RESEARCH ARTICLE

The Effect of the Use of Face Mask and Face Shield in the Fight against COVID-19 Pandemic

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ABSTRACT

The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly contagious virus that has threatened global health and the world economy. This study was conducted to investigate the effect of the use of a face mask and face shield in the fight against COVID-19 pandemic. Face mask and face shields were procured in a tailoring shop in Lafia. The materials were transported to the laboratory for sampling. Result obtained shows that the use of a face mask with face shield limits the spread of COVID-19. No bacterial growth was recorded in all plates when the face mask and face shield was worn simultaneously. On the use of only face mask, bacterial growths were recorded in a distance of 0.5, 1.0, and 1.5 metre respectively. While in talking, no bacterial growth was recorded in a distance of 2.0 metres. In sneezing and coughing, few bacterial growths were recorded in all distance which range between 1.5 ± 0.7-7 ± 1.4 mean values. On the use of only face shield, few bacterial growths were recorded in all distance both in talking, sneezing and coughing. The mean values range between 1.5 ± 0.7-13.5 ± 2.1. When the face mask and shield were not used, the result obtained shows that the number of bacterial growths were too numerous to count (TNTC) in a distance of 0.5 metre when sneezing and coughing. In a distance of 1.0, 1.5 and 2.0 meters, the number of bacterial growth recorded range between 4.5 ± 0.7-182 ± 2.8. The use of face mask with face shield simultaneously as well as keeping to a distance of 1.5-2 metres is highly recommended to limit the spread of COVID-19 pandemic.

Introduction

At the climax of 2019, wave of pneumonia like symptoms of unknown cause emerged in the capital city of the Hubei province, Wuhan in China [1]. The first case of this disease was reported in December 2019, and by the 24th of January 2020, 830 cases were reported in nine countries including the United States. The World Health Organisation (WHO) declared the disease outbreak a pandemic on January 30th, 2020 [2,3]. This unknown disease was later diagnosed to be a severe acute respiratory syndrome (SARS) caused by a coronavirus designated novel coronavirus and later named SARS coronavirus 2 (SARS-COV-2) by the International Committee on Taxonomy of Viruses. The disease, initially termed 2019-nCOV, was on the 11th of February, 2020 in an announcement by the DG of WHO, named COVID-19 [4-6].

COVID-19 presents with different symptoms, including but not limited to dry cough, nasal congestion, sore throat, and fever, loss of smell and taste, and tiredness. The disease could also be asymptomatic; this is attributed to its highly variable clinical features and risk factors. COVID-19 is caused by the virus SARS-COV-2, the third and a highly pathogenic strain of coronaviruses-with a natural and zoonotic origin-that has been introduced into the human population. SARS-COV-2 is a positive stranded RNA enveloped belonging to the β genera of coronaviruses. Other genera of coronaviruses are α, γ and δ. Membrane (M), envelope (E), nucleocapsid (N) and spike (S) are the four structural proteins of β coronaviruses and the spike (S) is responsible for establishing and mediating virus-host infection [7-10].

Currently, there've been over 16.3 million reported

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cases and 650,000 deaths globally with the Americas and Europe having the most cases of cases (jointly accounting for over 73% of global cases). In Africa, 871,970 cases have been recorded. Over 520,000 have recovered with 18,475 deaths. Nigeria has had its fair share of the pandemic having recorded a total of 41,180 confirmed cases with 860 deaths and over 18,000 recoveries [11-13].

Since the emergence and declaration of COVID-19 as a pandemic, governments all around the world have announced different control measures and policy(ies) to protect its people. Some of the measures put in place include compulsory hand washing, use of hand sanitisers/gloves, use of face masks and face shields, quarantine and isolation of suspected/confirmed cases, contact tracing social/physical distancing, and some extreme measures such as lockdown on all movements except for first-line responders, emergencies and security [14-17]. Although use of face mask is believed to have contributed in grossly reducing the spread of COVID-19 [14,15], there's little or no data especially in Nigeria to support this claim. This study therefore aims to ascertain, as well as compare the efficacy of face masks and face shield-in the prevention of the spread of COVID-19, and also the determine "safe distance".

Materials and Methods

Study area

The study was conducted in the Microbiology laboratory of the Federal University of Lafia, Nasarawa State, Nigeria. Lafia is a town located in North Central Nigeria and also the capital city of Nasarawa State. According to the 2006 national population census, Lafia has a total population of 330,712 inhabitants. Lafia is the largest town in Nasarawa State and is located in Latitude 8.49 and Longitude 8.52. It is situated at elevation 179 metres above sea level.

Preparation of media

All media used in this research work were prepared according to the manufacturer's instructions. They were autoclaved at 121°C for 15 minutes. After sterilization, the media were aseptically dispensed into sterile petri dishes and allowed to solidify [18].

