



SHORT COMMUNICATION

A study on the epidemiology of COVID-19 in the Baniyas and Alkadmos areas of Syria during 2021

Kanaan Al-Tameemi^{1*}, Rana Nassour², Renad Ali Sleman², Maya Sami Daoud² and Lara Samer Murad²

¹Department of Microbiology, Faculty of Medicine, Al-Andalus University for Medical Sciences, Tartus, Syria.

²Department of Basic Sciences, Faculty of Pharmacy, Al-Andalus University for Medical Sciences, Tartus, Syria.
Email: d_knaan@yahoo.com

Received 9 April 2022; Received in revised form 18 August 2022; Accepted 15 September 2022

ABSTRACT

Aims: Coronavirus disease-2019 (COVID-19) is an ongoing global pandemic. In Syria, the first case was reported in March 2020. This study was aimed to investigate the incidences of COVID-19 in the Baniyas and Alkadmos areas in Tartus, Syria, in 2021.

Methodology and results: Our data were obtained from the records of Baniyas and Alkadmos hospitals. The results were inferred by analysing data for 1026 COVID-19 patients. About 58.4% of total cases were among males and 41.6% were among females. Most patients were living in rural areas; 73% compared to 27% in urban ones. The severity of the disease varied between patients. About 67.4% of cases needed to be hospitalized for treatment, most of which were from the elderly. The same was noticed with the mortality rate, with 14.5% of total cases and 66.4% of them were older than 65.

Conclusion, significance and impact of study: Our study indicated that age and gender are risk factors for contracting COVID-19.

Keywords: Alkadmos, Baniyas, COVID-19, death, gender

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) belongs to the beta-coronavirus (Cevik *et al.*, 2020; Yan *et al.*, 2020; Al-Tameemi *et al.*, 2021a; Rehman *et al.*, 2021). It is a large enveloped RNA virus and shares about 75-80% of its viral genome with SARS-CoV (Al-Tameemi and Kabakli, 2020; Hu *et al.*, 2021; Saleh *et al.*, 2021), but spreads more efficiently compared to it, considering that it has a higher reproductive number ($R_0=2-3$) (Chaturvedi *et al.*, 2021). SARS-CoV-2 is a strain of coronavirus that caused the ongoing COVID-19 pandemic (Cevik *et al.*, 2020; Al-Tameemi *et al.*, 2021a).

It was first reported in December 2019 in Wuhan, China (Yan *et al.*, 2020; Holmes *et al.*, 2021; Hu *et al.*, 2021). Due to its high transmission characteristics, SARS-CoV-2 spread to all continents rapidly, which forced World Health Organization (WHO) to announce the pandemic state on March 11, 2020 (Chams *et al.*, 2020; Al-Tameemi *et al.*, 2021a; Saleh *et al.*, 2021; Worobey 2021).

The first COVID-19 case in Syria was reported on March 22, 2020, and the first death was reported a week

later, on March 29, 2020. The disease has spread rapidly among Syrians (Al-Ahdab, 2020; Abo Kasem and Almansour, 2021; Al-Tameemi *et al.*, 2021b). This disease was expected to be a massive challenge to the Syrian war-torn health system because of the lack of sufficient equipment and the loss of approximately 70% of health care workers (Al-Ahdab, 2020).

In order to stop the spread of COVID-19, strict measurements were imposed by the Syrian government, including a partial curfew from 6 pm to 6 am, complete closure of public spaces, postponing classes at schools and universities, preventing traveling between cities, suspending all flights as well as reducing the number of workers in the public institutions (Al-Ahdab, 2020; Abo Kasem and Almansour, 2021). Besides, a complete lockdown was posed on areas containing confirmed or suspected infections or deaths. In May 2020, the government gradually alleviated the curfew restrictions due to the economic deterioration (Al-Ahdab, 2020; Al-Tameemi *et al.*, 2021b), especially since 80% of Syrians live in poverty and thus, the lockdown measures may have severe consequences for the population (Abo Kasem and Almansour, 2021).

