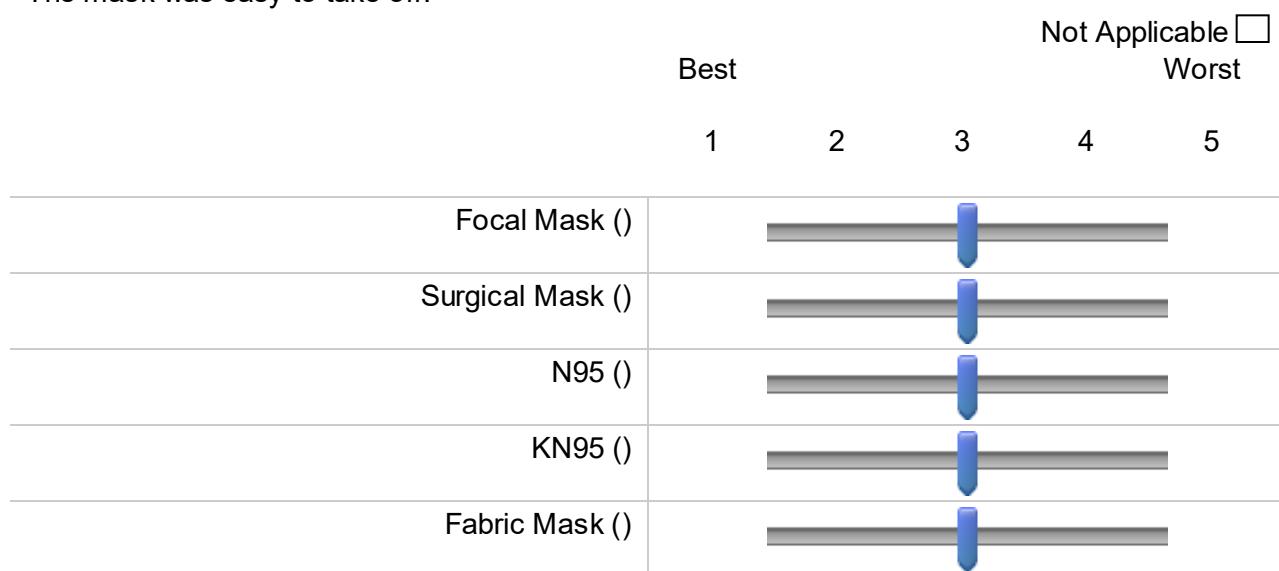
The mask did not require me to speak louder to others for them to hear me.



The mask was easy to put on.



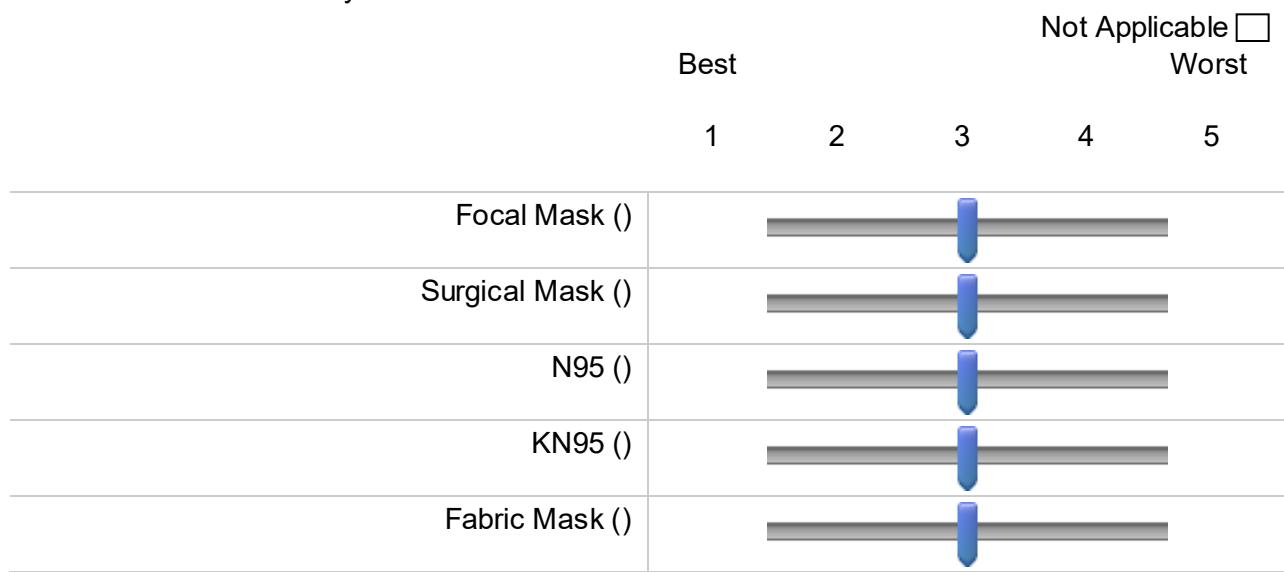
The mask was easy to take off.