Collection of materials

Face masks and face shield were procured in a tailoring shop in Lafia. The materials were transported to Microbiology laboratory of the Federal University of Lafia. The face masks were washing thoroughly using a detergent and dried for 3 hrs under sunlight. While the face shield was decontaminated using 75% ethanol before usage.

Sampling

Two media plates each were used for the sampling and a distance of 0.5, 1.0, 1.5, and 2 metres was observed. Firstly, a face mask and a face shield were worn simultaneously to talk, sneeze, and cough to the media plates at the different distance of 0.5, 1.0, 1.5, and 2 metres for 2 minutes respectively. Secondly, face mask was worn to talk, sneeze, and cough to the media plates at the different distance of 0.5, 1.0, 1.5, and 2 metres for 2 minutes respectively. Thirdly, face shield was worn to talk, sneeze, and cough to the media plates at the different distance of 0.5, 1.0, 1.5, and 2 metres for 2 minutes respectively. Finally, talking, sneezing, and coughing were carried out without the use of face mask and face shield at the different distance of 0.5, 1.0, 1.5, and 2 metres for 2 minutes respectively. The plates were labelled accordingly and then incubated for 24 hrs at 370°C to observe for growth. After 24 hrs of incubation, growths on the plates were counted and recorded

Result

Distance (m)	Talking FM/FS	Talking No.M/No S	Sneezing FM/FS	Sneezing No M/No S	Coughing FM/FS	Coughing No M/No S
0.5	00 ± 0.0	146 ± 4.2	00 ± 0.0	TNTC	00 ± 0.0	TNTC
1	00 ± 00	51 ± 12.4	00 ± 0.0	182 ± 2.8	00 ± 0.0	158 ± 13.2
1.5	00 ± 0.0	18.5 ± 3.2	00 ± 0.0	62.5 ± 13.2	00 ± 0.0	38.5 ± 10.6
2	00 ± 0.0	5.5 ± 0.7	00 ± 0.0	29 ± 10.6	00 ± 0.0	15.5 ± 2.8

Note: Values are Mean ± SD, FM=Face mask, FS=Face shield, No M=no mask, No S=No shield, TNTC=Too numerous to count

Table 1. Effect of face mask and face shield on talking, sneezing, and coughing

Distance (m)	Talking FM	Talking No. M	Sneezing FM	Sneezing No. M	Coughing FM	Coughing No. M
0.5	2.5 ± 0.7	150.5 ± 2.1	7 ± 1.4	TNTC	5.5 ± 0.7	TNTC
1	1.5 ± 0.7	46 ± 19.7	4.5 ± 0.7	176.5 ± 37.1	4 ± 2.8	171 ± 12.7
1.5	1.0 ± 0.0	17.5 ± 4.9	3.5 ± 0.7	56 ± 19.7	2.5 ± 0.7	40.5 ± 13.4
2	00 ± 0.0	6 ± 4.2	2.5 ± 0.7	23 ± 2.8	1.5 ± 0.7	18.5 ± 0.7

Note: Values are Mean ± SD, FM=Face mask, No M=No mask, TNTC=Too numerous to count

Table 2. Effect of face mask and no mask on talking, sneezing, and coughing

Distance (m)	Talking FS	Talking No. S	Sneezing FS	Sneezing No. S	Coughing FS	Coughing No. S
0.5	8.5 ± 0.7	144 ± 8.4	13.5 ± 2.1	TNTC	10.5 ± 0.7	TNTC
1	5.5 ± 0.7	55 ± 4.2	9 ± 2.1	170 ± 4.2	6 ± 2.8	162 ± 10.4
1.5	2.5 ± 0.7	19 ± 1.4	4 ± 1.4	48.5 ± 3.2	3 ± 0.0	36 ± 1.4
2	1.5 ± 0.7	4.5 ± 0.7	3 ± 0.0	20.5 ± 0.7	2 ± 0.0	14.5 ± 0.7

Note: Values are Mean ± SD, FS=Face shield, No S=No shield, TNTC=Too numerous to count

Table 3. Effect of face shield and no face shield on talking, sneezing, singing, and coughing

appropriately.

Discussion

In recent times, the world and its powerful health systems have been frustrated due to the COVID-19 pandemic. The impact of this pandemic cannot be overemphasized as its impact is overwhelming especially in Africa and Nigeria in particular. The measures put in place to check the spread of the disease in communities are consistent and are of little benefits to the countries in Africa (Nigeria) due to its peculiar challenges in terms of social infrastructure such as availability of running water, effective mode of transportation, poor health care systems and high rate of unemployment as citizens depends on daily tasks or menial jobs to sustain themselves and family [19]. The spread of the disease (COVID-19) in Nigeria have been treated with little seriousness among the citizenry due to poor confidence on their leaders especially those in the policy making cadre, making compliance to set guidelines copied from developed nations and advised by the World Health Organisation (WHO) such as wearing of face mask in public places, physical distancing, respiratory etiquette, frequent washing of hands and sanitation of hands and surfaces, and the stay at home order unrealistic [20].

