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Correspondence

Epidemiology of human common coronavirus acquisition in pilgrims



Dear Editor,

Human coronaviruses (HCoVs) belong to a group of viruses that primarily cause respiratory illnesses ranging from the common cold to more severe diseases such as bronchitis, pneumonia, and respiratory distress [1]. Currently, seven different HCoV species are known to infect humans. These comprise HCoV-229E, HCoV-OC43, Severe Acute Respiratory Syndrome CoV (SARS-CoV), HCoV-NL63, HCoV-HKU1, Middle East Respiratory Syndrome (MERS-CoV) [1] and SARS-CoV-2, the latter which was recently identified in humans and is responsible for an ongoing widespread epidemic affecting many countries [2]. HCoV-229E, HCoV-OC43, HCoV-NL63 and HCoV-HKU1 are the most common four HCoVs, with a global geographical distribution and a seasonal endemic transmission pattern [1]. We revisited our data by investigating the prevalence of common HCoVs in the Hajj and Grand Magal pilgrims and studying the potential risk factors for HCoV acquisition in a large number of individuals.

Data included French pilgrims from Marseille participating in the Muslim Hajj pilgrimage to Mecca, in the Kingdom of Saudi Arabia (KSA) between 2013 and 2018, international pilgrims (of 11 nationalities) participating in the 2013 Hajj and Senegalese pilgrims (from two rural villages in South Senegal) taking part in the Muslim Grand Magal pilgrimage in Touba, Central Senegal, between 2017 and 2019. Sampling dates of the Hajj and Grand Magal pilgrims were related to the dates of the two religious events that are defined each year according to the Muslim lunar calendar. Nasopharyngeal swabs were obtained from each participant prior to travelling to their destination and upon returning home. HCoVs were identified using the quantitative real-time PCR method (Supplementary data). The statistical significance of the data was evaluated with Stata version 14.2 (StataCorp, College Station, Texas, USA) (Supplementary data).

At total of 1723 pilgrims were include. The M/F gender ratio was 1.1 and the median age was 50.6 years (ranging from 0 to 96 years). A female predominance was observed in French Hajj pilgrims, while international Hajj pilgrims were more likely to be males (Supplementary Table 1). Senegalese Grand Magal pilgrims were characterised by their younger age, while Hajj pilgrims were mostly middle aged or elderly individuals (Supplementary Table 1). In total, 70.9% of the pilgrims presented at least one respiratory symptom during travel. A cough (62.0%) and a rhinitis (48.7%) were the most frequent symptoms, followed by fever (22.4%) and dyspnoea (10.8%) (Table 1). Symptoms were more frequent in Hajj pilgrims as compared to Grand Magal pilgrims (Supplementary Table 1).

Overall, a total of 3388 specimens, including 1699 nasopharyngeal pre-travel specimens and 1689 post-travel specimens were investigated. In total, 244/3388 (7.2%) samples tested positive for coronaviruses included 164 (4.8%) for HCoV-229E, 34 (1.0%) for HCoV-NL63, 38 (1.1%) for HCoV-OC43 and 18 (0.5%) for HCoV-HKU1. The prevalence

of HCoVs in international Hajj pilgrims sampled upon arrival in KSA, and thus reflecting the prevalence in origin countries, was 1.7% (12/692). That of French pilgrims sampled before travelling to KSA was 0.6% (4/703) and that of Senegalese pilgrims sampled before travelling to Touba was 1.0% (3/304). The prevalence of HCoVs post-travel to KSA was 18.5% (128/692) in international Hajj pilgrims and 9.9% (69/695) in French pilgrims while that of Senegalese pilgrims sampled after travelling to Touba was 9.9% (30/302). The acquisition rate in Hajj pilgrims overall was 14.2% (10.0% in French Hajj pilgrims and 18.4% in international Hajj pilgrims). The acquisition rate of coronaviruses in Senegalese pilgrims after participating to the Grand Magal, was 9.6%. The overall 10.8% prevalence of HCoVs acquired in individuals with respiratory symptoms in this study was consistent with results of other studies conducted in adult patients in Saudi Arabia (Hajj pilgrims) [3]. We also found a 7.7% prevalence of HCoVs acquired in asymptomatic individuals, in line with a 2.4% prevalence reported in a US study conducted in asymptomatic adults [4]. Hajj pilgrims were more likely to acquire HCoV 229E, while Grand Magal pilgrims were more likely to acquire HCoVs NL63 and OC43 (Supplementary figure 1).

In univariate analysis, acquisition of HCoVs was higher in Hajj pilgrims than in Grand Magal pilgrims. Our study also revealed annual differences in the prevalence of HCoVs that peaked in 2013 and 2016. These associations remained significant in multivariate analysis. Factors associated with annual variation in HCoV prevalence are currently unclear. Such annual variations were also observed in a study conducted in the US [5]. In addition, HCoVs acquisition was more frequent in pilgrims reporting respiratory symptoms, although this was not significant in univariate analysis. Clinical data were available for 1031/1723 (59.8%) of participants included in this work which unfortunately precluded multivariate analysis. Future studies are needed to understand the clinical significance of common HCoVs acquisition in these populations.