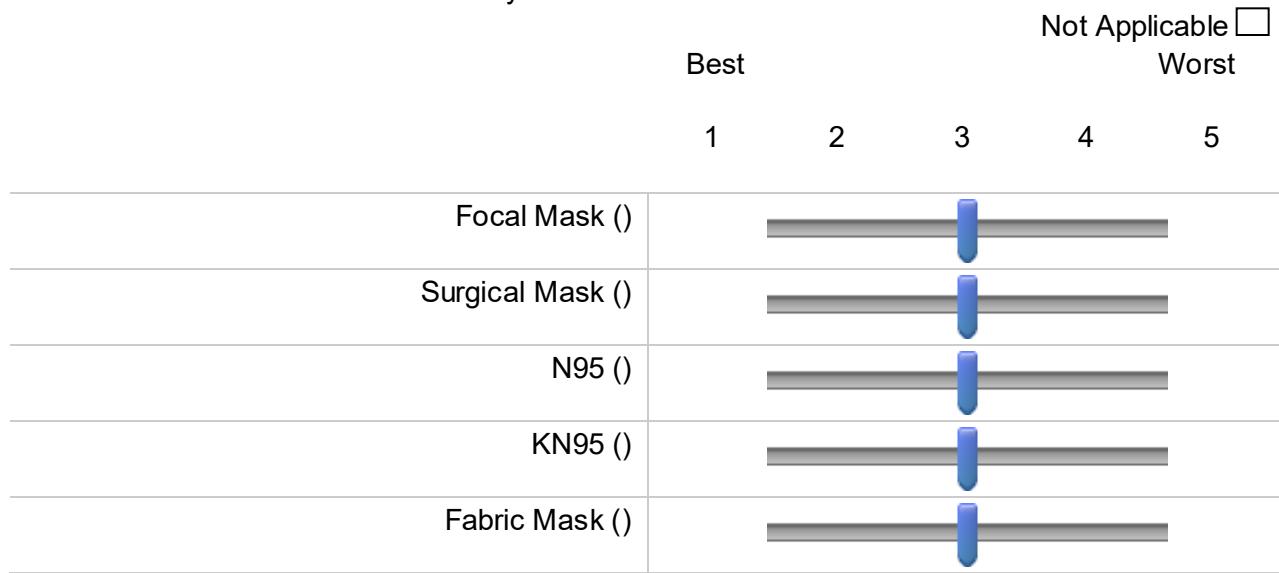
The mask was comfortable to wear.



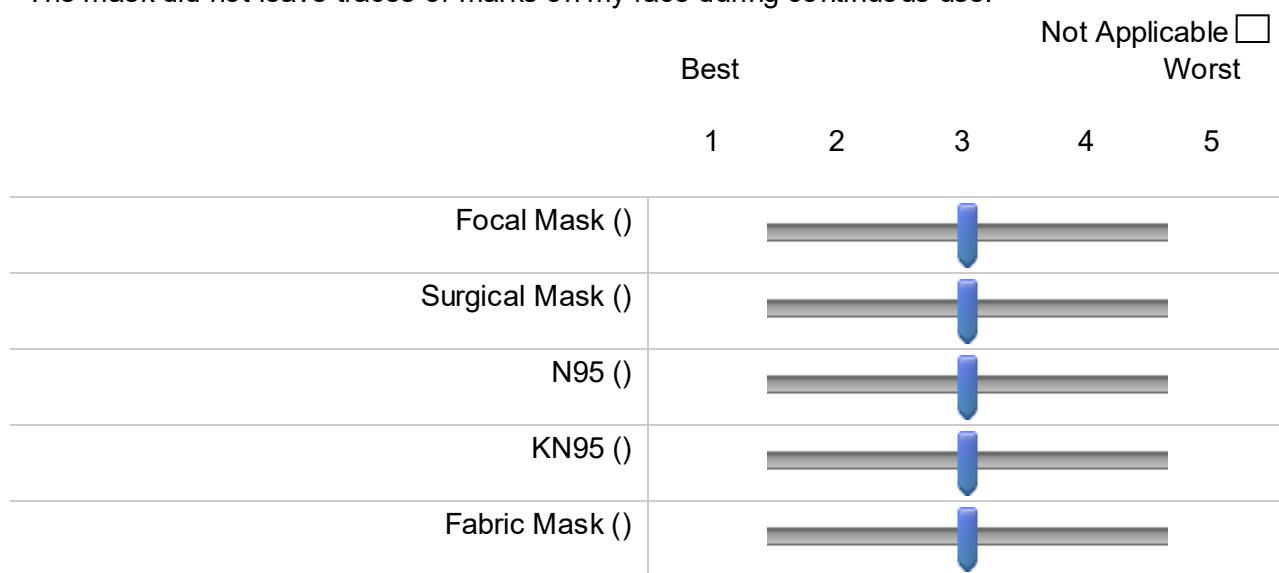
The mask was soft on my skin.



