COVID-19 infection: comparing the knowledge, attitude and practices in a sample of nursing students

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Abstract. Background: SARS-CoV-2 infection is a global health problem that is primarily detected in Italy with progressive increase in cases and deaths. To facilitate the management of the pandemic in Italy, it is essential to understand the level of attention on COVID-19. The aim of the study was to evaluate the knowledge, attitude and practices towards SARS-CoV-2 among the nursing students of University of Palermo during the rapid rise period of the COVID-19 pandemic. Methods: The current study was a cross-sectional study. On-line questionnaires were used for the collection of the data by providing a survey in all nursing students. The questionnaire consisted of two parts: demographics and Knowledge, Attitude and Practices (KAP) survey. A multivariate linear regression model was used and adjusted Odds Ratios (aOR) are presented. Results: 525 students were interviewed and their mean age was 21.8. The overall score indicates good practices among the three courses of study (p=0.025). The Multivariable logistic regression showed that the dependent variable “Practice poor score” is statistically significant associated with these independent variables: “Other country of birth” (aOR 17.7, 95% CI 2.31-136.03), “second” (aOR 2.65, 95% CI 1.21-7.80) and “third” (aOR 2.96, 95% CI 1.31-6.72) year of study, “low perceived health status” (aOR 2.35, 95% CI 1.04-5.30) and “Knowledge poor score (aOR 3.05, 95% CI 1.06-8.77). Conclusion: Our results suggest that health education programs aimed at improving COVID-19 knowledge are helpful for nursing students to hold optimistic attitudes and maintain appropriate practices. (www.actabiomedica.it)

Key words: Knowledge, Attitude, Practice, COVID-19, Italy, University students

Introduction

The outbreak of new pathogens that cause lethal human respiratory diseases with pandemic potential poses major challenges and quickly focus the attention of global public health authorities (1). Until a few months ago, two zoonotic coronaviruses, SARS-CoV and MERS-CoV, cause of respiratory tract infections in humans and with pandemic potential, appeared in the WHO Blueprint of priority pathogens for research and development. The first case of coronavirus due to Severe Acute Respiratory Syndrome (SARS) was first identified in the Chinese province of Guangdong in 2002-2003 and a second coronavirus is the one that caused Middle East Respiratory Syndrome (MERS) in 2012 (2-4). At the end of 2019, a new zoonotic coronavirus, SARS-CoV-2, was first reported in Wuhan, China, and was included on the WHO priority Blueprint list. The disease caused by SARS-CoV-2, abbreviated as COVID-19 (COrona-VIRus Disease-2019),
is widespread within China at an alarming rate and in the following weeks has spread all over the world, so that, on 11 March 2020 the WHO declared the outbreak a pandemic (5). The rapid spread that occurred in China, despite a “lock” of Wuhan through the suspension of public transport, the closure of public spaces, the close management of communities and isolation, has led to numerous chains of transmission and spread of the virus that was facilitated by the rush to travel nationally and internationally during the New Year holidays, which saw hundreds of thousands of people leave the city and carry the virus (6). The world has become increasingly susceptible to the advent of new infectious diseases that can spread rapidly due to the ease with which you move within regions and continents. To date, the virus has more than 3 million cases and about 220,000 deaths. In Italy alone, the total registered cases of the pandemic are more than 209,000, with a death toll of almost 29,000, in second place among the top 5 countries for local transmission in Europe (7). Numerous investigations and research into the COVID-19 epidemic quickly defined the epidemiological, virological and clinical characteristics, and provided evidence of human transmission in community, home and hospital settings (8). The time from exposure to the virus until the symptoms is between 2 and 14 days. As with SARS and MERS, the reported data present a series of clinical manifestations, from asymptomatic subclinical infection or mild respiratory tract disease and severe pneumonia that progresses to acute respiratory distress syndrome (ARDS) with need of intensive care, and even lead to death. While the world is waiting for the development of an effective vaccine and specific drugs for the treatment of people affected by SARS-CoV-2, the most important weapon available to minimize the risk of spreading the virus, is the respect of adequate preventive measures. Social distancing, the correct use of masks, the frequent washing of hands, avoiding touching the nose, mouth and eyes with dirty hands, are fundamental preventive measures to limit the spread of the virus in the general population, while the correct use of adequate PPE protects Health-Care Workers (HCWs) and, consequently, patients. Of course, the main goal is to minimize the risk of virus circulation and spread nationally and internationally and to identify and isolate infected patients quickly and safely. Aggressive isolation measures in China have led to a progressive reduction in cases. In Italy, the political and health authorities have paid the utmost attention to measures to contain the contagion throughout the national territory in order to face an emergency that is severely testing the health system. To date, one of the main objectives is to sensitize and educate the population on preventive measures to reduce infections, evaluating Knowledge, Attitudes and Practices at this critical moment. To facilitate the management of the epidemic in Italy, it is essential to understand the level of attention on COVID-19 also by HCWs, at high risk of infection or becoming vehicles of the virus, in order to improve their knowledge and attitudes towards the infection that will inevitably be reflected in general health.

