Open Access Maced J Med Sci. 2022 Feb 22; 10(E):355-360.

Republic of China in December 2019, where they case of COVID-19 was initially reported from People’s

Introduction

The coronavirus disease 2019 (COVID-19) is a multi-systemic infection caused by a member of an enveloped RNA virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the novelty of the genetic sequence and structural composition of this virus played a significant role in the COVID-19 pandemic within a brief time span [1]. The primary case of COVID-19 was initially reported from People’s Republic of China in December 2019, where they discovered that an unknown virus was responsible for causing life-threatening pneumonia among the residents of Wuhan city, which is the capital of Hubei province located in the central China [2]. Latter on January 30, 2020, the World Health Organization (WHO) announced it as a pandemic. Since then the cases gradually increased throughout the world with almost 77.6 million people getting infected and a death toll rising up to 1.71 million worldwide till December 23, 2020 [3].

To encounter the rapidly spreading of the COVID-19 infection, several preventive measures have been undertaken and these measures were aimed
to create awareness among the general population in context of psychological impact and false myths that were associated with this disease. The mode of transmission of this virus is mainly through respiratory droplets from an infected person sneeze or cough the expiratory droplets which acts as a vehicle to transport this virus in the surrounding environment [4]. These droplets can be either inhaled by other people within close proximity or can settle on the surfaces from where it can potentially infect other people [5].

Various preventive measures to control the spread of this infection were implemented by the concerned authorities. Social distancing, face covering, and personal hygiene are considered as the key preventive measure to reduce human interactions and control the spread of infection within a community [6]. Events, in which increase number of public gather at a same place and time or under same roof such as religious gatherings, cultural celebrations, conferences, and music concerts, should be restricted as there is a risk of spreading infection [6]. Various studies also proved that restriction on traveling and promoting quarantine leads to positive outcomes in controlling the spread of the COVID-19 infection [7], [8]. The studies on the risk associated with EBOLA virus transmission model, which was also a Public Health Emergency of International Concern by the WHO, revealed that a combined approach of patients isolation, contact-tracing with quarantine, and sanitary funeral practices should be executed with utmost urgency to slowdown the infection rate [9].

In this study, we provided collective information on the risk associated with the spread of this pandemic from several authenticated sources such as the Texas Medical Association (TMA), Center for Disease Prevention and Control (CDC), WHO, and Health and safety executive (HSE) and presented them all together under a single umbrella. To the best of our knowledge, this is first study that showed the complete analysis on the risk factors that include social gathering in games, restaurants, religious places, music concert, cinema halls, amusement parks, attending funerals, wedding, gymnasium, salon, traveling by bus or plane, pumping gasoline, grocery shopping, doctors waiting rooms, visiting library, hair salon, etc., were collected, combined, analyzed, and presented as percentage mean ± SD using the prism GraphPad statistical software (version-5, San Diego, CA, USA) and the data were compared by one-way ANOVA analysis followed by Tukey’s post hoc analysis or two-way ANOVA followed by Bonferroni post hoc tests as described previously with some modifications [13]. Briefly, the homogeneity of variances was tested using Brown–Forsythe or Bartlett’s tests, and in a case of unequal SDs, Brown–Forsythe or Welch test was applied. If data were not normally distributed, the comparisons were carried out by non-parametric one-way ANOVA followed by Tukey’s post hoc analysis or two-way ANOVA followed by Bonferroni post hoc tests and p < 0.05 was considered significant.

Results

Risk of the spreading COVID-19 in sport events

Analysis of the collected data from TMA, CDC, WHO, and HSE showed that the playing football and basketball have a higher risk for the spreading of the COVID-19 infection followed by swimming in public pools, playing at the beach, playing golf, and tennis (Figure 1). Importantly, the data also pointed out that playing tennis

![Figure 1: Risk of the COVID-19 spreading by playing games.](https://oamjms.eu/index.php/mjms/index)
and golf are much safer compared to playing other games such as swimming, basketball, and football (p < 0.05).