*Corresponding author

By April 9, 2022, 497.8 million cases were reported worldwide (433.4 million recovered and nearly 6.2 million deaths) and 55735 cases in Syria (51833 patients recovered and 3146 deaths) (Worldometer, 2022). As for the Syrian governorates, Tartus ranked sixth with 3890 cases (approximately 7.0% of total cases in Syria) and 277 deaths (8.8% of total deaths in Syria) (WHO, 2022).

In this research, we investigate the incidence rates of COVID-19 in two areas (Baniyas and Alkadmos) in the Tartus governorate within 2021.

MATERIALS AND METHODS

Our study was based on research and epidemiological investigation of the incidence rates of COVID-19 in the Baniyas and Alkadmos areas, Syria, in 2021. The data include 1026 COVID-19 patients. They were obtained from the records of Baniyas and Alkadmos Hospitals. Then they were scheduled according to seven age groups with ten years intervals (15-24, 25-34, 35-44, 45-54, 55-64, 65-74 and >75 years old). We investigated the link between age groups on one side and gender, place of residence, the severity of cases and deaths on the other side. The results were statistically analyzed using correlation and the ANOVA test.

RESULTS

The link between patients' age groups and genders

The data included 1026 COVID-19 adult patients. Of them, there were 599 males (58.4%) and 427 females (41.6%) (Table 1).

The lowest rates of COVID-19 incidences were for the first age group (19 patients, 1.9% of total cases). As results indicated, the incidences increased with age. It reached 63 (6.1%) and 112 (10.9%) for the second and third age groups, respectively. After the age of 55, the number of cases increased significantly, reaching 211 (20.6%), 232 (22.6%) and 211 (20.6%) for the age groups 55-64, 65-74 and >75 years, respectively.

The statistical analysis referred to a strong positive correlation and significant differences ($P < 0.05$) between increasing age and both genders, males and females.

The link between patients' age groups and place of residence

As mentioned earlier, our data included 1026 COVID-19 adult patients. Of them, 277 were living in urban (27.0%) and 749 were living in rural (73.0%) of total cases (Table 2).

The results indicated the rise of incidences between rural populations in the seven age groups (78.9%, 69.8%, 67.0%, 72.5%, 70.6%, 75.4% and 76.8%, respectively) compared to urban populations (21.1%, 30.2%, 33.0%, 27.5%, 29.4%, 24.6% and 23.2%, respectively). Infection among people older than 45 years increased remarkably, as they constituted 82.1% of total rural incidences.

Table 1: The link between patients' age groups and gender.

Age group	Gender	
	Male	Female
15-24	15 (78.9%)	4 (21.1%)
25-34	30 (47.6%)	33 (52.4%)
35-44	61 (54.5%)	51 (45.5%)
45-54	89 (50%)	89 (50%)
55-64	131 (62.1%)	80 (37.9%)
65-74	139 (59.9%)	93 (40.1%)
>75	134 (63.5%)	77 (36.5%)
Total	599 (58.4%)	427 (41.6%)
	1026	

Table 2: The link between patients' age groups and place of residence.

Age group	Residence	
	Urban	Rural
15-24	4 (21.1%)	15 (78.9%)
25-34	19 (30.2%)	44 (69.8%)
35-44	37 (33.0%)	75 (67.0%)
45-54	49 (27.5%)	129 (72.5%)
55-64	62 (29.4%)	149 (70.6%)
65-74	57 (24.6%)	175 (75.4%)
>75	49 (23.2%)	162 (76.8%)
Total	277 (27.0%)	749 (73.0%)
	1026	

The statistical analysis reflected strong positive correlations and significant differences ($P < 0.05$) between the age and residential settings of patients.

