

Risk Factors and Protective Factors for COVID-19 Infection among Patients Visiting University Health Centre of Vadodara District: A Case Control study

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Abstract:


Introduction: Identification of risk factors and protective factors of COVID-19 can help in controlling the disease in healthcare and the community. **Objective:** To determine the risk factors and protective factors of COVID-19 among patients visiting University Health Centre of Vadodara district. **Method:** A case control study was done at University Health Centre of the district. Hundred cases who were COVID-19 positive by RTPCR/RAT testing and 100 controls who were RTPCR/RAT negative and never displayed its signs and symptoms were asked about knowledge of parameters such as hand hygiene, social distancing, any ayurvedic or homeopathic medicine intake, chemoprophylaxis of HCQ, visit to public places, any travel history outside city, state or country, the manner, place, and type of masks used by them to know the risk and protective factors for COVID-19. **Results:** Significant risk factors for COVID-19 infection based on logistic regression were increasing age (OR=3.65, p=0.004), higher education (OR=4.72, p=0.001), self-medication of homeopathic or ayurvedic medicines (OR=6.27, p=0.005). Significant protective factors for COVID-19 infection based on logistic regression were regular use of mask (OR=0.03, p=<0.0001), correct technique of mask use (OR=0.17, p=0.02), and maintaining social distance (OR=0.18, p=0.049). **Conclusion:** This study revealed the factors associated with occurrence of COVID-19 were increasing age, higher education, self-medication and factors which protect from infection were regular use of mask, correct technique of mask use, and maintaining social distance.

Keywords: Case control Study, COVID-19, Protective factors, Risk factors

Introduction:

A new coronavirus called SARS-CoV-2 is responsible for COVID-19 disease. WHO first learned on 31 December 2019 about this virus.^[1] Based on available evidences, the COVID-19 virus is transmitted through direct means (droplet and person-to-person transmission) as well as by indirect contact (contaminated objects and airborne contagion).^[2] Preventive and diminution measures are key in both healthcare and community

environment. The most effective preventive measures in the community include: frequently performing hand hygiene with an alcohol-based hand rub if your hands are not visibly dirty or when hands seem dirty washing with soap and water; Avoiding touching your eyes, nose and mouth; wearing a medical mask if you have respiratory symptoms and performing hand hygiene after disposing of the mask; maintaining social distance (a minimum of 1 meter) from individuals with respiratory symptoms.^[1] Evidence was available

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according to which male gender, increased age, underlying disease conditions increase the risk of COVID-19 disease.^[3] A Case Control study conducted by J. Kishore found that cases suffering from Diabetes Mellitus (DM) and Hypertension had higher odds of getting COVID as compared to controls. Similar finding were observed by Zhou F in China.^[4] So this case control study was conducted to know the risk factors and protective factors for COVID-19.^[5]

On analysing various underlying medical conditions amongst controls and cases, it was found that there was a significant difference among cases and controls who had Diabetes Mellitus (DM) and Hypertension (p-value: 0.001) with a high odds ratio of 6.130 and 5.964 respectively.

Objective:

To determine the risk factors and protective factors for COVID-19 among patients visiting University Health Centre of Vadodara district.

Method:

A case control study was carried out at University Health Centre of the district. The study was conducted among residents of university campus including staff members and students studying and residing at university. Those who were COVID-19 positive and minimum 30 days have elapsed from the date of RTPCR/RAT testing were selected as cases. Those who were COVID-19 test negative or those who had never tested for COVID-19 and never developed any Covid related symptoms were selected as controls.

Each participant was explained the purpose of the study and only those who signed the consent form were included in the study. Blood sample for IgG antibody titre was collected by a trained laboratory technician. The blood sample was collected solely for the purpose of measurement of IgG antibody of COVID-19. Report of each participant was given and explained to them. After doing the antibody titer, we removed the participants from the controls who positively showed antibody titer as a result of

asymptomatic infection.

Out of 200 participants, 100 were cases and 100 were controls. Pilot study was done among 15 cases and 15 controls to generate the data for calculation of sample size. In this pilot study, the Odds of having antibody in COVID-19 positive patients were 3 times higher as compared to non-COVID-19 patients. At 95% CI with power-90%, ratio of cases and controls was 1:1, proportion of exposure in control-20% and in case-42% and using Open Epi software the sample size came 100 in each group.^[6] Thus sample size of 100 cases and 100 controls was considered.