**Risk of the spreading COVID-19 by taking food**

Risk of transmission of the COVID-19 infection from eating food was also analyzed from the data collected. The data showed that eating at buffet and in the restaurant is highly risky for the spreading of COVID-19 infection when compared with the food takeout from the restaurant (p < 0.01). Interestingly, eating at buffets, restaurants, and at the bars are almost equally risky for the COVID-19 spreading (p > 0.05). Food takehome from the restaurants was found to be the most safest ways among all studied risk factors (Figure 2).

![Figure 2: Risk of the COVID-19 spreading by taking food.](image)

**Risk of the spreading COVID-19 by social gathering**

The data on social gathering at the religious places, sports stadium, music concert, gathering in the cinema halls, amusement parks, attending funerals, and wedding ceremonies showed highly risky for the spread of COVID-19 infection as compared with the social gathering in the separate camps (p < 0.05). Whereas gathering with relatives and friends is also risky but safe as compared to other gatherings such as visiting at religious places, sports stadium, music concert, movies theaters, and amusement parks (Figure 3).

![Figure 3: Risk of the COVID-19 spreading by social gathering.](image)

**Risk of the spreading COVID-19 by general outing**

The data on general outing showed that going to the gymnasium (gym), traveling by bus or plane, and visiting in the hair salon are highly risky during the COVID-19 pandemic. Whereas riding bikes, running or walking, and going to the grocery stores and gasoline pumping are much safe as compared to other factors such as doctors visit, going to library, museum, mall, schools and kids daycare centers (Figure 4).

![Figure 4: Risk of the COVID-19 spreading by general outing.](image)

**Risk of the spreading COVID-19 by hugging, shaking hands, and kissing**

Transmission of the COVID-19 infection was found to be highest by kissing followed by shaking hands and hugging (Figure 5). The data gathered from TMA, CDC, WHO, and HSE showed that all these three factors are highly risky for the spread of COVID-19 infection.

![Figure 5: Risk of the spreading COVID-19 by hugging, shaking hands, and kissing.](image)

**Discussion**

This study determined the major risk factors associated with the transmission of COVID-19 infection. Social distancing has been considered as a vital technique to prevent transmission of the COVID-19 infection and it has been accomplished by various means, including voluntary compliance to lock down at the level of certain regions or the entire country.
as per recommendation of the WHO [14]. In most of the countries, the lockdown has now being waved off, leading to the initiation of daily activities and businesses but in general, the more a person interact with others or the lengthier interaction can increase the risk of being infected by the COVID-19 [15]. In this study, the data on the risk factors associated with the COVID-19 transmission were collected from different online sources such as TMA, CDC, WHO, and HSE and were combined, analyzed, and presented. Our analysis on the risk of the COVID-19 spreading in sport events showed that the playing football and basketball are highly risky for spreading of the COVID-19 infection followed by swimming in public pools, playing at the beach, playing golf, and tennis. Importantly, the playing tennis and golf were found to be safer compared to playing other games such as swimming, basketball, and football.

The data of this study also determined that the eating at buffet and in the restaurant is highly risky for the COVID-19 transmission as compared with the food takeout from the restaurant. These findings have been well supported by the studies showing the impact of social distancing in the transmission of this viral infection [15]. It is important to understand that there is no such interactive activity which can ensure a zero percent risk of contracting this viral infection; however, certain interactive activities if performed by undertaking precautions and preventive measures can significantly reduce the potential risk of getting infected and the spread of the COVID-19 in the community [14], [15].

