



Understanding Consumer Face Mask Consumption: A MaxDiff-based Cluster Analysis

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Introduction The pandemic triggered a series of health-related behaviors to prevent infection, such as social distancing, wearing face masks, and hand washing. Among them, public mask-wearing is suggested as the most effective way to reduce the transmission of infected respiratory particles (Howard et al., 2021). In general, three types of face masks are available in the marketplace: cloth masks, disposable surgical masks, and respirators (i.e., specialized filtering masks such as N95), in order of increasing protective power (CDC, 2022). By late 2022, the supply shortage of face masks was no longer a concern (U.S. FDA., 2022), and the face-masking policy had been loosened since early 2022. Therefore, decisions concerning whether to wear masks and which type of mask to wear in the post-pandemic era primarily stem from consumers' individual wills. This paper aims to investigate consumer face mask consumption behaviors from the perspective of salient attributes. Accordingly, a consumer typology will be developed, reflecting consumers' current face mask-related behaviors, mask type preference, future face-masking intention, and demographics.

Literature Review Product attributes refer to components that are associated with a product, such as quality, price, and aesthetics (North et al., 2003). Product attributes play a critical role in the consumer decision-making process as consumers evaluate alternative products by their attributes against specific evaluative criteria (Klenosky et al., 1993). Product attributes are generally categorized as intrinsic or extrinsic. Intrinsic attributes cannot be manipulated without also changing the physical characteristics of the product, while extrinsic attributes are not component parts of the physical product but are applied by the manufacturer or retailer (North et al., 2003). In line with previous research, five intrinsic attributes (i.e., protection, comfort, appearance, care requirement, and eco-friendliness) and three extrinsic attributes (i.e., price, accessibility, and brand) were assessed in the context of face masks in this study. While all product attributes can be important to a consumer's purchase decision, each carries different weight in the decision-making process. Often, tradeoffs are made with reference to critical attributes, particularly when resources are limited (Hollin et al., 2022). Commonly used approaches to measure attribute importance include rating, ranking, and chip allocation

(Sawtooth Software, 2020). Compared with them, Maximum Difference Scaling (MaxDiff) performs better in efficiently generating data with higher variance to elicit discriminating preferences of alternative product attributes (Hollin et al., 2022). Instead of burdening respondents to rank an entire set of attributes or compare all pairs, MaxDiff asks respondents to choose the most and least important ones from a subset of attributes. Therefore, the current study employed MaxDiff to gain consumer insights into the perceived importance of different face mask attributes.

Method With IRB approval, an online survey was conducted in April 2022. A national sample of 563 consumers aged between 18 and 65 was recruited by convenience sampling via an online sampling agency. MaxDiff experiments designed by JMP were used to measure respondents' perceived importance of face mask attributes. Following the MaxDiff design formula (Orme, 2005), this study included six sets of attributes with four attributes in each to measure the importance of the eight attributes. A hierarchical Bayes application of multinomial logit (HB-MNL) analysis was employed to estimate marginal utility and marginal probability for each face mask attribute to reflect its importance level. Then, cluster analysis was conducted based on individual-level utility scores. To further describe the characteristics of the identified clusters, Pearson's Chi-square tests, one-way ANOVA, and Tukey's test were conducted. All data analyses were performed in JMP. Finally, a consumer typology was developed reflecting consumers' prioritization of face mask attributes, current mask-related behaviors, future face-masking intention, and demographics.

Results HB-MNL analysis results suggested that protection took the absolute dominance in consumers' perceived importance of face mask attributes, with a marginal probability of 0.9452. The second essential attribute was comfort (0.0337), followed by accessibility (0.0065), care requirement (0.0056), price (0.0053), and eco-friendliness (0.0025). The least important attributes were appearance (0.0010) and brand (0.0002). Overall, function-related attributes were more critical than fashion-related ones. Using K-means clustering, three distinct groups were identified based on the tradeoffs consumers made on face mask attributes. Appropriate descriptive labels were assigned to each cluster, namely protection-focused (51.69%), utilitarian-driven (30.73%), and eco-conscious (17.58%) consumers, respectively. Figure 1 depicts the differences in the perceived attribute importance among the three clusters.



Figure 1. Attribute importance radar chart of the three clusters.

The three clusters were found significantly different in multiple aspects as shown in Table 1. Overall, the face-masking frequency and intention to wear masks in the future were high for Cluster 1. The surgical mask was the most chosen type of mask by this cluster, followed by cloth masks. Cluster 1 contained a great proportion of baby boomers. For Cluster 2, almost half members preferred cloth masks, followed by surgical masks. This group showed the lowest face-masking frequency and future intention. More females were represented in this group and a significantly large proportion lived in rural areas. Cluster 3 had the heaviest use of respirators and double masks among the three clusters proportionally. This group held the highest future face-masking intention. Not only was the youngest group, Cluster 3 also contained more males. Also, it had a large representation of metropolitan residents.

Table 1. Statistical Test Results of Cluster Differences.

	Test Statistics	Significance <i>p-value</i>
Face-masking-related behaviors		
Outdoor face masking frequency	$\chi^2=41.301$	<.0001***
Indoor face masking frequency	$\chi^2=39.311$	<.0001***
Opinion on face mask policy	$\chi^2=9.697$.0459*
The type of mask most frequently worn	$\chi^2=22.883$.0008***
Future face-masking intention		
Intention to wear face mask indoor	$F=35.465$	<.0001***
Intention to wear face mask outdoor	$F=31.145$	<.0001***
Demographics		
Age	$\chi^2=25.496$.0013**
Gender	$\chi^2=16.217$.0003***
Residency	$\chi^2=13.649$.0085**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Conclusion This study provides meaningful insight into the consumer face mask purchase decision-making process in the post-pandemic era. Theoretically, it enriches the understanding of consumer typology in the context of face masks. Also, this study serves as a good reference regarding the methodology for future consumer studies. From a practitioner standpoint, managerial implications are provided to face mask manufacturers for product development that better satisfy consumer needs, as well as to face mask retailers and marketers for accurate market segmentation and target marketing.

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