The link between patients' age groups and the severity of cases

Out of our sample, 692 (67.4%) of total cases required hospitalization, while self-home quarantine was sufficient for 334 (32.6%) of total cases (Table 3). Up to 44 years old, most patients (57.2%) did not have severe symptoms, so most of them committed to self-home quarantine. As for the age groups older than 65 years, 79.0% of the patients had severe symptoms and needed to enter the hospital for treatment. The most frequent symptom in severe cases was pneumonia, as it was reported in 67 patients (9.7% of hospitalized cases and 6.5% of total cases). It's worth noting that pneumonia appeared in individuals older than 45 years more than in younger groups (nearly 2.4-fold).

The statistical analysis referred to a weak positive correlation but significant differences ($P < 0.05$) between increasing age and self-home quarantine. However, there were a strong positive correlation and significant differences ($P < 0.05$) between increasing age and hospitalization.

Table 3: The link between patients' age groups and the severity of cases.

Age group	The severity of cases	
	Self-home quarantine	Hospitalization
15-24	11 (57.9%)	8 (42.1%)
25-34	36 (57.1%)	27 (42.9%)
35-44	64 (57.1%)	48 (42.9%)
45-54	74 (41.6%)	104 (58.4%)
55-64	56 (26.5%)	155 (73.5%)
65-74	52 (22.4%)	180 (77.6%)
>75	41 (19.4%)	170 (80.6%)
Total	334 (32.6%)	692 (67.4%)
	1026	

Table 4: The link between patients' age groups and death.

Age group	Deaths
15-24	0 (0.0%)
25-34	4 (2.7%)
35-44	4 (2.7%)
45-54	18 (12.1%)
55-64	24 (16.1%)
65-74	46 (30.9%)
>75	53 (35.6%)
Total	149

The link between patients' age groups and death

Of the COVID-19 adult patients in our study, 149 people passed away (Table 4). The death incidences increased with aging. The first age group (15-24 years old) fully recovered without any death cases. The death incidences increased with aging, as it reached among patients older than 65 years, about 66.4% of total deaths and 21.5% of the hospitalized patients in the studied period.

The statistical analysis referred to a strong positive correlation between increasing age and death, but without significant differences ($P > 0.05$).

DISCUSSION

The link between patients' age groups and genders

In general, gender differences in the susceptibility to bacterial, viral, fungal and parasitic infections are observed at all ages, with a larger and more significant burden among males (Peckham *et al.*, 2020). The COVID-19 is not an exception, as many studies indicated that males are more vulnerable to COVID-19 than females (Abate *et al.*, 2020; Bischof *et al.*, 2020; Bwire, 2020; Yanez *et al.*, 2020; de Paz Nieves *et al.*, 2021; Salahshoori *et al.*, 2021).

Many factors are involved in the different COVID-19 responses between males and females. Starting with the differences in the adaptive immune system, females have more CD4+ T cells, stronger CD8+ T cell cytotoxic activity and higher B cell production of immunoglobulin compared

to males (Peckham *et al.*, 2020). Besides, females produce an increased amount of type 1 interferon (IFN) and inflammatory cytokines (IL-1, TNFs) compared to males. IFN is an antiviral cytokine that is important for the early response to COVID-19 (Capuano *et al.*, 2020; Peckham *et al.*, 2020; Trouillet-Assant *et al.*, 2020). The increased production of IFN in females is correlated to the concentration of sex hormones and the number of X chromosomes present (Peckham *et al.*, 2020).

In addition, sex hormones have a crucial role in facing viral infections. In females, the estrogen level varies throughout the menstrual cycle and declines with menopause, whereas the testosterone level in males remains steady up to 60 (Capuano *et al.*, 2020). Some studies demonstrated that testosterone suppresses the immune system, while estrogen may have suppressive or non-suppressive effects depending on its levels (Capuano *et al.*, 2020; Peckham *et al.*, 2020; Naz *et al.*, 2021).

Oestradiol plays a positive one by enhancing T cell responses, antibody production and neutrophils (Peckham *et al.*, 2020; Naz *et al.*, 2021). On the contrary, high estrogens inhibit innate and pro-inflammatory immune responses (Capuano *et al.*, 2020). As for men, androgens deficiency correlates with increased levels of inflammatory cytokines and CD4+/CD8+ T-cell ratio (Capuano *et al.*, 2020).