The CDC published a report on their website showed that social gathering always enhances the chances of spreading the COVID-19 infection as an asymptomatic person has ability to transmit infection [11]. We also studied the association of various interactive social gathering such as gathering at the religious places, sports stadium, music concert, gathering in the cinema halls, amusement parks, attending funerals, and wedding ceremonies shows a higher risk of the COVID-19 transmission. Moreover, our data also pointed out that the gathering with relatives and friends was also risky for the transmission of COVID-19 infection but comparatively much safer as the gathering at the religious places, sports stadium, music concert, movies theaters, and amusement parks. These findings pointed out that social distancing plays an important role in preventing the transmission of COVID-19 infection. It is important to point out that the clinical presentation of this viral infection was not found to be same in every human who was exposed as it depends on various factors such as age, chronic illness such diabetes, and immune status of a person [16].

Besides these, the basic preventive measures such as hand hygiene, avoiding touching of face with unwashed hands, and wearing a mask also played a fundamental role in the transmission of this viral infection [3], [11], [12], [13], [14]. Furthermore, our data on the general outing showed that going to the gymnasium, traveling by bus or plane, and visiting in the hair salon are highly risky for the COVID-19 transmission. On the other hand, certain places such as barbershops linked with close contact between people, in which there is an increased risk of getting infected by COVID-19. In our study, we revealed a high risk of the COVID-19 association with a visit to a barbershop. These findings have also been well supported by the previous reports showing higher rate of the COVID-19 infection among the barbers [17], [18]. To reduce the chances of getting infected, staff working in barbershops should be screened for the COVID-19 symptoms before starting their working shift as instructed by the CDC [19]. In addition, they must wear personal protective equipment such as gloves, mask, and face shield and the limiting the number of clients at a specific time should be allowed in accordance with space and seating capacity [19].

It is well documented that the physical activity has a beneficial role in strengthening the immune system [20] and regular exercise also plays a role in the prevention of a low-grade inflammation [21]. During lockdown pandemic period, the levels of physical activity were declined and were found to be linked with the increased risk of various health problems such as depression, coronary disease, obesity, and diabetes [22], [23]. We found out that exercising in the gym has also been highly associated with a high risk of the COVID-19 transmission. In support of this, the WHO mentioned various online practical home-based exercises such as stretching, bridges, squats, and chair dips, being performed for 10–15 repetitions up to 5 times with a minute rest between sets [24]. Traveling between countries was reported to be one of the major risk factors for the spreading of the COVID-19 infection [25]; for this reason, restrictions of flights between countries throughout the world were undertaken. We found out a high risk of being infected with the COVID-19 while
traveling through plane or bus. These results are well supported by the recent studies revealed that when all seats were occupied in a jet aircraft, then the risk of contracting the COVID-19 from a nearby passenger was about one in 7000; however, if the middle seat was kept empty, it reduces that risk to about one in 14,000 [26]. In short, the combined analysis from the data of TMA, CDC, WHO, and HSE showed that among games, playing football and basketball are highly risky followed by swimming in the public pool and playing at the beach. Whereas playing golf and tennis are relatively safe. Moreover, the carryout food from the restaurants is much safer as compared with eating at buffet and in restaurants. The data on the social gathering showed that religious places, sports stadium, music concert, cinema halls, amusement parks, attending funerals, and wedding showed highly risky for the COVID-19 transmission. Whereas gathering with relatives and friends is also risky but much safer as compared with the gathering at other places. The data on general outing showed that going to gymnasium, traveling by bus or plane, and visiting in salon are also highly risky, whereas riding with bike, running or walking, and going to the grocery stores and gasoline pumping are much safer as compared to other going out factors such as doctors visit, going library, museum, mall, schools, and kids daycare centers. Moreover, hugging, shaking hands and kissing are also highly risky for transmission of the COVID-19 infection.

Conclusions

This study provides the collective details of the risk factors associated with the spreading of the COVID-19 infection. Playing football, basketball, swimming in public pool, playing at the beach, eating food in restaurants, social gathering at religious places, sports stadium, music concert, cinema halls, amusement parks, funerals, wedding, going to gymnasium, traveling by bus or plane, doctors visit, going library, museum, mall, schools and kids daycares, hugging, shaking hands, and kissing were found to be risky for transmission of the COVID-19 infection. This study contributed to the health authorities such as Ministry of Health, health associated workers to formulate the preventive measures to limit the COVID-19 transmission.