A pre-tested, semi-structured questionnaire was used by investigators to conduct the interviews to collect data on COVID-19 disease regarding socio demographic details of the participants, comorbidity of the patients, knowledge of hand hygiene, social distancing, any ayurvedic medicine or homeopathic medicine intake, chemoprophylaxis of HCQ, visit to public places like hotels, malls, parks, participation in social gatherings like party, marriage, any travel history outside city, state or country, the manner, place, and type of masks used by them.

Data entry was done in Microsoft Excel 2007 and analyzed by using MedCalc software version 12.5.0.0.^[7] Descriptive analysis was used to describe the distribution of all variables in cases and control group. Chi-square test was applied to determine the association between exposure and outcome. Factors which were found statistically significant were considered for logistic regression analysis.

The study was approved from the Institutional Ethical Committee for Biomedical and Health Research (IECBHR) of the institute. After explaining the participants in their local language about the study, its purpose and confidentiality of information a written consent was taken from them before starting interview.

Results:

Hundred cases and hundred controls (mean age and SD of cases-42.97±15.91 years, controls-

Table 1: Factors Associated with Coronavirus Disease among Cases And Controls (Cases 100, Controls 100)

Parameters	Cases n=100(%)	Controls n=100(%)	Crude OR	95%CI	χ ²	pvalue
Age(in years)						
>45	49(49%)	28(28%)	2.47	1.37-4.44	9.31	0.0025
≤45	51(51%)	72(72%)				
Gender						
Male	46(46%)	43(43%)	1.12	0.64-1.97	0.06	0.806
Female	54(54%)	57(57%)				
Education						
More than or equal to graduation	68(68%)	44(44%)	2.70	1.51-4.81	11.68	0.0007
Less than graduation	32(32%)	56(56%)				
Travel History						
Yes	39(39%)	40(40%)	0.959	0.54-1.69	0.020	0.885
No	61(61%)	60(60%)				
Visit outside the home						
Never	31(31%)	79(79%)	0.591	0.31-1.12	2.59	0.108
Twice weekly/ Daily	69(69%)	21(21%)				
Social gathering						
Yes	30(30%)	79(79%)	1.049	0.57-1.92	0.024	0.876
No	70(70%)	21(21%)				
Mask use						
Regular	48(48%)	86(86%)	0.150	0.07-0.29	32.64	<0.0001
Irregular	52(52%)	14(14%)				
Technique of wearing mask						
Correct	80(80%)	90(90%)	0.44	0.19-1.0	3.921	0.051
Incorrect	20(20%)	10(10%)				
Knowledge of hand hygiene						
Yes	85(85%)	77(77%)	1.69	0.82-3.47	2.07	0.149
No	15(15%)	23(23%)				
Maintaining social distance						
Yes	83(83%)	90(90%)	0.54	0.23-1.25	2.098	0.1478
No	17(17%)	10(10%)				
Self-medication of Homeopathic/ Ayurvedic medicine						
Yes	21(21%)	7(7%)	3.531	1.42-8.74	8.13	0.004
No	79(79%)	93(93%)				
Home remedies						
Yes	30(30%)	22(22%)	1.519	0.80-2.87	1.663	0.197
No	70(70%)	78(78%)				
HCQ prophylaxis						
Yes	8(8%)	5(5%)	1.65	0.52-5.23	0.404	0.389
No	92(92%)	95(95%)				
Comorbid conditions						
Present	34(34%)	23(23%)	1.72	0.92-3.21	2.454	0.117
Absent	66(66%)	77(77%)				

Table 2: Regression Analysis of Factors Associated With COVID-19 (Cases 100, Controls 100)

Variables	Coefficient	Std. error	Crude OR	Adjusted OR	95% CI		p-value
					Lower	Upper	
Age>45 years	0.807	0.388	2.47	2.24	1.047	4.799	0.0375
Age ≤45 years	Reference						
Mask use- regular	-1.67	0.430	0.15	0.187	0.080	0.435	0.0001
Mask use- irregular	Reference						
Taking homeopathic/ Ayurvedic medicine	1.337	0.571	3.53	3.81	1.24	11.69	0.019
Not taking Homeopathic/ Ayurvedic medicine	Reference						
Antibody present	1.864	0.408	8.09	6.45	2.90	14.366	<0.0001
Antibody absent	Reference						
Education- more than equal to graduation	1.716	0.409	2.70	5.56	2.49	12.40	<0.0001
Less than graduation	Reference						

37.53±14.52 years) were included. Among cases 46% were males and among controls 43% were males. The education level of cases was more than or equal to graduate in 68% cases while it was 44% among controls.