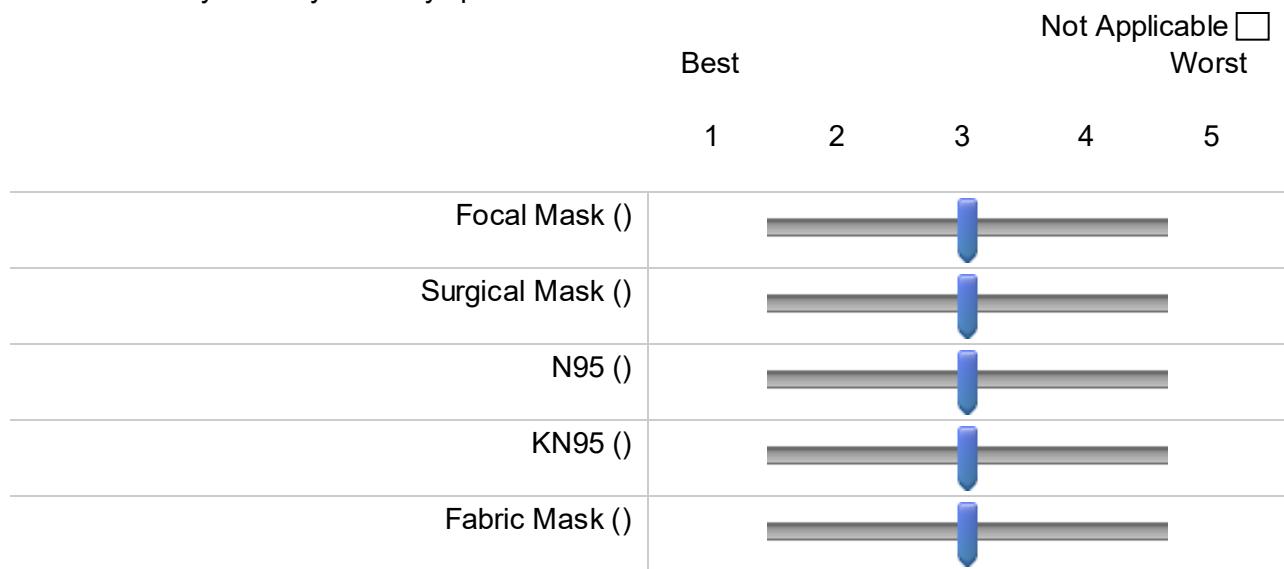
The mask did not cause rashes on my face.



The mask did not leave traces or marks on my face during continuous use.



The mask stayed away from my lips when I had it on.



The mask did not have an odor to it when I wore it.