The COVID-19 pandemic has proven to be a disaster, especially in countries with better healthcare system including, USA, China, Italy, Russia, and Iran in the aspect of health and economic [21]. Since there is no

specific therapeutics for the management of COVID-19 pandemic and vaccines, the best possible preventive measures have been the use of face mask, face shield and proper hand washing as well as the practice of social distancing (1-2 metres). The use of face mask and face shield simultaneously in the present study proves to be effective to limit the spread of COVID-19 pandemic. This study has also proven that face shield is not a substitute for face mask, unless one is dealing in close proximity with COVID-19 patient and with face mask worn, face shield is absolutely unnecessary and do not protect one unless use simultaneously with face mask.

The deadly coronavirus expanded on the 8th of December 2019 from Wuhan, China when the first suspected case was reported [22]. Wuhan is the 7th most populous city in China before it was exported to other countries [21]. On the 13th of January, 2020 the first confirmed case of the virus outside China was diagnosed in Bangkok, Thailand [23]. The epidemic was officially declared an outbreak by China on the 20th of January. The number of COVID-19 cases is increasing worldwide. As at 28th July, 2020 a report by Johns Hopkins University puts the total number of confirmed corona virus cases to be 16.3 million, total deaths 650,000 and total recovery 9 million plus. USA has the highest number of confirmed cases followed by Brazil, India, Russia and South Africa respectively.

The result on the effect on the use of face mask and face shield on talking, sneezing and coughing presented in

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Table 1 shows that the use of face mask and face shield simultaneously limits the spread of corona virus. The result obtained reveals that at a distance of 0.5, 1.0, 1.5, and 2.0 metres, there was no bacterial growth recorded when talking, sneezing, and coughing when face mask and face shield was worn simultaneously. But when face mask and face shield was not worn, there was high number of bacterial growths recorded which range between 5.5 ± 0.7 too numerous to count (TNTC). The result on the effect of the use of only face mask and no face mask when talking, sneezing, and coughing presented in Table 2 shows that the use of only face mask can limit the spread of corona virus but is not 100% efficient (Table 3). Result obtained shows that few bacterial growths were recorded when only face mask was worn in a distance of 0.5, 1.0, and 1.5 metre respectively. While in talking, no bacterial growth was recorded in a distance of 2 metres. In sneezing and coughing, few bacterial growths were recorded in all distance ranging between 1.5 ± 0.7-7 ± 1.4 mean values. The result on the effect of the use of only face shield when taking, sneezing, and coughing, the result obtained revealed that few bacterial growths were recorded in all distance both in talking, sneezing, and coughing and the mean values range between 1.5 ± 0.7-13.5 ± 2.1

The social media has frustrated the effort of the government and the front liners against the fight against the coronavirus pandemic as citizens doubt its existence. The myths on COVID-19 and the other issues associated with the disease, such as, the government is increasing the number of cases to receive funds, controversial cases reported and fake news associating the disease with the rich and the government officials reported to have contracted the disease makes the fight against the disease unsuccessful as Nigeria continue to have exponential increase in the number of cases [20].

The impact of this pandemic on education, tourism, economy and social life is overwhelming. Schools have been closed down indefinitely with no plans to continue learning through online mode and physical classes for research and graduating students as obtained in other developed nations and countries in Africa like Ghana and Zambia. This has halted academic activities exposing students to crimes. The small and medium enterprises which are the means of livelihood have been greatly affected and big business is collapsing due to border closure and restrictions of movement [24].

Conclusion

The government effort to cushion the effect of the pandemic has little or no significant impact as the palliative provided for the poorest of the poor and the vulnerable is not sufficient for the timing population of the country. Government should encourage the use of face mask with face shield simultaneously as well as keeping to a distance of at least 1.5-2 metres when in public gathering of more than 20 persons and to adhere strictly to personal hygiene to limit the spread of COVID-19 pandemic. It is also recommended that government and all stakeholders contribute to enlighten the populace about COVID-19 and be transparent in their activities like in the developed nations to regain the trust of the people about the existence of the disease. This will enable all and sundry to take responsibility in the fight against the spread of the disease and to embrace the new normal by adhering to guidelines set by those in authority. The government should reopen schools and other research institutions and fund research to provide solutions to this pandemic especially in the area of therapy and vaccine development. Furthermore, intensify effort in providing social amenities and developing our health care systems.

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