On the other hand, there is a significant association between morbidity and older COVID-19 patients. For example, males show a decline in B cells with age and a trend to accelerate immune aging (Peckham *et al.*, 2020).

Apart from the hormonal variation, social and behavioural differences could contribute to the noticed gender difference in COVID-19 disease severity. For instance, hygiene behaviours; as men are less probably to remember washing their hands after having respiratory symptoms, before preparing or eating food, as well as after using the restroom (Johnson *et al.*, 2003; Haston *et al.*, 2020). In many societies, men are more likely to get out of their houses and enter crowded regions (Peckham *et al.*, 2020).

The link between patients' age groups and place of residence

In large urban areas, the high population density forced the implementation of strict precautions such as lockdowns and social distancing practices, which led to slower infection spread in these areas (Cuadros *et al.*, 2021). As for rural areas, lower population density theoretically should reduce the risk of COVID-19 transmission. So rural people may have had a false sense of security and taken fewer precautions (OECD, 2021).

On the other hand, higher incidence rates in rural areas could be logical because most people have to take public transportation to get to their workplaces. Moreover, rural patients usually are less vaccinated due to a lack of health awareness (Murthy *et al.*, 2021; Sun and Monnat, 2021).

Besides, older, poorer and less healthy rural patients often face limited healthcare capacity (OECD, 2021).

The link between patients' age groups and the severity of cases

COVID-19 usually spreads via respiratory droplets produced during coughing and sneezing by symptomatic and asymptomatic patients before showing any symptoms (Özdemir, 2020; Salahshoori *et al.*, 2021). People of all ages may get SARS-CoV-2 infection, with the majority of incidences among middle-aged and older individuals (Özdemir, 2020; Al-Tameemi *et al.*, 2021b; Katz, 2021; Safadia and da Silva, 2021). This could be due to the loss of immune protection with age, causing cellular and molecular dysregulation in the innate immune system and damage-repair capabilities impairment in older people (Al-Tameemi *et al.*, 2021a; Turke, 2021).

In this context, previous research reported the correlation between severe cases and comorbidities, such as obesity, asthma, hypertension, cardiovascular disease and diabetes (Cunningham *et al.*, 2021; Djaharuddin *et al.*, 2021; Htun *et al.*, 2021; Sandova *et al.*, 2021). Younger populations are less likely to develop severe disease, considering that they have fewer comorbidities (Dioguardi *et al.*, 2021; Turke, 2021). However, Cunningham *et al.* (2021) confirmed that young adults with more than one of the previously mentioned diseases might face risks similar to those observed in healthy middle-aged adults (Cunningham *et al.*, 2021).

In addition, previous research reported the poor acceptance of the vaccination among Syrians (Shibani *et al.*, 2021); as it's according to statistics, 7.4% of the population were fully vaccinated by April 9, 2022 (COVID-19 Task Force Dashboard, 2022). This could be one of the reasons for the increasing infection rates and their severity among Syrians. That indicates the necessity of increasing people's confidence in the vaccine and its importance in controlling the pandemic.

COVID-19 has different degrees of severity, from flu-like symptoms to serious ones ending with death (Yang *et al.*, 2020). The common symptoms involve fever, headache, dry cough, sore throat, rhinorrhoea, loss of taste and/or smell, conjunctivitis, dyspnea, as well as musculoskeletal and gastrointestinal manifestations (Jamil *et al.*, 2020; Lupia *et al.*, 2020; Özdemir, 2020; Htun *et al.*, 2021; Safadia and da Silva, 2021; Snider *et al.*, 2021; Yupari-Azabache *et al.*, 2021). Thus, there is no particular clinical description that differentiates COVID-19 from other upper/lower airway viral infections. In severe cases, COVID-19 disease may develop into pneumonia, pulmonary failure and eventually death (Özdemir, 2020).