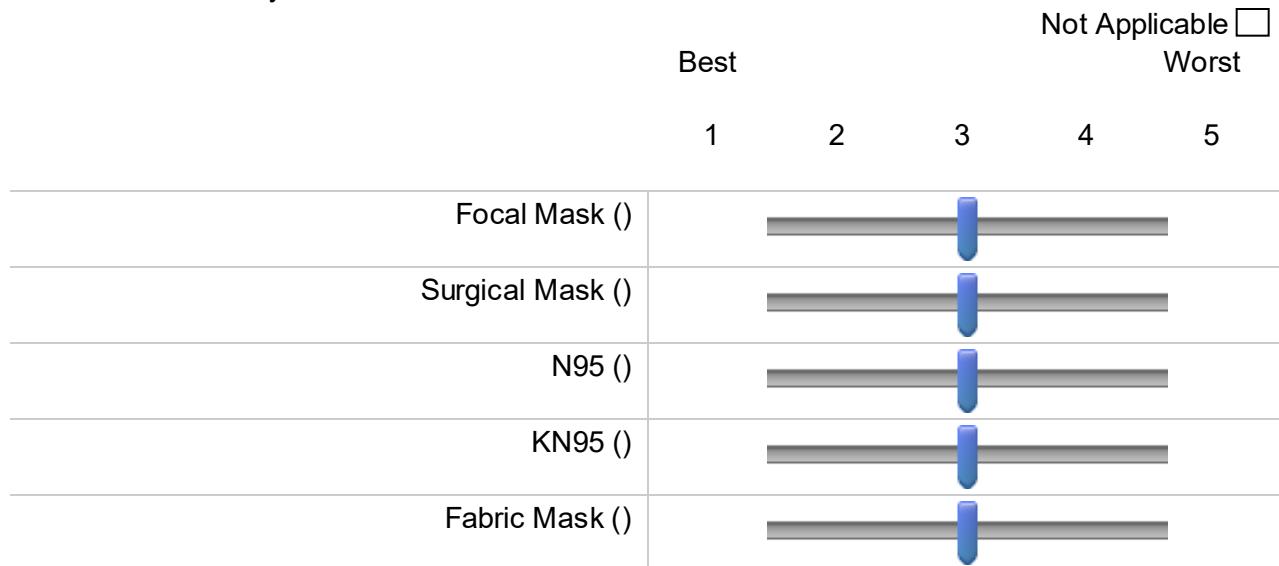


Rate the washing performance of each mask you used.

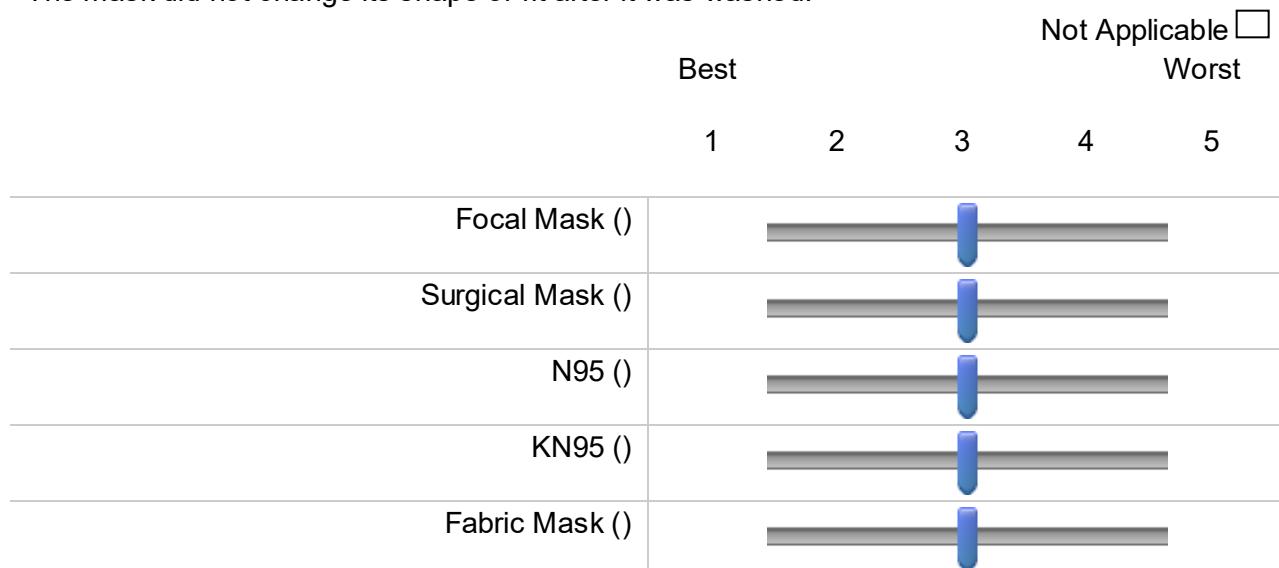
Scale: 1 - best; 5 - worst.

If the performance is similar, you can provide the same rating. Check "Not Applicable" if you did not use that type of mask or is not washable (e.g., Surgical mask).