Aim

The aim of the study was to evaluate the knowledge, attitude and practices towards SARS-CoV-2 among the nursing students of University of Palermo during the rapid rise period of the COVID-19 pandemic.

Materials and methods

Study design

This cross-sectional survey was conducted on March 2020 the week immediately after the lockdown of Italy. A survey was provided to all nursing students of University of Palermo of the three years of course, accompanied by informed consent. Nursing students who understood the aims of the study, and agreed to participate in the study were instructed to complete the on-line questionnaire via clicking a special link. Because it was not feasible to do a community-based national sampling survey during the lockdown, we decided to collect the data online during the lessons, students completed the questionnaire during the lesson, within the 20-minute interval allowed for the break during the lesson.
**Instrument**

The questionnaire consisted of two parts: demographics and Knowledge, Attitude and Practices (KAP) survey. In the first section of the questionnaire, personal information was requested, relating to the course of study undertaken, the perception of the economic and health status and voluptuary habits. According to guidelines for clinical and community management of COVID-19 by the Ministry of Health of Italy (9), a KAP Survey (see Table 1) was designed and modified from previously published research articles (10,11). It consists of mainly three sections: Knowledge of nursing students towards COVID-19 in which the options “Yes” or “No” against each set of 13 questions were evaluated; Attitude of nursing students towards COVID-19 in which five options “Strongly agree (SA)”, “Agree (A)”, “Undecided (U)”, “Disagree (D)”, “Strongly disagree (SD)” against each set of 7 questions were used; and Practice of nursing students towards COVID-19 in which the options “Yes”, “No” or “Sometimes” against each set of 8 questions were evaluated. Three scores can be obtained from the KAP Survey respectively. Knowledge score was assessed by giving 1 to correct answer and 0 to wrong answer. The scale measured knowledge of maximum 13 to minimum 0. Score of < 9 were taken as poor while ≥ 9 as good. Assessment of attitude was carried out through item questions in which the responses were recorded on 5 point likert scale: a score of 1 was given to “SA”, 2 to “A”, 3 to “U”, 4 to “D” and 5 to “SD”. A mean score of ≤2 was considered as positive attitude while score of 3-5 was taken as negative attitude. Questions of practices have an overall practice score that ranged from 0 to 8. From the “yes” option was given a score of 1, from the other options (“no” or “Sometimes”) it was given a null score. Finally practice scores were dichotomized to good practice (1 point) with score ≥ 6 or poor practice (0 point) with score < 6.

**Data Analysis**

For all qualitative variables absolute and relative frequencies have been calculated; categorical variables were analyzed by Pearson’s Chi-square test ($\chi^2$). A multivariable logistic regression was performed, considering it as a dependent variable “practice poor score”, in order to evaluate the role of the variables in the first section of the questionnaire. The statistical significance level chosen for all analyzes was 0.05. The results were analyzed using the STATA statistical software version 14 (12). Results are expressed as adjusted Odds Ratio (aOR) with 95% Confidence Intervals (95% CI).

Ethical approval was given by the local Ethical Committee of the University Hospital Paolo Giaccone of Palermo, No. 03/2020 (13. Studio Sars-CoV 2 - KAP Survey Student) of March 16, 2020.