The link between patients' age groups and death

As expected, death rates were most especially evident among the elderly. This is consistent with previous studies in different parts of the world (Bonanad *et al.*, 2020; Michelozzi *et al.*, 2020; Salahshoori *et al.*, 2021; Zhang *et al.*, 2021).

As stated earlier, severe COVID-19 cases are associated with increasing age and comorbidities. Those, in their turn, are translated into a higher mortality rate at

the population level (Yanez *et al.*, 2020; Yupari-Azabache *et al.*, 2021).

In addition, there was a considerable delay in testing and diagnosing some of the patients who ended up dead, which indicates the importance of timeliness when dealing with suspicious patients (Ceballos, 2021).

Xu *et al.* (2021) reported that mortality rates in COVID-19 vaccine recipients are lower than in unvaccinated people and these observations align with our research findings. So, we can conclude that the low vaccination rates among Syrian could be one reason for more extended hospitalization and higher death probability (Xu *et al.*, 2021).

CONCLUSION

We concluded that COVID-19 affects adults of all age groups. Male were more vulnerable than females to being infected. The severity of cases and mortality increased with age, comorbidities and rural residency. Targeted nationwide campaigns are needed to raise the population's awareness about the importance of vaccination toward ending the pandemic.

ACKNOWLEDGEMENTS

We thank the department of health in Tartus for their cooperation.

REFERENCES

- Abate, B. B., Kassie, A. M., Kassaw, M. W., Aragie, T. G. and Masresha, S. A. (2020). Sex difference in coronavirus disease (COVID-19): A systematic review and meta-analysis. *BMJ Open* **10**, e040129.
- Abo Kasem, R. and Almansour, M. (2021). COVID-19 during the crisis in the Syrian Arab Republic. *Eastern Mediterranean Health Journal* **27**(1), 5-6.
- Al-Ahdab, S. (2020). Knowledge, attitudes and practices (KAP) towards pandemic COVID-19 among Syrians. *BMC Public Health* **21**, 296.
- Al-Tameemi, K. and Kabakli, R. (2020). Novel coronavirus (2019-nCoV): Disease briefings. *Asian Journal of Pharmaceutical and Clinical Research* **13**(5), 22-27.
- Al-Tameemi, K., Khudhur, H. R., Dayoob, H., Youssef, S. and Zuzu, T. (2021b). SARS-COV-2 pandemic in Syria: Symptoms and treatments. *British Journal of Medical and Health Research* **8**(7), 36-50.
- Al-Tameemi, K., Nassour, R. and Hadi, A. O. A. (2021a). COVID-19 incidences and symptoms among children. *World Journal of Pharmaceutical and Medical Research* **7**(10), 260-264.
- Bischof, E., Wolfe, J. and Klein, S. L. (2020). Clinical trials for COVID-19 should include sex as a variable. *The Journal of Clinical Investigation* **130**(7), 3350-3352.
- Bonanad, C., García-Blas, S., Tarazona-Santabalbina, F., Sanchis, J., Bertomeu-González, V., Fácila, L., Ariza, A., Núñez, J. and Cordero, A. (2020). The