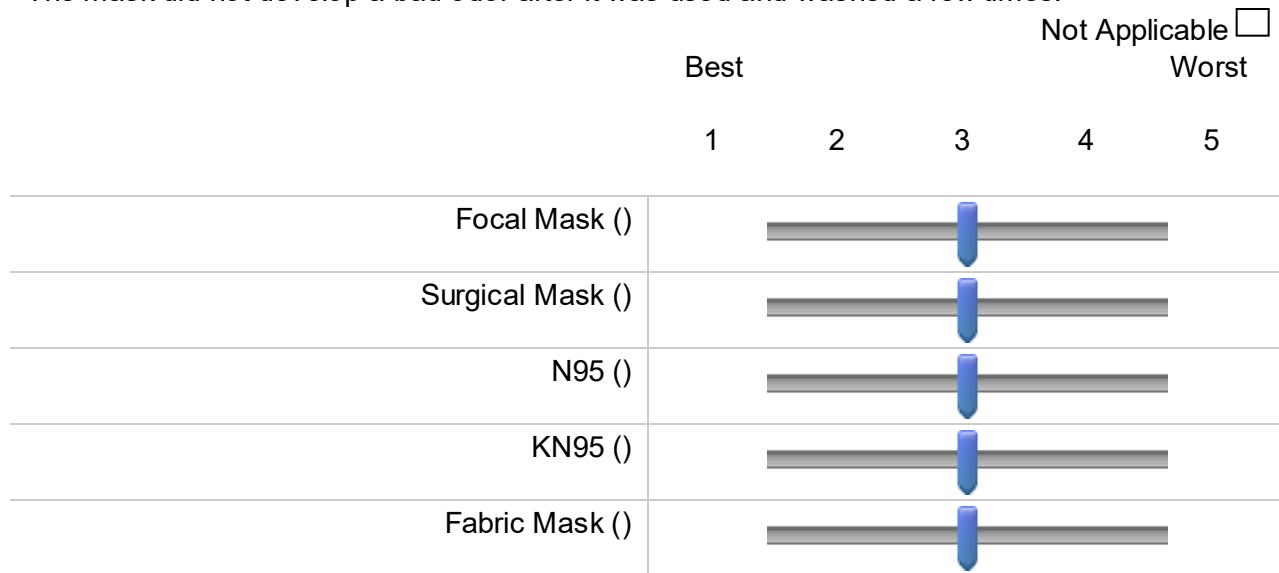
The mask was easy to wash.



The mask did not change its shape or fit after it was washed.



The mask did not develop a bad odor after it was used and washed a few times.



Wearing the mask impeded my performance in class or at my work.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Wearing the mask limited my social life.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

I had reservations about wearing the mask when meeting socially with my friends.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Coordinating the **color** of my mask with my Casual / Semi-formal / Formal clothing is very important to me. Fill out accordingly for each row.

	Strongly agree (12)	Somewhat agree (13)	Neither agree nor disagree (14)	Somewhat disagree (15)	Strongly disagree (16)
School (Casual) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social (Semi-formal) (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business (Formal) (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Coordinating the **design (patterns)** of my mask with my Casual / Semi-formal / Formal clothing is very important to me. Fill out accordingly for each row.

	Strongly agree (12)	Somewhat agree (13)	Neither agree nor disagree (14)	Somewhat disagree (15)	Strongly disagree (16)
School (Casual) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social (Semi-formal) (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business (Formal) (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Coordinating the **style** of my mask with my Casual / Semi-formal / Formal clothing is very important to me. Fill out accordingly for each row.

	Strongly agree (12)	Somewhat agree (13)	Neither agree nor disagree (14)	Somewhat disagree (15)	Strongly disagree (16)
School (Casual) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social (Semi-formal) (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business (Formal) (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I believe everyone should wear masks in indoor public settings.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

I believe everyone should wear masks in outdoor public settings.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

The reusability of the mask is important to me.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

Having a built-in filter is important to me.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

List any specific issues when wearing the focal mask.

What changes would you make to the design of the focal mask?

List any additional thoughts or input you have on your experience using the focal mask.

Appendix II: Statistical Analysis of Post-Study Surveys

Q1. The mask was breathable.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	155	23	43	134
Average	1.9	1.8	2.6	2.4	2.3
Mode	2	1	3	3	3
Median	2	2	3	2	2
SD	0.85	0.83	1.16	1.14	1.05

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	187	1.87	0.72030303
Surgical Mask	155	274	1.7677419	0.685965647
N95	23	60	2.6086957	1.339920949
KN95	43	104	2.4186047	1.296788483
Fabric Mask	134	314	2.3432836	1.099315453

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	40.0506063	4	10.012652	11.0677516	1.43228E-08	2.391758
Within Groups	407.101042	450	0.904669			
Total	447.1516484	454				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	0.341347658	Null
Focal Mask vs N95	0.000652144	Alternate
Focal Mask vs KN95	0.001780898	Alternate
Focal Mask vs Fabric Mask	0.000270484	Alternate
Surgical Mask vs N95	2.8793E-05	Alternate
Surgical Mask vs KN95	4.42331E-05	Alternate
Surgical Mask vs Fabric Mask	3.63761E-07	Alternate
N95 vs KN95	0.522832795	Null
N95 vs Fabric Mask	0.271069012	Null
KN95 vs Fabric Mask	0.688674797	Null

