

## RESEARCH ARTICLE

# Students' belief towards COVID-19 vaccine: A challenge in reopening university

Nor Azimah Abd Aziz<sup>1</sup>, Mohammad Ghazali Masuri<sup>2</sup>, Ajau Danis<sup>3</sup>, Siti Nor Ismalina Isa<sup>3</sup>, Kartini Illias<sup>3</sup>, Mathumalar Loganathan<sup>5</sup>, Khairil Anuar Md Isa<sup>3,4\*</sup>

<sup>1</sup>Department of Ophthalmology, Faculty of Medicine, Universiti Teknologi MARA Cawangan Selangor Kampus Sungai Buloh, 47000 Jalan Hospital Sungai Buloh, Selangor, Malaysia; <sup>2</sup>Centre of Occupational Therapy, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; <sup>3</sup>Department of Basic Sciences, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; <sup>4</sup>Institute for Biodiversity and Sustainable Development (IBSD), Universiti Teknologi MARA, 40450 Shah Alam, Selangor, <sup>5</sup>Faculty of Pharmacy, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

## Abstract:

Little is known about health sciences students' belief and its relation to COVID-19 vaccine uptake as vaccination program was already taken place in Malaysia. An anonymous electronic survey of health sciences students was conducted at one large Malaysian university setting. The objectives of this study were the students' beliefs and actual behaviour towards Covid-19 vaccines. Students' beliefs about COVID-19 vaccines were elicited through a series of questions about the vaccine's acceptance, the risk of COVID -19 exposure, the perceived severity of COVID -19 and their negative attitudes towards vaccination. The main outcome of the study was the students' acceptance of COVID-19 vaccines and multiple logistics regression was performed to elucidate associated factors related to COVID-19 vaccine acceptance. A total of 275 students participated in this survey. The average age of the participants was 21.9(0.9) and more than three quarters of them (82.5%) were female. Most of the respondents have completed the COVID -19 booster vaccination (82.9%), and a higher acceptance of the vaccine 4.8 (95% CI: 4.7— 4.8). Students' risk of COVID-19 exposure, perceived severity of COVID -19 and their negative attitudes towards vaccination were measured at 0.4 (95% CI:0.3—0.5), 3.8(95% CI: 3.7—4.0) and 3.2 (95% CI: 3.1—3.2) respectively. Student belief in the safety of the COVID–19 vaccine was the only significant factor in vaccine acceptance. While health sciences students reported having high acceptance and vaccine uptake, concerns about the safety of the vaccine safety remained.

**Keywords:** Belief, COVID-19, health-behaviour, student, vaccine

## \*Corresponding Author

Khairil Anuar Md Isa  
Email:  
khairil996@uitm.edu.my

## 1. INTRODUCTION

The 2019 coronavirus pandemic (COVID-19) continues to pose a public health and societal challenge worldwide (Bouza et al., 2020; Ladhani et al., 2020; Li et al., 2020; Tsai et al., 2022). In Malaysia, concerted public health efforts are being made at all levels, from local to national, to protect the population, especially those most at risk of severe illness and death (Abdul Taib et al., 2022; Jayasundara et al., 2021; Marzo et al., 2022).

As of October 2022, many universities in Malaysia, has resumed face-to-face classes after a hiatus of about 2 years. Although there are many classes that are conducted in a hybrid manner, some of them are conducted entirely face to face. The reopening of the universities and campuses brings with it new

challenges and associated risks for transmission on campuses and in the surrounding communities (Wilson et al., 2020).

Although the risk of severe health outcomes from COVID-19 is relatively low in young adults without underlying health history, university students who are in close contact with faculty members, university staff and in the community are at significantly higher risk for COVID-19 should they become infected. As we can clearly see in the US, young adults were contributing to the sharp regional increase in COVID-19 infections in the southern US in June 2020, following the opening of colleges and universities (Boehmer et al., 2020).

In the run-up to the start of the semester, universities managements have planned and implemented various COVID

-19 prevention measures and actions in case students are infected. However, as this is our first attempt to reopen the universities nationwide, there is limited evidence from the university environment to prove the impact of many specific efforts employed. Besides, we still do not know how students' belief about vaccines and how they behave because the vaccine has already been administered to the Malaysian population. Therefore, in this study we would like to investigate the students' beliefs and actual behaviour towards Covid-19 vaccines. The findings can serve as a basis for strategies and nationwide measures that could contain the spread of Covid 19 in university areas and campuses in the event of an outbreak.

## 2. MATERIALS AND METHODS

### 2.1. Design

A cross-sectional survey was conducted online among health sciences university students in Faculty of Health Sciences, Universiti Teknologi MARA (UiTM) Kampus Selangor, Bandar Puncak Alam, Malaysia (latitude N 3° 12.0456', longitude E 101° 26.8446) between September to November 2022. This faculty comprised of eight schools namely school of nursing, dietetic, medical lab technology, optometry, occupational therapy, physiotherapy, medical imaging and school of environmental health and safety. Participants were over 18 years old and currently enrolled as full-time students at UiTM. They were contacted via social media and email with invitation survey web-link to participate in this survey. The survey took less than 10 minutes to complete. Participants were encouraged to share the link with other students. The study protocol was approved by the UiTM Ethics Committee.