- effect of age on mortality in patients with COVID-19: A meta-analysis with 611,583 subjects. *Journal of the American Medical Directors Association* **21**, 915-918.
- Bwire, G. M. (2020).** Coronavirus: Why men are more vulnerable to Covid-19 than women? *SN Comprehensive Clinical Medicine* **2**, 874-876.
- Capuano, A., Rossi, F. and Paolisso, G. (2020).** Covid-19 kills more men than women: An overview of possible reasons. *Frontiers in Cardiovascular Medicine* **7**, 131.
- Ceballos, R. F. (2021).** Mortality analysis of early COVID-19 cases in the Philippines based on observed demographic and clinical characteristics. *Recoletos Multidisciplinary Research Journal* **9(1)**, 91-106.
- Cevik, M., Kuppalli, K., Kindrachuk, J. and Peiris, M. (2020).** Virology, transmission, and pathogenesis of SARS-CoV-2. *British Medical Journal* **371**, m3862.
- Chams, N., Chams, S., Badran, R., Shams, A., Araji, A., Raad, M., Mukhopadhyay, S., Stroberg, E., Duval, E. J., Barton, L. M. and Hussein, I. H. (2020).** COVID-19: A multidisciplinary review. *Frontiers in Public Health* **8**, 383.
- Chaturvedi, R., Malhotra, S. and Sharma, A. (2021).** Epidemiological profiles of SARS-CoV and SARS-Cov-2 in Singapore and its promising containment strategies. *Journal of Global Health* **11**, 03027.
- COVID-19 Task Force Dashboard. (2022).** The Task Force:
<https://data.covid19taskforce.com/data/countries/Syria/n%20Arab%20Republic> [Retrieved on 9 April 2022].
- Cuadros, D. F., Branscum, A. J., Mukandavire, Z., Miller, F. D. and MacKinnon, N. (2021).** Dynamics of the COVID-19 epidemic in urban and rural areas in the United States. *Annals of Epidemiology* **59**, 16-20.
- Cunningham, J. W., Vaduganathan, M., Claggett, B. L., Jering, K. S., Bhatt, A. S., Rosenthal, N. and Solomon, S. D. (2021).** Clinical outcomes in young US adults hospitalized with COVID-19. *JAMA Internal Medicine* **181(3)**, 379-381.
- de Paz Nieves, C., Gaddis, I. and Muller, M. (2021).** Gender and COVID-19: What Have We Learnt, One Year Later? Policy Research Working Paper No. 9709. World Bank Group, Washington.
- Dioguardi, M., Cazzolla, A. P., Arena, C., Sovereto, D., Caloro, G. A., Dioguardi, A., Crincolim V., Laino, L., Troiano, G. and Muzio, L. L. (2021).** Innate immunity in children and the role of ACE2 expression in SARS-CoV-2 infection. *Pediatric Reports* **13**, 363-382.
- Djagaruddin, I., Munawwarah, S., Nurulit, A., Ilyas, E., Tabri, N. A. and Lihawa, N. (2021).** Comorbidities and mortality in COVID-19 patients. *Gaceta Sanitaria* **35**, S530-S532.
- Haston, J. C., Miller, G. F., Berendes, D., Andújar, A., Marshall, B., Cope, J., Hunter, C. M., Robinson, B. M., Hill, V. R. and Garcia-Williams, A. G. (2020).** Characteristics associated with adults remembering to wash hands in multiple situations before and during the COVID-19 pandemic – United States, October 2019 and June 2020. *Morbidity and Mortality Weekly Report* **69(40)**, 1443-1449.