Q2. The mask conformed to the shape of my face to prevent leakage.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	25	42	133
Average	1.4	2.9	2.1	2.0	2.6
Mode	1	3	2	1	3
Median	1	3	2	2	3
SD	0.89	1.02	1.20	1.19	0.92

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	140	1.4	0.787878788
Surgical Mask	156	455	2.9166667	1.044623656
N95	25	53	2.12	1.443333333
KN95	42	84	2	1.414634146
Fabric Mask	133	343	2.5789474	0.851674641

ANOVA

Significant

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	153.7569298	4	38.439232	38.9594649	5.05948E-28	2.391714
Within Groups	444.9777193		451	0.9866468		
Total	598.7346491		455			

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	3.42742E-27	Alternate
Focal Mask vs N95	0.00102224	Alternate
Focal Mask vs KN95	0.001183617	Alternate
Focal Mask vs Fabric Mask	3.23802E-19	Alternate
Surgical Mask vs N95	0.000530197	Alternate
Surgical Mask vs KN95	1.40284E-06	Alternate
Surgical Mask vs Fabric Mask	0.003698606	Alternate
N95 vs KN95	0.691992985	Null
N95 vs Fabric Mask	0.03164194	Null
KN95 vs Fabric Mask	0.001191605	Alternate

Q3. The mask stayed in place when speaking to others.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	158	23	39	136
Average	1.4	2.3	2.1	2.2	2.4
Mode	1	2	1	1	2
Median	1	2	2	2	2
SD	0.69	1.01	1.31	1.33	1.13

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	139	1.39	0.482727273
Surgical Mask	158	370	2.3417722	1.02894461
N95	23	48	2.0869565	1.719367589
KN95	39	84	2.1538462	1.765182186
Fabric Mask	136	331	2.4338235	1.284477124

ANOVA

Significant

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	74.46353756	4	18.615884	17.21707438	3.73625E-13	2.391714
Within Groups	487.6417256	451	1.0812455			
Total	562.1052632	455				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	9.17549E-15	Alternate
Focal Mask vs N95	0.000490665	Alternate
Focal Mask vs KN95	2.00213E-05	Alternate
Focal Mask vs Fabric Mask	2.19623E-14	Alternate
Surgical Mask vs N95	0.280765228	Null
Surgical Mask vs KN95	0.332912844	Null
Surgical Mask vs Fabric Mask	0.463063617	Null
N95 vs KN95	0.848066267	Null
N95 vs Fabric Mask	0.186638708	Null
KN95 vs Fabric Mask	0.192832634	Null

Q4. The mask did not require me to speak louder to others for them to hear me

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	23	41	134
Average	1.9	2.0	2.6	2.6	2.6
Mode	2	2	2	2	3
Median	2	2	2	2	3
SD	0.84	1.00	1.23	1.20	1.14

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	189	1.89	0.704949495
Surgical Mask	156	308	1.974359	1.005789909
N95	23	60	2.6086957	1.52173913
KN95	41	106	2.5853659	1.448780488
Fabric Mask	134	349	2.6044776	1.293513635

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	49.02198174	4	12.255495	11.24945286	1.04581E-08	2.391802
Within Groups	489.1542297	449	1.0894304			
Total	538.1762115	453				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	0.485432948	Null
Focal Mask vs N95	0.001029174	Alternate
Focal Mask vs KN95	0.000142949	Alternate
Focal Mask vs Fabric Mask	2.74912E-07	Alternate
Surgical Mask vs N95	0.006662839	Null
Surgical Mask vs KN95	0.001057963	Alternate
Surgical Mask vs Fabric Mask	9.35402E-07	Alternate
N95 vs KN95	0.941451107	Null
N95 vs Fabric Mask	0.98707171	Null
KN95 vs Fabric Mask	0.926110828	Null

Q5. The mask was easy to put on.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	20	40	134
Average	3.0	1.3	2.1	1.8	1.7
Mode	2	1	1	1	1
Median	3	1	1.5	1	1
SD	1.12	0.56	1.28	1.22	0.96

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	300	3	1.252525253
Surgical Mask	156	195	1.25	0.317741935
N95	20	41	2.05	1.628947368
KN95	40	73	1.825	1.481410256
Fabric Mask	134	223	1.6641791	0.916451577