### 2.2. Sample

#### Instrument development and measures

The questionnaire used in this study was developed based on literature review and discussion with several faculty members. They also were asked to review the questionnaire to ensure the content validity of the survey items. Prior to distribution of the questionnaires, a pilot survey (n=30) was conducted to improve the clarity of the items and the use of wording. The data from the pilot survey was not used for further analysis and was only used to assess the face validity of the questionnaires. The final version of the questionnaire took less than 10 minutes to complete. The questionnaire was developed in English, as the lectures are mainly given in this language, and they have a good command of it. A copy of the sample questionnaire can be obtained by emailing to correspondence author.

Participants' sociodemographic characteristics were obtained by asking questions about their gender, age, smoking, scholarship status, accommodation during the academic semester and their health insurance. Study participants were also asked about their medical history by asking if they had been diagnosed with various chronic conditions and diseases. They were also asked if they had had COVID-19 related symptoms in the last 6 months and if they had received a Covid-19 vaccination.

Students' beliefs were elicited through a series of questions about the acceptance towards COVID-19 vaccine, the risk of COVID -19 exposure, the perceived severity of COVID -19 and their negative attitudes towards vaccination. Acceptance of the Covid-19 vaccine was measured by asking participants if they would take the Covid-19 vaccine when it became available. They answered this question on a five-Likert scale (1=Definitely not at all to 5=Definitely take it). The score for this item was calculated by summing the points, with a higher score representing a higher acceptance of the Covid-19 vaccine. The risk of Covid-19 exposure was asked through two items. The first item asked participants about their risk of getting Covid-19 due to work exposure, and the second item asked about their risk of getting Covid-19 due to personal exposure. Participants could choose between three response options (true, false and not sure). To assess risk exposure, each item was dichotomized into 0 (false or not sure) and 1 (true) to indicate the occurrence of exposure. A summed score was calculated, with a higher score representing a higher risk of Covid-19 exposure.

Participants were also asked about their perceived severity of Covid-19. This was assessed by participants' agreement with the statement "Covid-19 is just a flu-like disease and is generally harmless." They could choose between 1=strongly disagree and 5=strongly agree on a five-point Likert scale. The answers were then reverse coded, with a higher score representing a higher severity of Covid-19.

To ask participants about their negative attitudes towards vaccination, four questions were asked: 'Vaccines are safe', 'Vaccines have side effects', "Vaccines contain dangerous ingredients" and "Vaccines cause long-term harm'. Respondents rated each item on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Summated scores were formed, with a higher score indicating a higher level of negative attitudes towards vaccination.

### 2.3. Statistical analysis

SPSS version 21.0 (SPSS Inc., Chicago, IL) was used for data entering and data analysis. Categorical data were reported as frequencies and percentages. Prior to data analysis, data were checked for outliers and normality based on box's plot

and histogram. Numerical data were reported as mean and standard deviation for normal data however for non-normal data their median and inter quartile range were reported.

The main outcome of the study was the students' acceptance of COVID-19 vaccines. In order to determine the factors that affect the acceptance among the student population to receive COVID-19 vaccines, multiple logistics regression was performed. At first, potential predictors for COVID-19 acceptance were screened using univariate logistic regression, and variables with  $p < 0.25$  were considered in multiple logistic regression analysis. Vaccine acceptability outcome was recorded in two binary variables (acceptable [1] and not acceptable [0]), with students who responded 4 or 5 recorded as 1, while those who responded 1, 2 or 3 recorded as 0. A p-value of less than 0.05 was considered as statistically significant.

### 3. RESULTS AND DISCUSSION

A total of 275 students participated in this survey. The average age of the participants was 21.9(0.9) and more than three quarters of them (82.5%) were female. About half of the respondents (45.8%) received a scholarship. In addition, 35.6% reported having health insurance. The proportion of current and former smokers was 2.9% and 3.3% respectively. More than half of the respondents lived in a student residence (54.2%), followed by rented accommodation (42.2%) and accommodation with parents or family members (3.6%). Detailed demographics are presented in Table 1.

Table 1. Demographic characteristics of study participants (N=275).

Variable	N	(%)
<b>Gender</b>		
Male	48	(17.5)
Female	227	(82.5)
<b>Age, Mean (SD)</b>	21.9	(0.9)
<b>Health insurance coverage</b>		
Insured	98	(35.6)
Uninsured	177	(64.4)
<b>Scholarship status</b>		
Receiver	126	(45.8)
Non receiver	149	(54.2)
<b>Smoking status</b>		
Not a smoker	258	(93.8)
Ex-smoker	9	(3.3)
Current smoker	8	(2.9)
<b>Accommodation during academic semester</b>		
Living in hostel	149	(54.2)

Living with parents or family members	10	(3.6)
Living in rental house or apartment	116	(42.2)

The majority of the respondents have completed the COVID-19 booster vaccination (82.9%), surprisingly six (2.2%) of the respondents have not received any vaccination yet. Half of the respondents reported suffering from symptoms such as runny nose (51.6%), sore throat (50.9%) and fatigue (51.3%) in the last 6 months. Most of the respondents had not reported any chronic diseases, with less than 3% having chronic diseases, with chronic lung disease being the most frequently reported (2.9%). About 28% of respondents reported that they may be infected with COVID-19 in the last 6 months, with 55 and 49 respondents testing positive either by rapid test/serology or RT-PCR (Table 2).