- Holmes, E. C., Goldstein, S. A., Rasmussen, A. L., Robertson, D. L., Crits-Christoph, A., Wertheim, J. O. et al. (2021).** The origins of SARS-CoV-2: A critical review. *Cell* **184(19)**, 4848-4856.
- Htun, Y. N., Win, T. T., Aung, A., Latt, T. Z., Phyo, Y. N., Tun, T. M., Htun, N. S., Tun, K. M. and Htun, K. A. (2021).** Initial presenting symptoms, comorbidities and severity of COVID-19 patients during the second wave of epidemic in Myanmar. *Tropical Medicine and Health* **49**, 62.
- Hu, B., Guo, H., Zhou, P. and Shi, Z. L. (2021).** Characteristics of SARS-CoV-2 and COVID-19. *Nature Reviews Microbiology* **19**, 141-154.
- Jamil, S., Mark, N., Carlos, G., Cruz, C. S. D., Gross, J. E. and Pasnick, S. (2020).** Diagnosis and management of COVID-19 disease. *American Journal of Respiratory and Critical Care Medicine* **201(10)**, 19-22.
- Johnson, H. D., Sholcosky, D., Gabello, K., Ragni, R. and Ogonosky, N. (2003).** Sex differences in public restroom handwashing behavior associated with visual behavior prompts. *Perceptual and Motor Skills* **97**, 805-810.
- Katz, M. H. (2021).** Regardless of age, obesity and hypertension increase risks with COVID-19. *JAMA Internal Medicine* **181(3)**, 381.
- Lupia, T., Scabini, S., Pinna, S. M., Di Perri, G., De Rosa, F. G. and Corcione, S. (2020).** 2019 novel coronavirus (2019-nCoV) outbreak: A new challenge. *Journal of Global Antimicrobial Resistance* **21**, 22-27.
- Michelozzi, P., de'Donato, F., Scortichini, M., Pezzotti, P., Stafoggia, M., De Sario, M., Costa, G., Noccioli, F., Riccardo, F., Bella, A., Demaria, M., Rossi, P., Brusaferrero, S., Rezza, G. and Davoli, M. (2020).** Temporal dynamics in total excess mortality and COVID-19 deaths in Italian cities. *BMC Public Health* **20**, 1238.
- Murthy, B. P., Sterrett, N., Weller, D., Zell, E., Reynolds, L., Toblin, R. L. et al. (2021).** Disparities in COVID-19 vaccination coverage between urban and rural counties – United States, December 14, 2020-April 10, 2021. *Morbidity and Mortality Weekly Report* **70(20)**, 759-764.
- Naz, M. S. G., Banaei, M., Dashti, S. and Tehrani, F. R. (2021).** An overview of sex hormones in relation to SARS-CoV-2 infection. *Future Virology* **16(8)**, 555-564.
- OECD, Organisation for Economic Co-operation and Development. (2021).** OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions. OECD Publishing, Paris. pp. 14-36.
- Özdemir, Ö. (2020).** Coronavirus disease 2019 (COVID-19): Diagnosis and management. *Erciyes Medical Journal* **42(3)**, 242-247.
- Peckham, H., de Gruijter, N. M., Raine, C., Radziszewska, A., Ciurtin, C., Wedderburn, L. R.,**