**Results**

A total of 525 nursing students were included (response rate of 99.3%). The study showed that the mostly participants were female (70.3%) and the mean age was 21.8 (Standard Deviation ± 3.83). 37.5% of participants reported attending the first year of study, 35.3% second year of study, 27.2% third year of study 19.2% reported a low economic status whilst 8.57% reported a low perceived health status. A total of 501 (95.4%) respondents showed good knowledge while 24 (4.6%) of nursing students had poor knowledge of SARS CoV-2. Of 525 respondents, 478 (91.1%) showed positive attitude while 47 (8.9%) participants displayed negative attitude about SARS CoV-2. The majority of the studied sample (89.3%) reported good practice and 10.7% reported poor practice. For more details see Table 2 that shows the demographic characteristics of the participants. Table 3 shows bivariate associations between knowledge, attitude, practice score and years of university course attended. The overall score indicates good practices among first year (93.9%), second year (87.6%), third year (85.3%) showed statistically significant (p=0.025). No statistically significant results were showed for the overall score of knowledge and attitudes. Finally, Table 4 shows the aOR, each independent variable is adjusted for all the other independent variables. Considering the dependent variable: “Practice poor score” the statistically significant independent variables associated are: “Other country of birth” (aOR 17.7, 95% CI 2.31-136.03), “second” (aOR 2.65, 95% CI 1.21-7.80) and “third” (aOR 2.96, 95% CI 1.31-6.72) year of study, “low perceived health status”(aOR 2.35, 95% CI 1.04-5.30) and “Knowledge poor score (aOR 3.05, 95% CI 1.06-8.77).
Table 1. KAP Survey towards COVID-19

| Questions         | A1. Transmission of SARS CoV-2 infection can be prevented by using universal precautions given by CDC, WHO |
|-------------------|-----------------------------------------------------------------------------------------------------------|
| K1. SARS CoV-2 is caused by beta-coronavirus          | A2. Prevalence of SARS CoV-2 can be reduced by active participation of HCWs in hospital infection control program |
| K2. SARS CoV-2 patients develop severe acute respiratory illness | A3. Any related information about SARS CoV-2 should be disseminated among peers and other HCWs             |
| K3. Fever, cough and shortness of breath are hallmark symptoms of SARS CoV-2 | A4. SARS CoV-2 patients should be kept in isolation                                                     |
| K4. People with co-morbidity (Diabetes, cancer and other chronic diseases) are more likely to be infected | A5. Intensive and emergency treatment should be given to diagnosed patients                             |
| K5. Incubation time for virus is 14-28 days            | A6. HCWs must acknowledge themselves with all the information about SARS CoV-2                       |
| K6. SARS CoV-2 spreads with greater probability following close contact with infected people | A7. Gowns, gloves, mask and googles must be used when dealing with SARS CoV-2 patients                 |
| K7. The main source of SARS CoV-2 is plant             | A8. Use soap and water to wash my hands continuously                                                  |
| K8. Washing hand with soap and water for at least 30 secs can help in prevention of transmission of disease | A9. Cover my nose and mouth with a tissue during sneezing or coughing                                 |
| K9. Vaccination of SARS CoV-2 is available in market   | A10. Any related information about SARS CoV-2 should be disseminated among peers and other HCWs        |
| K10. Polymerase Chain Reaction (PCR) can used to diagnose SARS CoV-2 | A11. SARS CoV-2 patients should be kept in isolation                                                  |
| K11. Special attention must be paid if a person has characteristic symptoms after staying in major areas contagion risk | A12. Intensive and emergency treatment should be given to diagnosed patients                         |
| K12. Antibiotics are first line treatment               | A13. Gowns, gloves, mask and googles must be used when dealing with SARS CoV-2 patients               |
| K13. SARS CoV-2 can be fatal                           | P1. Use soap and water to wash my hands continuously                                                  |
| A1. Transmission of SARS CoV-2 infection can be prevented by using universal precautions given by CDC, WHO | P2. Cover my nose and mouth with a tissue during sneezing or coughing                                 |
| A2. Prevalence of SARS CoV-2 can be reduced by active participation of HCWs in hospital infection control program | P3. Throw the used tissue in the trash                                                               |
| A3. Any related information about SARS CoV-2 should be disseminated among peers and other HCWs | P4. Avoid touching my eyes, nose or mouth as far as I can                                              |
| A4. SARS CoV-2 patients should be kept in isolation    | P5. Use face mask in crowds                                                                           |
| A5. Intensive and emergency treatment should be given to diagnosed patients | P6. Carefully handle suspected patient’s belongings                                                   |
| A6. HCWs must acknowledge themselves with all the information about SARS CoV-2 | P7. Keep on healthy eating and health styles                                                           |
| A7. Gowns, gloves, mask and googles must be used when dealing with SARS CoV-2 patients | P8. Used to educate clients about the disease                                                          |