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	193.8613847	4	48.465346	56.18430455	2.37271E-38	2.391982
Within Groups	383.8630597	445	0.8626136			
Total	577.7244444	449				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	3.31868E-42	Alternate
Focal Mask vs N95	0.000968692	Alternate
Focal Mask vs KN95	2.02822E-07	Alternate
Focal Mask vs Fabric Mask	2.9672E-19	Alternate
Surgical Mask vs N95	1.65668E-06	Alternate
Surgical Mask vs KN95	2.03884E-05	Alternate
Surgical Mask vs Fabric Mask	7.51657E-06	Alternate
N95 vs KN95	0.509151547	Null
N95 vs Fabric Mask	0.110550134	Null
KN95 vs Fabric Mask	0.383693557	Null

Q6. The mask was easy to take off.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	23	39	133
Average	2.9	1.2	2.0	1.6	1.5
Mode	3	1	1	1	1
Median	3	1	1	1	1
SD	1.15	0.46	1.40	1.11	0.86

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	294	2.94	1.32969697
Surgical Mask	156	186	1.1923077	0.207940447
N95	23	45	1.9565217	1.95256917
KN95	39	63	1.6153846	1.24291498
Fabric Mask	133	194	1.4586466	0.735019367

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	202.9903368	4	50.747584	64.46787857	5.34744E-43	2.391936
Within Groups	351.0806166	446	0.7871763			
Total	554.0709534	450				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	9.54529E-44	Alternate
Focal Mask vs N95	0.000568015	Alternate
Focal Mask vs KN95	8.36193E-09	Alternate
Focal Mask vs Fabric Mask	1.07145E-23	Alternate
Surgical Mask vs N95	4.32986E-07	Alternate
Surgical Mask vs KN95	0.000299259	Alternate
Surgical Mask vs Fabric Mask	0.000876543	Alternate
N95 vs KN95	0.294134953	Null
N95 vs Fabric Mask	0.022075933	Null
KN95 vs Fabric Mask	0.351426344	Null

Q7. The mask was comfortable to wear.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	21	38	133
Average	2.2	2.1	2.8	2.5	2.1
Mode	1	2	3	3	2
Median	2	2	3	2.5	2
SD	1.12	0.94	1.36	0.83	1.00

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	216	2.16	1.246868687
Surgical Mask	156	323	2.0705128	0.878866832
N95	21	59	2.8095238	1.861904762
KN95	38	94	2.4736842	0.688477952
Fabric Mask	133	274	2.0601504	0.996354523

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	15.16756458	4	3.7918911	3.700873587	0.00562111	2.392073
Within Groups	453.8949354	443	1.0245935			
Total	469.0625	447				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	0.490260663	Null
Focal Mask vs N95	0.021564178	Null
Focal Mask vs KN95	0.118026976	Null
Focal Mask vs Fabric Mask	0.47344125	Null
Surgical Mask vs N95	0.001667626	Alternate
Surgical Mask vs KN95	0.01608225	Null
Surgical Mask vs Fabric Mask	0.927632253	Null
N95 vs KN95	0.243879271	Null
N95 vs Fabric Mask	0.002886109	Alternate
KN95 vs Fabric Mask	0.020849209	Null

Q8. The mask was soft on my skin.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	21	40	133
Average	1.5	2.4	3.1	2.6	1.8
Mode	1	2	2	2	1
Median	1	2	3	2.5	2
SD	0.72	1.00	1.37	0.98	0.97

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	146	1.46	0.513535354
Surgical Mask	156	379	2.4294872	1.00789909
N95	21	65	3.0952381	1.89047619
KN95	40	104	2.6	0.964102564
Fabric Mask	133	243	1.8270677	0.947140579

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	98.4613386	4	24.615335	26.88078439	5.41403E-20	2.391982
Within Groups	407.4964392	445	0.9157223			
Total	505.957778	449				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	3.59738E-15	Alternate
Focal Mask vs N95	1.61966E-12	Alternate
Focal Mask vs KN95	3.83691E-12	Alternate
Focal Mask vs Fabric Mask	0.001683178	Alternate
Surgical Mask vs N95	0.007185694	Null
Surgical Mask vs KN95	0.336977521	Null
Surgical Mask vs Fabric Mask	4.70092E-07	Alternate
N95 vs KN95	0.109374734	Null
N95 vs Fabric Mask	5.83862E-07	Alternate
KN95 vs Fabric Mask	1.93755E-05	Alternate

Q9. The mask did not cause rashes on my face.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	98	156	22	39	131
Average	1.5	1.5	2.0	1.6	1.5
Mode	1	1	1	1	1
Median	1	1	1	1	1
SD	0.98	0.86	1.36	0.99	1.05