- Rosser, E. C., Webb, K. and Deakin, C. T. (2020).** Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ICU admission. *Nature Communications* **11**, 6317.
- Rehman, M. F. U., Fariha, C., Anwar, A., Shahzad, N., Ahmad, M., Mukhtar, S. and Haque, M. F. U. (2021).** Novel coronavirus disease (COVID-19) pandemic: A recent mini review. *Computational and Structural Biotechnology Journal* **19**, 612-623.
- Safadia, M. A. P. and da Silva, C. A. A. (2021).** The challenging and unpredictable spectrum of COVID-19 in children and adolescents. *Revista Paulista de Pediatria* **39**, e2020192.
- Salahshoori, I., Mobaraki-Asl, N., Seyfaee, A., Nasirabad, N. M., Dehghan, Z., Faraji, M., Ganjkhani, M., Babapoor, A., Shadmehr, S. Z. and Hamrang, A. (2021).** Overview of COVID-19 disease: Virology, epidemiology, prevention diagnosis, treatment, and vaccines. *Biologics* **1(1)**, 2-40.
- Saleh, N. Y., Aboelghar, H. M., Salem, S. S., Ibrahim, R. A., Khalil, F. O., Abdelgawad, A. S. and Mahmoud, A. A. (2021).** The severity and atypical presentations of COVID-19 infection in pediatrics. *BMC Pediatrics* **21**, 144.
- Sandova, M., Nguyen, D. T., Vahidy, F. S. and Graviss, E. A. (2021).** Risk factors for severity of COVID-19 in hospital patients age 18-29 years. *PLoS ONE* **16(7)**, e0255544.
- Shibani, M., Alzabibi, A. M., Mouhandes, A. E., Alsuliman, T., Mouki, A., Ismail, H., Alhayk, S., Rmman, A. A., Mansour, M., Marrawi, M., Alhalabi, N., Habib, M. B., Albuni, M. K., Al-Moujahed, A., Sawaf, B. and Data Collection Group (2021).** COVID-19 vaccination acceptance among Syrian population: A nationwide cross-sectional study. *BMC Public Health* **21**, 2117.
- Snider, B., Patel, B. and McBean, E. (2021).** Asymptomatic cases, the hidden challenge in predicting COVID-19 caseload increases. *Infectious Disease Reports* **13**, 340-347.
- Sun, Y. and Monnat, S. M. (2021).** Rural-urban and within-rural differences in COVID-19 vaccination rates. *The Journal of Rural Health* **2021**, doi: 10.1111/jrh.12625.
- Trouillet-Assant, S., Viel, S., Gaymard, A., Pons, S., Richard, J., Perret, M., Villard, M., Brengel-Pesce, K., Lina, B., Mezidi, M., Bitker, L., Belot, A. and COVID HCL Study group. (2020).** Type I IFN immunoprofiling in COVID-19 patients. *Journal of Allergy and Clinical Immunology* **146(1)**, 206-208.e2.
- Turke, P. W. (2021).** Five reasons COVID-19 is less severe in younger age-groups. *Evolution, Medicine, and Public Health* **9(1)**, 113-117.
- WHO, World Health Organization. (2022).** COVID-19 Dashboard – Syria. WHO: <https://app.powerbi.com/view?r=eyJrIjoiaWY5OQYzNDYtNjZhMy00MWlyLWlyMzctYzc4MmI3ZDNIODk5IiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIslmMiOjh9> [Retrieved on 9 April 2022].
- Worldometer. (2022).** COVID Live – Coronavirus Statistics. Worldometer: <https://www.worldometers.info/coronavirus/#countries> [Retrieved on 9 April 2022].
- Worobey, M. (2021).** Dissecting the early COVID-19 cases in Wuhan. *Science* **374(6572)**, 1202-1204.
- Xu, S., Huang, R., Sy, L. S., Glenn, S. C., Ryan, D. S., Morrisette, K., Shay, D. K., Vazquez-Benitez, G., Glanz, J. M., Klein, N. P., McClure, D., Liles, E. G., Weintraub, E. S., Tseng, H. and Qian, L. (2021).** COVID-19 vaccination and non-COVID-19 mortality risk – Seven Integrated Health Care Organizations, United States, December 14, 2020-July 31, 2021. *Morbidity and Mortality Weekly Report* **70(43)**, 1520-1524.
- Yan, Y., Shin, W. I., Pang, Y. X., Meng, Y., Lai, J., You, C., Zhao, H., Lester, E., Wu, T. and Pang, C. H. (2020).** The first 75 days of novel coronavirus (SARS-CoV-2) outbreak: Recent advances, prevention, and treatment. *International Journal of Environmental Research and Public Health* **17**, 2323.
- Yanez, N. D., Weiss, N. S., Romand, J. and Treggiari, M. M. (2020).** COVID-19 mortality risk for older men and Women. *BMC Public Health* **20**, 1742.
- Yang, Y., Peng, F., Wang, R., Guan, K., Jiang, T., Xu, G., Sun, J. and Chang, C. (2020).** The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *Journal of Autoimmunity* **109**, 102434.
- Yupari-Azabache, I., Bardales-Aguirre, L., Rodriguez-Azabache, J., Barros-Sevillano, J. S. and Rodríguez-Díaz, A. (2021).** COVID-19 mortality risk factors in hospitalized patients: A logistic regression model. *Revista de la Facultad de Medicina Humana* **21(1)**, 19-27.
- Zhang, X. B., Hu, L., Ming, Q., Wei, X. J., Zhang, Z. Y., Chen, L. D., Wang, M. H., Yao, W. Z., Huang, Q. F., Ye, Z. Q., Cai, Y. Q. and Zeng, H. Q. (2021).** Risk factors for mortality of coronavirus disease-2019 (COVID-19) patients in two centers of Hubei province, China: A retrospective analysis. *PLoS ONE* **16(1)**, e0246030.