Authors’ Contributions

Zafar Rasheed: Data collection, interpretation, validation, and manuscript drafting. Homaidan T Alhomaidan: Conceptualization, data collection and interpretation, and manuscript drafting. Ali Shariq: Conceptualization, data interpretation, and manuscript drafting. Mohammad Alkhowailed: Data collection and interpretation and manuscript drafting. Fuhaid Alqossayir: Data collection and interpretation and manuscript drafting. Naila Rasheed: Data collection, interpretation, validation, and manuscript drafting. Abdullah Alkhamiss: Data interpretation and manuscript drafting. Ruiqah Alghasham: Manuscript revision. Almonther A. Hershon: Data interpretation and manuscript drafting. Sami Alharbi: Data interpretation and manuscript drafting. Sharifa K Alduraibi: Data interpretation and manuscript drafting. Waled Al Abdulmonem: Data collection and interpretation and manuscript drafting.

Acknowledgments

The authors thank the Research Unit, College of Medicine, Qassim University for assisting in data collection and analysis.

References

1. Dao TL, Hoang VT, Gautret P. Recurrence of SARS-CoV-2 viral RNA in recovered COVID-19 patients: A narrative review. Eur J Clin Microbiol Infect Dis. 2021;40(1):13-25. https://doi.org/10.1007/s10096-020-04088-z PMid:33113040
2. Alabdulmonem W, Shariq A, Rasheed Z. COVID-19: A global public health disaster. Int J Health Sci (Qassim). 2020;14(3):7-8. PMid:32536842
3. World Health Organization. Coronavirus Disease (COVID-19) Pandemic. Geneva: World Health Organization; 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019.[Last accessed on 2020 Dec 08].
4. Somsen GA, van Rijn C, Kooij S, Bern RA, Bonn D. Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2 transmission. Lancet Respir Med. 2020;8(7):658-59. https://doi.org/10.1016/S2213-2600(20)30245-9 PMid:32473123
5. Pasnick S, Carlos WG, Cruz CS, Gross JE, Garrison G, Jamil S. SARS-CoV-2 transmission and the risk of aerosol-generating procedures. Am J Respir Crit Care Med. 2020;202(4):13-4. https://doi.org/10.1164/rccm.202004-05654O PMid:32795140
6. Regmi K, Lwin CM. Impact of non-pharmaceutical interventions for reducing transmission of COVID-19: A systematic review and meta-analysis protocol. BMJ Open. 2020;10(10):e041383. https://doi.org/10.1136/bmjopen-2020-041383 PMid:33030308
7. Munjal M, Das S, Chatterjee N, Setra AE, Govil D. Systemic involvement of novel coronavirus (COVID-19): A review of literature. Indian J Crit Care Med. 2020;24(7):565-9. https://doi.org/10.5005/jp-journals-10071-23498
8. Nussbaumer-Streit B, Mayr V, Dobrescu AI, Chapman A, Persad E, Klerings I, et al. Quarantine alone or in combination with other public health measures to control COVID-19: A rapid review. Cochrane Database Syst Rev. 2020;4(4):CD013574. https://doi.org/10.1002/14651858.CD013574
PMid:32267544

9. Pandey A, Atkins KE, Medlock J, Wenzel N, Townsend JP, Childs JE, et al. Strategies for containing Ebola in West Africa. Science. 2014;346(6212):991-5. https://doi.org/10.1126/science.1260612
PMid:32267544

10. TMA Chart Shows COVID-19 Risks for Various Activities Texas Medical Association; 2020. Available from: https://www.texmed.org/TexasMedicineDetail.aspx?Pageid=46106&id=54216. [Last accessed on 2020 Dec 08].