From the Table 1, there was statistically significant difference with p value <0.05 observed in age (OR-2.47), education (OR-2.70), mask use regularity (OR-0.150), and, self-medication of homeopathic/ayurvedic medicine (OR-3.53) between cases and control. On applying logistic regression as shown in Table 2, the association of COVID-19 disease with age factor was statistically significant. The adjusted odds ratio was 2.24 (95% CI 1.04-4.79, p-value=0.0375) which showed that the odds of having older age group that is >45 years of age among COVID-19 patients was 2 times higher than among those who fall under the age group of ≤45 years.

In case of mask use regularity, adjusted odds ratio was found to be 0.187 (95% CI 0.080-0.435, p-value=0.0001) which showed that the risk of having COVID-19 disease is 0.187 times lower in those group that wore mask regularly as compared to the group that did not wear mask regularly, this association was

statistically significant. In other words, the probability of developing COVID-19 was 81% (1-0.187) lesser in those participants who wore mask regularly as compared to the control group.

Regarding participant's taking homeopathic or ayurvedic medicines it was found that the adjusted odds ratio was 3.81 (95% CI 1.24-11.69, p-value=0.019) which showed that the odds of taking homeopathic/ayurvedic medicine among cases was 3.81 times higher than among controls, this association was statistically significant.

With respect to the presence of antibodies, the adjusted odds ratio was 6.45 (95% CI 2.90-14.36, p-value=<0.0001) which showed that the formation of antibody in cases was 6.45 times higher as compared to the control, this association was statistically significant.

Regarding education, adjusted odds ratio was 5.56 (95% CI 2.49-12.40, p-value=0.019) which showed that the odds of having higher education up to graduation or post-graduation among COVID-19 patients was 5.56 times higher than among those who were educated up to school level below graduation, this association was statistically significant. The above analysis was with respect to

Table 3: Factors Associated with Corona virus Disease among Cases and Controls (Cases 100, Controls 64*)

Parameters	Cases n=100(%)	Controls n=64(%)	Crude OR	95%CI	χ^2	pvalue
Age(inyears)						
>45	49(49%)	16(25%)	2.88	1.44-5.73	9.395	0.0026
≤45	51(51%)	48(75%)				
Gender						
Male	46(46%)	34(53.12%)	0.751	0.40-1.40	0.792	0.373
Female	54(54%)	30(46.88%)				
Education						
More than or equal to graduation	68(68%)	31(48.43%)	1.99	1.04-3.80	4.456	0.035
Less than graduation	32(32%)	33(51.56%)				
Travel History						
Yes	39(39%)	32(50%)	0.63	0.33-1.20	1.923	0.16
No	61(61%)	32(50%)				
Visit out side the home						
Never	31(31%)	21(32.81%)	0.91	0.46-1.8	0.059	0.80
Twice weekly/ Daily	69(69%)	43(67.19%)				
Social gathering						
Yes	30(30%)	18(28.13%)	1.09	0.54-2.18	0.066	0.796
No	70(70%)	46(71.87%)				
Mask use						
Regular	48(48%)	61(95.31%)	0.045	0.03-0.15	39.19	<0.0001
Irregular	52(52%)	3(4.69%)				
Technique of wearing mask						
Correct	80(80%)	61(95.31%)	0.197	0.05-0.69	7.588	0.011
Incorrect	20(20%)	3(4.69%)				
Knowledge of hand hygiene						
Yes	85(85%)	53(82.81%)	1.176	0.50-2.75	0.14	0.708
No	15(15%)	11(17.19%)				
Maintaining social distance						
Yes	83(83%)	61(95.31%)	0.24	0.06-0.85	5.524	0.027
No	17(17%)	3(4.69%)				
Self-medication of Homeopathic/Ayurvedic medicine						
Yes	21(21%)	4(6.25%)	3.987	1.30-12.2	6.571	0.015
No	79(79%)	60(93.75%)				
Home remedies						
Yes	30(30%)	13(20.31%)	1.681	0.79-3.53	1.893	0.171
No	70(70%)	51(79.69%)				
HCQ as prophylaxis						
Yes	8(8%)	4(6.25%)	1.30	0.37-4.52	0.176	0.675
No	92(92%)	60(93.75%)				
Comorbid condition						
Present	34(34%)	17(26.6%)	1.42	0.71-2.84	1.007	0.316
Absent	66(66%)	47(73.4%)				

