# Discomfort from wearing face coverings in public transport

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## ABSTRACT

Within 12 months, the usage of Face Masks (FM) has shifted from being specifically used by some specialists, to being the norm for most of the world's population. The design of FM has changed as they have become more common. Compliance with wearing any PPE (personal protective equipment) is closely associated with comfort, whether it be FM, hearing protection, body armour, etc. It is now normal for passengers to travel for long periods of time wearing FM, but these are anecdotally considered uncomfortable but there is little independent research helping to understand what makes for a comfortable, or uncomfortable, mask. This is of particular concern in the airline industry.

This paper reports a study that assesses the comfort of Face Mask/Face coverings (FM/FC) through eliciting the opinions of FM users, with a closer look at design features. An online questionnaire survey of the public (n=202) was conducted covering topics such as experience with FM, FM irritation, comfort perception of a range of FMs. Priming questions on perception of comfort in travel environments were included to provide context.. The highest factor of irritation in surgical FM was associated with the ear loops, where for a short period (44%) and long period (50%) achieved the highest percentage of votes in both conditions. For FM, the fabric FM performed best across the board with a key result of showing a statistical significance (p<0.05) against the surgical FM. Dissatisfaction of the ear loops on FM was clearly shown in data, as well as in the general comments section at the end of the survey. The data has clearly shown that an interest in further development of the ear loops will see a significant improvement in the comfort of FM.

#### **KEYWORDS**

Face mask, face covering, COVID-19

#### Introduction

In the six months from the beginning of 2020 the use of Face Masks (FM) shifted from being limited to specific workers for PPE, to becoming a requirement in order to function in society across much of the world. At the time of writing the COVID-19 pandemic continues to dominate global travel and social interactions. It is anticipated that FM use will perpetuate for some time in order to minimise viral spread.

In order to obtain protection from any PPE it is necessary that it is worn by users. For those items that need to be worn for extended periods of time, comfort is a critical factor in selection for individuals in order to maximise compliance (e.g. hearing protectors; Gerges, 2021). The immediate demand for FM during the COVID-19 pandemic meant that there was little opportunity for manufacturers to optimise design before taking to market and therefore a wide range of products and designs are commercially available. The effectiveness of many designs at minimising virus

spread, and their comfort, is largely unevaluated for products targeted at the general consumer (e.g. Lee et al. 2020).

A questionnaire study was designed to investigate the properties of FM that users associated with feelings of comfort and discomfort. The study was designed in September 2020 in order to review and survey commonly used FM types available in the UK.

## Methods

A questionnaire was developed using Google forms and comprised several sections. The first sections of the questionnaire elicited information on experience of FM and experience of travel whilst using FM. The second section introduced the concept of vehicle comfort by asking questions related to general seating comfort; this section was designed to prime respondents to comfort concepts later in the questionnaire. The third section elicited information on which elements of FM caused discomfort for short and long periods of wear, and rankings of FM comfort. Finally, participants were asked to select a type of FM for use on a regional flight, and given opportunity to give general comment. The study design was approved by Nottingham Trent University Ethical Advisory Committee.

202 participants completed the survey. They had a mean age of 42.3y (s.d. 17.4y). 53% were male, 47% female. 92% resided in the UK, with others residing in USA, Germany, Australia, India, Indonesia, Ireland, Iran, Netherlands, Malaysia, Spain.

For the purposes of this paper, the term Face Masks (FM) is used generically to mean all types of face covering. The effectiveness or certification of the FM was not considered, although its importance is acknowledged.

## Results

Data for *Frequency of use, Location of use, Who does it protect?, Experience of use,* and *Duration of use* are shown in Table 1.

64% reported wearing masks 'Everyday' or 'Most Days' with 2% stating 'Never'. Almost all respondents reported wearing FM for shopping and about half wore them at work. Most (78%) thought that the FM protected both them and others; 6% did not consider them effective. Of those who had experienced FM in public transport, 80% had experienced them on trains (both underground and overground), and 63% taxi. Approximately 1/3 or respondents had experienced using FM whilst flying. The longest time worn in public transport was reported as over 2 hours for 36% and less than 30 minutes for 27%.

Participants were asked two similar questions:

- In your opinion, identify the area of a face mask which causes you the most discomfort when wearing for a SHORT period of time (E.g. Single supermarket shop)
- In your opinion, identify the area of a face mask which causes you the most discomfort when wearing for a LONG period of time (E.g. Long train journey, Full day of work)

Frequency of use	Location of use	Who does it protect?	Experience of use	Duration of use on public transport
Everyday 39%	Shopping 96%	Protects both me and others 78%	Train 80%	<30 mins 27%
Most days 25%	At work 46%	Only protects me 1%	Aircraft 32%	30-60 mins 20%
A few times a week 27%	Commuting 44%	Only protects others 15%	Bus 40%	1hr-2hrs 18%
About once a week 5%	Travelling for leisure 34%	Is not effective 6%	Tram 13%	2hrs+ 36%
Less than once a week 5%	Travelling for business 24%		Taxi 63%	
Never 2%			Boat 9%	

**Table 1.** Percentage of participants with responses to questions relating to Frequency of use, Location of use, Who does it protect?, Experience of use, and Duration of use on public transport. (Rounding errors have not been adjusted).

The region of the FM identified by participants as the main source of discomfort was similar for both short and long wear times (Figure 1). The ear loops were considered the most uncomfortable part, reaching 50% of complaints for long duration wear. The upper stitching across the nose was the second most commonly rated area of discomfort.



Figure 1. Distribution of responses showing area of FM considered to cause the most discomfort for short and long-term wear.

Participants were asked:

If you were travelling on a regional flights (e.g. 1-2 hours within Europe) which type of mask would you choose to wear (assume all are allowed, legally)?

Of the 7 choices offered, the most popular (26%) was a surgical mask followed by two fabric FM with ear loops (19% and 17%) and a CE marked dust mask (Figure 2). Despite garter ear loops being previously identified as the most uncomfortable part of FM, two of the three least popular FM included fastenings that did not use ear loops.



Figure 2. Distribution of responses showing preferred type of FM for use on a regional flight or similar.

Participants were asked to score FM A, C, D, F and G based on their perceived comfort (NB this was only based on the presented image and previous experience – physical examples were not presented). FM A, fabric with garter straps, was considered the most comfortable (p<0.02, t-test). FM G, including an air valve system, was considered the least comfortable, although the differences were not significant between G and C, D and F. Considering the selection of FM (Figure 2), this indicates that the choice of the preferred type of FM is not made on comfort alone.

# Conclusions

The majority of participants completing this survey had worn FM in a variety of settings. Most had travelled on public transport whilst wearing a FM and over 1/3 had travelled for more than 2 hours wearing a mask. The ear loops and nose bridge are considered the most uncomfortable regions of FM.

It is concluded that the design of FM needs to be improved in order to maximise comfort for the wearer. Improved comfort is likely to improve compliance with wear. Although comfort is considered important, it is noted that the preferred type of FM was not the most comfortable, but one that is widely associated with being effective (i.e. surgical mask).

## References

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