11. Center for Disease Prevention and Control; 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html; https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/assessing-risk-factors.html. [Last accessed on 2020 Dec 08].

12. Health and Safety Executive 2020 Managing Risks and Risk Assessment at Work. Available from: https://www.hse.gov.uk/simple-health-safety/risk/risk-assessment-template-and-examples.htm. [Last accessed on 2020 Dec 08].

13. Krumina A, Chapenko S, Kenina V, Mihailova M, Logina I, Rasa S, et al. The role of HHV-6 and HHV-7 infections in the development of fibromyalgia. J Neurovirol. 2019;25(2):194-207. https://doi.org/10.1007/s13365-018-0703-8
PMid:30617851

14. World Health Organization. Coronavirus Disease (COVID-19) Advice for the Public. Geneva: World Health Organization; 2019. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public. [Last accessed on 2020 Dec 08].

15. Xie K, Liang B, Dulebenets MA, Mei Y. The impact of risk perception on social distancing during the COVID-19 pandemic in China. Int J Environ Res Public Health. 2020;17(17):6256. https://doi.org/10.3390/ijerph17176256
PMid:32867381

16. Oran DP, Topol E.J. Prevalence of asymptomatic SARS-CoV-2 infection: A narrative review. Ann Intern Med. 2020;173(5):362-7. https://doi.org/10.7326/M20-3012.
PMid:32491919

17. New York Barber Working Illicitly Tests Positive for Covid-19. Available from: https://edition.cnn.com/2020/05/15/us/new-york-coronavirus-kingston-barber-trnd/index.html. [Last accessed on 2020 Dec 08].

18. Two Missouri Hairdressers with Coronavirus Saw 140 Clients in their Salon, but no One got infected. Available from: https://www.businessinsider.com/two-missouri-hairdressers-with-coronavirus-saw-140-clients-none-infected-2020-6. [Last accessed on 2020 Dec 08].

19. Centers for Disease Control and Prevention. What Beauty Salon and Barbershop Employees Need to Know about COVID-19. Available from: https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/beauty-salon-barber-employees.html. [Last accessed on 2020 Dec 08].

20. Simpson RJ, Kunz H, Agha N, Graff R. Exercise and the regulation of immune functions. Prog Mol Biol Transl Sci. 2015;135:355-80. https://doi.org/10.1016/b�.pmbts.2015.08.001
PMid:26477922

21. Paoucci EM, Loukov D, Bowdish DM, Heisz JJ. Exercise reduces depression and inflammation but intensity matters. Biol Psychol. 2018;133:79-84. https://doi.org/10.1016/j.biopsycho.2018.01.015
PMid:29408464

22. Nochaiwong S, Ruengorn C, Awiphan R, Ruanta Y, Boonchien W, Nanta S, et al. Mental health circumstances among health care workers and general public under the pandemic situation of COVID-19 (HOME-COVID-19). Medicine (Baltimore). 2020;99(26):e20751. https://doi.org/10.1097/MD.0000000000020751
PMid:32590751

23. Mukhtar S. Psychological health during the coronavirus disease 2019 pandemic outbreak. Int J Soc Psychiatry. 2020;66(5):512-16. https://doi.org/10.1177/0020764020925835
PMid:32434402

24. World Health Organization. Healthy at Home Physical Activity. Geneva: World Health Organization; 2020. Available from: https://www.who.int/news-room/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome--physical-activity#:~:text=Adults%20aged%20over%2018%20years&text=All%20adults%20should%20do%20at,physical%20activity%20throughout%20the%20week. [Last accessed on 2020 Dec 08].

25. Devi S. Travel restrictions hampering COVID-19 response. Lancet. 2020;395(10233):1331-2. https://doi.org/10.1016/S0140-6736(20)30967-3
PMid:32334692

26. Arnold Barnett A. Covid-19 risk among airline passengers: Should the middle seat stay empty? MedRxiv. 2020;2020;20143826. https://doi.org/10.1101/2020.07.02.20143826