This report reveals the role of participation in a large gathering in common HCoVs acquisition and related infections. Significant acquisition of HCoVs following participation in the Hajj pilgrimage has been reported by several authors due to overcrowded conditions encouraging the person-to-person spread of respiratory viruses including HCoVs [3]. This is of particular concern in the current context of the SARS-CoV-2 pandemic where international travel including mass gatherings played a key role in the global spread of the disease [6].

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tmaid.2020.101845>.

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Table 1
Associations between multiple factors and acquisition of human coronaviruses.

Characteristics	Total n (%)	Risk factor for acquisition of human coronaviruses					
		Univariable analysis				Multivariable analysis	
		No n (%)	Yes n (%)	OR [95% CI]	p	aOR [95% CI]	p
Gender ^{1722x}							
Male	814 (47.3)	772 (87.4)	111 (12.6)	Ref	Ref	–	–
Female	908 (52.7)	675 (85.7)	113 (14.3)	1.16 [0.93–1.61]	0.29	–	–
Age ¹⁷⁰⁴							
Mean ± SD	50.6 ± 18.1	50.3 ± 18.2	51.7 ± 17.9	t = –1.19	0.24	–	–
Rang	0–96						
Age group ¹⁷⁰⁴							
0–15	79 (4.6)	66 (84.6)	12 (15.4)	1.37 [0.70–2.70]	0.36	–	–
15–45	473 (27.8)	408 (88.3)	54 (11.7)	Ref	Ref	–	–
45–60	558 (32.7)	468 (86.3)	74 (13.6)	1.19 [0.82–1.74]	0.35	–	–
>60	594 (34.9)	492 (85.7)	82 (14.3)	1.26 [0.87–1.82]	0.22	–	–
Population ¹⁷²³							
Magal pilgrims	304 (17.6)	273 (90.4)	29 (9.6)	Ref	Ref	Ref	Ref
Hajj pilgrims	1419 (82.4)	1175 (85.8)	195 (14.2)	1.56 [1.04–2.36]	0.034	0.61 [0.32–1.16]	0.13
Years ¹⁷²³							
2019	93 (5.4)	87 (93.6)	6 (6.4)	3.66 [0.72–18.57]	0.12	2.23 [0.39–12.82]	0.37
2018	222 (12.9)	204 (91.9)	18 (8.1)	4.68 [1.06–20.54]	0.04	3.64 [0.79–16.7]	0.1
2017	261 (15.2)	220 (90.5)	23 (9.5)	5.54 [1.28–23.94]	0.022	4.34 [0.96–19.56]	0.06
2016	109 (6.3)	80 (80.8)	19 (19.2)	12.59 [2.84–55.6]	0.001	12.59 [2.85–55.6]	0.001
2015	119 (6.9)	106 (98.1)	2 (1.9)	Ref	Ref	Ref	Ref
2014	98 (5.7)	86 (96.6)	3 (3.4)	1.85 [0.3–11.32]	0.51	1.84 [0.30–11.31]	0.51
2013	821 (47.6)	665 (81.3)	153 (18.7)	12.19 [2.98–49.9]	0.001	12.2 [2.98–49.9]	0.001
Respiratory symptom ¹⁰³¹							
At least one symptom							
Yes	731 (70.9)	21 (7.7)	76 (10.8)	1.45 [0.87–2.39]	0.15	NA	NA
No	300 (29.1)	252 (92.3)	631 (89.3)			NA	NA
Fever							
Yes	231 (22.4)	67 (8.9)	30 (13.2)	1.56 [0.98–2.47]	0.06	NA	NA
No	800 (77.6)	686 (91.1)	197 (86.8)			NA	NA
Cough							
Yes	639 (62.0)	32 (8.8)	65 (10.5)	1.22 [0.39–1.90]	0.39	NA	NA
No	392 (38.0)	331 (91.2)	552 (89.5)			NA	NA
Rhinitis							
Yes	502 (48.7)	40 (8.1)	57 (11.8)	1.53 [0.99–2.34]	0.051	NA	NA
No	529 (51.3)	457 (92.0)	426 (88.2)			NA	NA
Dyspnea							
Yes	111 (10.8)	83 (9.5)	14 (13.2)	1.45 [0.79–2.66]	0.23	NA	NA
No	920 (89.2)	791 (90.5)	92 (86.8)			NA	NA

^x Number of cases for whom data were available.

NA: not applicable (respiratory symptoms were not included in the model, because of missing data in international Hajj pilgrims in 2013).

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