*Total 36 controls (Out of 100) had positive antibody titer so they were removed for this analysis

Table 4: Regression Analysis of Factors Associated with COVID-19 (Cases 100, Controls 64*)

Variables	Coefficient	Std. error	Crude OR	Adjusted OR	95% CI		p-value
					Lower	Upper	
Age>45 years	1.29	0.46	2.88	3.65	1.48	8.99	0.004
Age ≤45 years	Reference						
Education- more than equal to graduation	1.55	0.48	1.99	4.72	1.81	12.28	0.001
Less than graduation	Reference						
Mask use-regular	-3.24	0.67	0.04	0.03	0.01	0.14	<0.001
Mask use- irregular	Reference						
Correct technique of mask use	-1.76	0.79	0.19	0.17	0.03	0.81	0.02
Incorrect technique of mask use	Reference						
Maintaining social distance	-1.69	0.86	0.24	0.18	0.03	0.99	0.049
Not maintaining social distance	Reference						
Self-medication of Homeopathic/ Ayurvedic medicine	1.83	0.65	3.98	6.27	1.74	22.51	0.005
Not taking Homeopathic/ Ayurvedic medicine	Reference						

*Total 36 controls (Out of 100) had positive antibody titer so they were removed for this analysis

the total sample size 200, that is 100 cases and controls each. total 36 controls were found to be seropositive for IgGAb titre of COVID-19. Although they were asymptomatic and healthy, at some point of time they were positive for COVID-19. It was decided not to include these 36 seropositive participants for IgGAb titre of COVID-19 among cases because at the time of ethical approval cases were defined as RTPCR/RAT positive. After removing the controls in which antibody titre was found, the sample size for controls became 64 (100-36). Therefore, the analysis shown in the Table 3 was with respect to 100 cases and 64 controls.

As shown in Table 3, there was statistically significant difference observed in age (OR-2.88, 95% CI 1.44-5.73, p-value-0.002), education (OR-1.99, 95% CI- 1.04-3.80, p-value-0.035), mask use regularity (OR-0.045, 95% CI-0.03-0.15, p-value-<0.0001), technique of mask wearing (OR-0.197, 95% CI-0.05-0.69, p-value-0.011), maintaining social distance (OR-0.24, 95% CI-0.06-0.85, p-value-0.027) and, self-medication of homeopathic/ayurvedic medicine (OR-3.98, 95% CI-1.30-12.2, p-value-0.015) between cases and control.

On applying logistic regression as shown in Table 4, the association of COVID-19 disease with age was statistically significant. The adjusted odds ratio was 3.65 (95% CI 1.48-8.99, p-value=0.004) which showed that the odds of having older age group that is >45 years of age among COVID-19 patients was 3.65 times higher than among those who were under the age group of <45 years. Regarding education, adjusted odds ratios was found to be 4.72 (95% CI 1.81-12.28, p-value=0.001) which showed that the odds of having higher education up to graduation or post-graduation among COVID-19 patients was 4.72 times higher than those who were educated up to school level below graduation, this association was statistically significant. In case of mask use regularity, adjusted odds ratio was found to be 0.03 (95% CI 0.01-0.14, p-value=<0.0001) which showed that the probability of developing COVID-19 was 97% (1-0.03) lesser in those participants who wore mask regularly as compared to those participants who did not wear masks regularly, this association was statistically significant.

The association of technique of mask use with COVID-19 was statistically significant. The adjusted

odds ratio was 0.17 (95% CI 0.01-0.14, p-value= <0.0001) which showed that the probability of developing COVID-19 was 83% (1-0.17) lesser in those participants whose technique of wearing mask was correct as compared to participants whose technique at wearing mask was incorrect. This association was statistically significant.

