INTRODUCTION

Following the emergence of COVID-19 in late 2019, the SARS-CoV-2 virus has spread to almost every country in the world. In many countries worldwide, medical systems have been pushed beyond capacity in a similar manner to that observed in Wuhan city, China, during the early stages of the pandemic.

Following several months of struggle against the epidemic, the situation in China is now stabilizing. At the beginning of the outbreak, the Chinese government made the wearing of facemasks by the general public mandatory in public places, a measure which is now thought to have aided in the control of the epidemic (Zhong et al., 2020). Initially, however, the general consensus had been that ordinary sanitary-style masks were not effective in blocking the inhalation of airborne virions and the use of N95 or higher-grade masks was generally recommended (Liu & Zhang, 2020). However, the use of lower-grade masks and face coverings can act to prevent infected persons from introducing the virus to the environment through the expulsion of airborne droplets and so can help with reduction of transmission even if they do not protect from infection.

There is an increasing acceptance of the benefits of the use of facemasks and face coverings by the general population in public settings, with, for example, the UK government making their use mandatory on public transport from 15 June 2020. Similarly, the Centers for Disease Control and Prevention in the USA, currently the worst affected country in the world, now recommends the use of facemasks in public, although this is not mandatory. Several cities in Brazil have also adopted a policy of requiring their citizens to wear masks in public.

Despite the increased awareness of the effectiveness of mask use amongst the general population, there remain concerns about their effectiveness (Leung, Lam, & Cheng, 2020). In particular, concerns have been raised that those who use masks will be prone to adjust or otherwise touch their mask, thus causing increased hand-to-face contact, and so increasing the risk of viral infection.

In China and many other countries, wearing masks is not only a protective measure but is also a symbol of awareness and...
participation in collective effort against the virus. There are many types of masks supplied in China, high-efficiency medical protective masks, surgical masks and general-purpose medical masks. Sanitary masks usually used in the food and IT industry and in households are the most widely used masks for healthy people from the outset of the epidemic to date. The production of these types of sanitary masks is relatively cheap and easy, and although they may not have strong virus blocking effects, they are far more effective at reducing droplet discharge than covering coughs or sneezes with an elbow. These types of mask are more comfortable to wear than N95 masks, a fact that may reduce the occurrence of face touching in order to adjust the mask.

COVID-19 is a respiratory infectious disease transmitted primarily through airborne droplets and through direct contact with contaminated surfaces. Wearing ordinary masks not only prevents the formation of droplets, but also blocks the inhalation of droplets. Our aim in this study was to assess whether or not wearing masks can prevent or exacerbate contact transmission through hand-to-face touching.

2 | MATERIALS AND METHODS

Comparisons were made regarding the number of times passengers riding on intercity buses between Bengbu city and Huaiyuan county touched their faces before and after the COVID-19 outbreak through the observation of surveillance videos recorded on the bus. These were then used to analyse the potential value of masks in preventing contact transmission. On January 20, human-to-human transmission of COVID-19 was confirmed (Huang et al., 2020). Before this date, the use of facemasks amongst citizens in public places was rare. Thereafter, citizens were strictly required to wear masks when leaving their homes. On March 1, after a long suspension, intercity bus services resumed operation, and wearing masks was a prerequisite for all passengers to board buses.

Surveillance videos captured on buses before January 20 and after March 1 were retrieved and taken to represent before and after COVID-19 outbreak groups, with three or four different buses analysed in each group. Seven to 10 passengers whose facial touching events were clearly visible on the monitoring screen, and who stayed seated on the bus for at least 30 min were selected. From the moment of bus movement, all facial touching events (chin and ears also included) were counted for 30-min intervals. Two observers assessed each video. Videos were paused upon observation of a facial touching event and the event confirmed by both observers following playback. If there was continuous facial touching during a short period of time, for example a prolonged period of hand-face contact, or multiple touching events with periods of less than five seconds between them, only one touch was recorded. For the March 1 group, mask touching or adjustment events (including elastics pulling and nose strip fitting) were also recorded.

Statistical analysis was performed with GraphPad Prism version 8.4.2. Facial touching events between groups were compared using a Mann–Whitney test, with p values of <.05 being considered significant.

3 | RESULTS

Thirty-one passengers with no masks in the January 20 group touched their faces 71 times in total (0–11 times, median = 1.0, 95% CI: 0–3.0 times). For the March 1 group, 30 passengers wearing masks touched their face 66 times in total (0–10 times, median = 1.0, 95% CI: 0–2.0 times), including touching or adjusting their masks 54 times (0–9 times, median = 1.0, 95% CI: 0–2.0 times, Figure 1). The majority of facial touching events in the latter group were related to the wearing of masks (81.82%, 54/66). There was no significant difference in total facial touching events between the two groups (p > .05).

4 | DISCUSSION

Intercity buses drive long distances (generally 25 km or more), and passengers stay in their seats for long periods of time (generally from 45 min to 1 hr), providing an opportunity to study facial touching behaviour (Russell et al., 2011). There was no observable decrease in facial touching events in the January 20 group compared with the
March 1 group, despite the latter group having been subjected to a high-intensity public education programme explaining the role of facial touching in the spread of COVID-19. Importantly, despite the fact that the majority of facial touching events in the March 1 groups were related to the mask, the use of masks did not increase the total number of facial touches but did reduce the risk of direct contact of the hands with the nose and mouth; a high-risk action for virus transmission.

The subjects analysed in this study were all adults, and it is possible that children may display a different pattern of facial touching while wearing facemasks, and this should be taken into consideration when interpreting these results. Furthermore, the subjects in the second group had been exposed to education programmes warning of the dangers of face touching for contracting COVID-19, whereas those in the first group had not. Given this, it is possible that such education would lead to a reduction in facial touching in the absence of mask wearing, which would be abrogated in the presence of mask use.

It is possible that mask-type might affect the regularity of hand-face contact, with less comfortable masks requiring more frequent adjustment. The masks typically worn by the bus passengers analysed in this study were commercially produced sanitary-type masks. There is currently a lack of availability of these types of masks in resource-poor settings (for example, in many developing countries), and people are being encouraged to make their own face coverings and masks from available materials. Variation in the relative comfort of such home-made face coverings may lead to an increase in hand-face touching frequency, and this requires further investigation.

In low-transmission risk areas, the benefits of wearing masks, whether or not the population is ill or healthy, may not be significant. However, in high-transmission risk areas, advising all people to wear masks may be greatly advantageous. The use of face masks amongst the general population will not only reduce the incidence of individuals ejecting infectious droplets to the surrounding environment but will also protect healthy people from directly touching their mouths and noses. This further reduces the risk of contact transmission as well as reducing the risk of inhalation of small droplets (Wang & Yu, 2020).

Many countries around the world, including those in Europe and East Asia, are moving towards the ease of lockdown measures following reductions in the numbers of new COVID-19 infections. The use of facemasks and coverings has now been widely adopted in these regions, as a protective measure to mitigate the resurgence of disease transmission. In other regions of the world, such as South America and Asia, where infections continue to increase, encouragement of the use of facemasks and coverings amongst the general population can form part of effective public health strategies to reduce transmission. The fact that we find that the wearing of masks does not increase hand-to-face contact in this study may inform national guidelines regarding their use during this pandemic.

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ETHICAL APPROVAL
The authors confirm that the ethical policies of the journal, as noted on the journal’s author guidelines page, have been adhered to. This work was approved by the institutional ethics review board of Bengbu Medical College (2020-052).

CONFLICT OF INTEREST
The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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