Discussion

Today the COVID-19 pandemic, mediated by the SARS-CoV-2 virus, is a topic of daily debate particularly on social media and involves, in times of public health crisis, directly the health systems, all Health Care Workers (HCWs) but also the patients. Among the strengths of our study is the involvement of future HCWs and the association between their knowledge in relation to SARS-CoV-2 with practice. Among the students of the degree course in nursing at the University of Palermo, there is a good general knowledge of SARS-CoV-2, according to what emerges from the literature regarding medical students (13), given the absence of data for studies on nursing students. The most interesting results of our study emerge from multivariable logistic regression, in which each independent variable is adjusted for all other independent variables, with the aOR results shown in Table 4. The dependent variable “Poor Knowledge Score” is asso-
associated in a statistically significant way (p <0.05) with several independent variables, which, for convenience and clarity, we analyze individually below. The independent variable “Country of birth: Other” (aOR 17.73, IC 2.31-136.03) despite having a p value = 0.006, a value that is statistically very significant in itself, is simultaneously associated with a decidedly large IC, so despite the significance of the p value, the data loses consistency when the IC is taken into consideration. The independent variables “Year of study: Second - Third” (Second: aOR 2.65, IC 1.21-7.80, Third: aOR 2.96 IC 1.31-6.72) present in both cases statistically significant p values (p = 0.015 and p = 0.009 ), joining a “Poor Knowledge Score”. This observation is apparently a contradiction. Proceeding with the studies should give the student more and more knowledge,

| Table 2. Description of the sample |
|-----------------------------------|
| Gender                           | N  | %  |
| Male                             | 156 | 29.71 |
| Female                           | 369 | 70.29 |
| Country of birth                 |    |     |
| Italy                            | 520 | 99.05 |
| Other                            | 5   | 0.95 |
| Year of study                    |    |     |
| First                            | 197 | 37.52 |
| Second                           | 185 | 35.24 |
| Third                            | 143 | 27.24 |
| Perceived economic status        |    |     |
| Medium-high                      | 424 | 80.76 |
| Low                              | 101 | 19.24 |
| Perceived health status          |    |     |
| Medium-high                      | 480 | 91.43 |
| Low                              | 45  | 8.57 |
| Knowledge score                  |    |     |
| Good                             | 501 | 95.43 |
| Poor                             | 24  | 4.57 |
| Attitude score                   |    |     |
| Positive                         | 478 | 91.05 |
| Negative                         | 47  | 8.95 |
| Practice score                   |    |     |
| Good                             | 469 | 89.33 |
| Poor                             | 56  | 10.67 |
| Age                              | 21.83 (SD ± 3.83)* |

*mean (Standard Deviation)

| Table 3. Mean score of knowledge, attitude and Practices of nursing students about SARS CoV-2 |
|-----------------------------------------------|
| Knowledge | Attitude | Practices |
| Good (% ) | Poor (% ) | p-value | Positive (% ) | Negative (% ) | p-value | Good (% ) | Poor (% ) | p-value |
|-----------|-----------|---------|--------------|---------------|---------|-----------|-----------|---------|
| First year| 188 (95.43) | 9 (4.57) | 0.970 | 175 (88.83) | 22 (11.17) | 0.204 | 185 (93.91) | 12 (6.09) | 0.025 |
| Second year | 177 (95.68) | 8 (4.32) | 168 (90.81) | 17 (9.19) | 162 (87.57) | 23 (12.43) |
| Third year | 136 (95.10) | 7 (4.90) | 135 (94.41) | 8 (5.59) | 122 (85.31) | 21 (14.69) |

Used Pearson chi-square test
instead we observe exactly the opposite phenomenon, and we do not find anything similar in literature. This is probably a limitation of our study, which will have to be re-evaluated following specific training for COVID-19 aimed at students of the nursing degree course. The purpose of the specific training is to understand if these gaps are linked to objective deficiencies in the content of the course of study or to a methodological error in our study.