In case of maintaining social distance, adjusted odds ratio was found to be 0.18 (95% CI 0.03-0.81, p-value=0.02) which showed that the risk of having COVID-19 disease was 0.18 times lower in those group who maintained proper social distance compared to the group that did not maintain proper social distance, this association was statistically significant. In other words, the probability of developing COVID-19 was 82% (1-0.18) lesser in those participants who maintained proper social distance among public as compared to participants who did not maintain social distance, this association was statistically significant.

Regarding participant's taking homeopathic or ayurvedic medicines the adjusted odds ratio was 6.27 (95% CI 1.74-22.51, p-value=0.005) which shows that the odds of taking homeopathic/ayurvedic medicine among cases was 6.27 times higher than among controls, this association was statistically significant.

Discussion:

The occurrence of COVID-19 was 3.65 times higher in people with >45 years of age as compared to people with ≤ 45 years of age. This result was in concordance with a study done by Shahbaziet al who also demonstrated a higher incidence rate between the elderly populations with odds ratio 1.97 and the incidence of COVID-19 in men was 2.19 times higher than women.^[3] Elderly people, because they have a less capable immune response to infectious challenges, are more susceptible to infection. In our study, no statistically significant difference was observed among men and women in having COVID-19.

Those who were highly educated were at high risk of getting COVID-19 and this difference was statistically significant. The reason might be going outside home frequently either for job or other purposes. Being highly educated the participants would have been more aware & hence have got themselves tested early. In the present study, no association was found between mass gathering history, travel history and COVID-19. Contradictory to the study, one cross sectional study conducted by Whaley C et al suggested that social gatherings were associated with increased rates of diagnosed COVID-19.^[8] Similar findings were observed by cohort study conducted by Al Awaidy in Muscat, Oman.^[9]

In this study, compliance to mask use and technique of its use was strongly associated with lower risk of COVID-19. The probability of developing COVID-19 was 97% lesser in those participants who wore mask regularly as compared to the their counterparts who did not wear mask properly. Similar finding was observed in a study by Doung-Ngern P et al^[10] But deciding the specific type of mask use by participants was difficult as maximum of them used mix type of mask.

In present study, knowledge of hand hygiene was not statistically significant among cases and controls. But a negative association was found between risk for COVID-19 and maintaining a social distance of ≥ 2 m. In the study conducted by Doung-Ngern P et al in Thailand, it was found that there was a negative association between risk for SARS-CoV-2 infection and hand washing, maintaining a distance of ≥ 1 m from a COVID-19 patient thus acting as protective factors against COVID-19.^[10]

According to this research, those who were taking homeopathic or ayurvedic medicines had more chances of acquiring COVID-19 infection. Firstly, It suggests that homeopathic or ayurvedic medicines are not effective in preventing the occurrence of infection. Secondly, using these medicines might have given a false sense of security to the cases which might have led to not following COVID appropriate behavior.

In the present study, the role of HCQ in preventing cases of COVID-19 was not established. Similarly in a study conducted by Rajasingham R et al, it was concluded that pre-exposure prophylaxis with hydroxychloroquine did not significantly reduce COVID-19 illness.^[11] Similar findings were concluded in another study conducted by Boulware DR et al.^[12]

In the present study, no statistically significant difference was observed in comorbid conditions between cases and control. On the other hand, a study conducted by Shahbaziet al estimated the OR of the incidence of COVID-19 was 2.26 times more in comorbid patients compared to healthy ones.^[3] The generalizability of the study is limited because the study was conducted in university health centre at the time of second wave of COVID-19.

Conclusion:

Increasing age, higher education, self-medication of homeopathic/ayurvedic medicine were found to be strongly associated with COVID-19 infection. Whereas, regular use of mask, maintaining proper social distance and correct technique of wearing mask were found to be protective factors against COVID-19.

Recommendations:

People in higher age group (>45 years) were at high risk of getting COVID-19 disease. People should strictly use mask on regular basis, maintain social distance and wear mask properly to avoid COVID-19. Operational research for effective implementation and behaviour change communication to community regarding preventive measures are recommended.

Declaration:

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Conflict of Interest: Nil

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