ANOVA: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Focal Mask	98	146	1.4897959	0.953503051
Surgical Mask	156	238	1.525641	0.74127378
N95	22	43	1.9545455	1.854978355
KN95	39	64	1.6410256	0.973009447
Fabric Mask	131	200	1.5267176	1.097357604

ANOVA

Not Significant

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	4.442173412	4	1.1105434	1.149720874	0.332538315	2.392164
Within Groups	425.9726248	441	0.9659243			
Total	430.4147982	445				

Q10. The mask did not leave traces or marks on my face during continuous use.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	21	39	133
Average	2.2	1.6	2.7	2.3	1.6
Mode	1	1	1	2	1
Median	2	1	2	2	1
SD	1.36	0.87	1.49	1.15	1.00

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	222	2.22	1.85010101
Surgical Mask	156	243	1.5576923	0.751488834
N95	21	56	2.6666667	2.233333333
KN95	39	91	2.3333333	1.333333333
Fabric Mask	133	216	1.6240602	1.009113693

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	56.90974961	4	14.227437	11.95996965	3.07701E-09	2.392027
Within Groups	528.1771101	444	1.1895881			
Total	585.0868597	448				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	3.25151E-06	Alternate
Focal Mask vs N95	0.181233394	Null
Focal Mask vs KN95	0.646595644	Null
Focal Mask vs Fabric Mask	0.00015451	Alternate
Surgical Mask vs N95	1.57304E-06	Alternate
Surgical Mask vs KN95	6.00014E-06	Alternate
Surgical Mask vs Fabric Mask	0.54705372	Null
N95 vs KN95	0.340747469	Null
N95 vs Fabric Mask	6.58872E-05	Alternate
KN95 vs Fabric Mask	0.000246495	Alternate

Q11. The mask stayed away from my lips when I had it on.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	21	39	133
Average	1.5	2.4	1.9	1.7	2.6
Mode	1	3	1	1	3
Median	1	2.5	1	1	3
SD	0.72	0.99	1.28	1.02	1.07

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	148	1.48	0.514747475
Surgical Mask	156	382	2.4487179	0.984449959
N95	21	39	1.8571429	1.628571429
KN95	39	67	1.7179487	1.049932524
Fabric Mask	133	344	2.5864662	1.153451811

ANOVA

Source of Variation	SS	df	MS	Significant		
				F	P-value	F crit
Between Groups	92.75025173	4	23.187563	24.03898439	5.09835E-18	2.392027
Within Groups	428.2742472	444	0.9645816			
Total	521.0244989	448				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	2.32643E-15	Alternate
Focal Mask vs N95	0.063202005	Null
Focal Mask vs KN95	0.124000173	Null
Focal Mask vs Fabric Mask	1.52934E-16	Alternate
Surgical Mask vs N95	0.014305624	Null
Surgical Mask vs KN95	6.3984E-05	Alternate
Surgical Mask vs Fabric Mask	0.647184867	Null
N95 vs KN95	0.647184867	Null
N95 vs Fabric Mask	0.005497158	Null
KN95 vs Fabric Mask	1.3312E-05	Alternate

Q12. The mask did not have an odor to it when I wore it.

DATA: Summary

	Focal Mask	Surgical Mask	N95	KN95	Fabric Mask
Count	100	156	21	39	133
Average	1.7	1.9	2.1	2.3	2.2
Mode	1	1	2	2	1
Median	1	2	2	2	2
SD	0.98	0.94	1.15	1.23	1.08

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Focal Mask	100	173	1.73	0.966767677
Surgical Mask	156	292	1.8717949	0.886683209
N95	21	45	2.1428571	1.328571429
KN95	39	88	2.2564103	1.511470985
Fabric Mask	133	295	2.2180451	1.156641604

ANOVA

Significant

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	19.11440554	4	4.7786014	4.515887444	0.001383746	2.392027
Within Groups	469.8299152	444	1.0581755			
Total	488.9443207	448				

Bonferroni Post Hoc Test (t-test)

Bonferroni correction: 0.005

t-Test: Two-Sample Assuming Equal Variances

	P Value	Hypothesis
Focal Mask vs Surgical Mask	0.249041242	Null
Focal Mask vs N95	0.092363983	Null
Focal Mask vs KN95	0.009323133	Null
Focal Mask vs Fabric Mask	0.000456858	Alternate
Surgical Mask vs N95	0.229985486	Null
Surgical Mask vs KN95	0.033774254	Null
Surgical Mask vs Fabric Mask	0.003801344	Alternate
N95 vs KN95	0.728655841	Null
N95 vs Fabric Mask	0.768502087	Null
KN95 vs Fabric Mask	0.849920213	Null