The independent variable “Perceived health status: Low” (aOR 2.35, IC 1.04-5.30) has a value of p = 0.039, therefore statistically significant. Students who perceive a poor state of health are likely to document more than those who perceive a good state of health, and this type of approach ends in a period, such as the one we are experiencing, in which we face the pandemic caused by SARS-CoV-2 and the sources of information are varied. A good method to avoid information overload for health professionals who are on the front line for which the influx of new information is extremely rapid and from multiple sources, could be the creation of short summary documents with the most up-to-date information, allowing healthcare workers to read up quickly, avoiding the stress of having to draw from multiple sources (14). The independent variable “KAP Knowledge: Poor” (aOR 3.05, IC 1.06-8.77) has a value of p = 0.038, therefore statistically significant, in relation to the dependent variable “Practice poor score” according to what emerges in the literature (15). This observation is extremely important as it associates the knowledge of SARS-CoV-2, and therefore the “Knowledge” Score, to the Practice. The results of our KAP survey on the students of the degree course in Nursing at the University of Palermo highlight the importance and the need to improve some aspects of the knowledge of SARS-CoV-2, which, consequently, can also lead to improvements in their practices (16). HCWs, today more than ever, play a fundamental role in the contrast of SARS-CoV-2, both as regards the therapeutic and preventive as-

### Table 4

| Independent variables                  | aOR   | 95% CI      | p-value |
|----------------------------------------|-------|-------------|---------|
| Gender                                 |       |             |         |
| Male                                   | 1     |             |         |
| Female                                 | 1.27  | 0.66-2.47   | 0.471   |
| Country of birth                       |       |             |         |
| Italy                                  | 1     |             |         |
| Other                                  | 17.73 | 2.31-136.03 | 0.006   |
| Year of study                          |       |             |         |
| First                                  | 1     |             |         |
| Second                                 | 2.65  | 1.21-7.80   | 0.015   |
| Third                                  | 2.96  | 1.31-6.72   | 0.009   |
| Perceived economic status              |       |             |         |
| Medium-high                            | 1     |             |         |
| Low                                    | 1.23  | 0.62-2.45   | 0.559   |
| Perceived health status                |       |             |         |
| Medium-high                            | 1     |             |         |
| Low                                    | 2.35  | 1.04-5.30   | 0.039   |
| KAP Attitude                           |       |             |         |
| Positive                               | 1     |             |         |
| Negative                               | 1.24  | 0.47-3.29   | 0.663   |
| KAP Knowledge                          |       |             |         |
| Good                                   | 1     |             |         |
| Poor                                   | 3.05  | 1.06-8.77   | 0.038   |
| Age                                    |       |             |         |
| As the unit increase                   | 0.98  | 0.66-2.47   | 0.471   |
pects, so it is of fundamental importance that the basic knowledge is solid in order to decrease the risk of work infection and maximize the effectiveness of preventive measures, the only real weapons available in the absence of both an approved SARS-CoV-2 vaccine and specific therapy (17).

Conclusions

In summary, our findings suggest that nursing students of the University of Palermo have had a good level of knowledge, optimistic attitudes, and appropriate practices towards COVID-19 during the rapid rise period of the COVID-19 outbreak. In reality, the study shows a deterioration of knowledge as students progressed through their program; nevertheless, students reported adequate practice and positive attitudes about the infection. Limit of our study or not, this result indicates that health education programs aimed at improving COVID-19 knowledge are helpful for encouraging an optimistic attitude and maintaining safe practices, demonstrating that surveillance and infection control measures are basic for global public health, especially in nurses or other HCWs category. However, the global pandemic opened up opportunities to the country to upgrade its educational mode of delivery and transfer its attention to emerging technologies. Higher education institutions thereby need to seize the opportunity to strengthen its evidence-based practices, provide accessible mental health-related services, and make the curriculum responsive to the needs of the changing times. Therefore, health care workers’ knowledge, attitude and practice play a major role in the prevention and restrain in complications of SARS-CoV-2 infection, in accordance with KAP theory.

Ethical approval: This study was approved by the Ethical Committee of the University Hospital “P. Giaccone” of Palermo, Minutes No. 03/2020 (13) of March 16, 2020.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

References

1. Zumla A, Hui DSC. Emerging and Reemerging Infectious Diseases: Global Overview. Infect Dis Clin North Am. 2019;33(4):xiii-xix. doi:10.1016/j.jidc.2019.09.001
2. WHO. A research and development Blueprint for action to prevent epidemics. Available from: https://www.who.int/teams/blueprint
3. Hui DS, Memish ZA, Zumla A. Severe acute respiratory syndrome vs. the Middle East respiratory syndrome. Curr Opin Pulm Med. 2014;20(3):233–241. doi:10.1097/MCP.000000000000046
4. Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. [The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]. Zhonghua Liu Xing Bing Xue Za Zhi. 2020 Feb 17;41(2):145-151. doi: 10.3760/cma.j.isn.0254-6450.2020.02.003. [Epub ahead of print] Chinese. PubMed PMID: 32064853.
5. Ippolito G, Hui DS, Ntoumi F, Maeurer M, Zumla A. Toning down the 2019-nCoV media hype and restoring hope. Lancet Respir Med. 2020;8(3):230-231. doi:10.1016/S2213-2600(20)30070-9
6. Haider N, Yavlinsky A, Simons D, et al. Passengers’ destinations from China: low risk of Novel Coronavirus (2019-nCoV) transmission into Africa and South America. Epidemiol Infect. 2020;148:e41. Published 2020 Feb 26. doi:10.1017/S0950268820000424
7. Italian Ministry of Health. Novel coronavirus (2020). Available from: http://www.salute.gov.it/portale/nuovocoronavirus/dettaglioContenutiNuovoCoronavirus.jsp?area=nuovoCoronavirus&id=5351&menu=nuovo
8. Lu R, Zhao X, Li J, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet. 2020;395(10224):565-574. doi:10.1016/S0140-6736(20)30251-8
9. Italian Ministry of Health. Novel coronavirus (2020). Available from: http://www.salute.gov.it/nuovocoronavirus?gclid=EAIaIQobChMIwav3wYzq6AIVFeaaCh1iEy8mEAYASAAEgL8eID_BwE
10. Nour MO, Babligith AO, Natto HA, Al-amin FO, Alawneh SM. Knowledge, attitude and practices of healthcare providers towards MERS-CoV infection atMakkah hospitals. KSA 2015;3(October):103–12.
11. Khan MU, Shah S, Ahmad A, Fatokun O. Knowledge and attitude of healthcareworkers about middle east respiratory syndrome in multispecialty hospitals of qassim, Saudi Arabia. BMC Public Health 2014;14:1281.
12. StataCorp 2015. Stata Statistical Software. Release 14. College Station, TX: StataCorp LP.
13. Taghrir MH, Borazjani R, Shiraly R. COVID-19 and Iranian Medical Students; A Survey on Their Related-Knowledge, Preventive Behaviors and Risk Perception. Arch Iran Med. 2020 Apr 1;23(4):249-254. doi: 10.34172/aim.2020.06. PubMed PMID: 32271598
14. Poonia SK, Rajasekaran K. Information Overload: A Meth-
15. Zhong BL, Luo W, Li HM, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. Int J Biol Sci. 2020;16(10):1745–1752. Published 2020 Mar 15. doi:10.7150/ijbs.45221

16. Tachfouti N, Slama K, Berraho M, Nejjari C. The impact of knowledge and attitudes on adherence to tuberculosis treatment: a case-control study in a Moroccan region. Pan Afr Med J. 2012;12:52. Epub 2012 Jun 28. PubMed PMID:22937192; PubMed Central PMCID: PMC3428172.

17. Ahn DG, Shin HJ, Kim MH, et al. Current Status of Epidemiology, Diagnosis, Therapeutics, and Vaccines for Novel Coronavirus Disease 2019 (COVID-19). J Microbiol Biotechnol. 2020 Mar 28;30(3):313-324. doi: 10.4014/jmb.2003.03011. Review. PubMed PMID: 32238757.