Table 2. COVID-19 vaccine related information and medical history

Information	N	(%)	
<b>Have you received the influenza (COVID-19) vaccine?</b>			
Completed booster	228	(82.9)	
1 <sup>st</sup> dose vaccine	2	(0.7)	
2 <sup>nd</sup> doses vaccine	39	(14.2)	
Not taking any	6	(2.2)	
<b>For the past 6 months, did you experience any of these symptoms?</b>	<b>Yes</b>	<b>No</b>	<b>Unknown</b>
Fever more than 38°C	69(25.1)	192(69.8)	14(5.1)
Subjective fever (felt feverish)	128(46.5)	133(48.4)	14(5.1)
Chills	116(42.2)	149(54.2)	10(3.6)
Rigors	69(25.1)	195(70.9)	11(4.0)
Myalgia	109(39.6)	158(57.5)	8(2.9)
Runny nose	142(51.6)	123(44.7)	10(3.6)
Sore throat	140(50.9)	130(47.3)	5(1.8)
New olfactory and taste disorder(s)	19(6.9)	245(89.1)	11(4.0)
Fatigue	141(51.3)	126(45.8)	8(2.9)
Cough (New onset or worsening of chronic cough)	92(33.5)	172(62.5)	11(4.0)
Dyspnoea (Shortness of breath)	47(17.1)	216(78.5)	12(4.4)
Wheezing	41(14.9)	221(80.4)	13(4.7)
Difficulty breathing	30(10.9)	232(84.4)	13(4.7)
Chest pain	29(10.5)	239(86.9)	7(2.5)
Nausea or vomiting	54(19.6)	211(76.7)	10(3.6)

Abdominal pain	56(20.4)	211(76.7)	8(2.9)
Diarrhoea (loose stool/24h period)	39(14.2)	231(84.0)	5(1.8)
<b>Have you been diagnosed with an underlying medical condition?</b>			
Diabetes mellitus	2(0.7)	269(97.8)	4(1.5)
Hypertension	4(1.5)	268(97.5)	3(1.1)
Cardiovascular disease	1(0.4)	267(97.1)	7(2.5)
Chronic renal disease	1(0.4)	269(97.8)	5(1.8)
Chronic lung disease (asthma/emphysema/COPD)	8(2.9)	262(95.3)	5(1.8)
Disability	1(0.4)	271(98.5)	3(1.1)
Psychological/psychiatric conditions	5(1.8)	262(95.3)	8(2.9)
<b>For the past 6 months did you ever infected with COVID-19 virus?</b>	79(28.7)	191(69.5)	5(1.8)
<b>If yes, did you confirm it by conducting and test?</b>			
Rapid test/serology	55		
RT-PCR	49		

In the present study, the respondents were found to have a higher acceptance of the vaccine. When asked how likely they would be to receive the vaccine COVID-19 if it were available, the acceptance rate of respondents was 4.8 (95% CI: 4.7-4.8). In addition, respondents were found to be at low risk of COVID-19 workplace or personal exposure, with a score of 0.4 (95% CI: 0.3—0.5). Their perceived severity of COVID -19 was on the higher side of the scale, with a mean score of 3.8 (95% CI: 3.7-4.0) observed, indicating a higher perception of the severity of COVID -19 (Table 3).

Table 3. Student’s belief towards COVID-19 vaccine

Acceptance towards COVID-19 vaccine	M	(SD)	(95% CI)
How likely are you to get a COVID-19 vaccine when it is available?	<b>4.8</b>	<b>(0.6)</b>	<b>(4.7—4.8)</b>
<b>Risk of COVID-19 exposure</b>	<b>0.4</b>	<b>(0.0)</b>	<b>(0.3—0.5)</b>
<b>Perceived severity of COVID-19</b>			
COVID-19 is just a flu-like disease and generally harmless	<b>3.8</b>	<b>(1.2)</b>	<b>(3.7—4.0)</b>
<b>Negative attitudes toward COVID-19 vaccine, Overall Score</b>	<b>3.2</b>	<b>(0.5)</b>	<b>(3.1—3.2)</b>
Vaccines are safe	4.3	(0.8)	(4.3—4.4)
Vaccines have side effects	4.1	(0.9)	(4.0—4.2)
Vaccines contain dangerous ingredients	2.2	(1.0)	(2.1—2.3)
Vaccines cause long-term harm	2.2	(1.0)	(2.1—2.3)

A negative perception of the safety and the side effects of the vaccine was observed among the study participants. Here we see that when asked about the safety of the vaccine and the side effects of the vaccine, the students gave a score of 4.3 (95% CI: 4.2—4.4) and 4.1(95% CI: 4.0—4.2) respectively. However, the study participants reported having a positive attitude when asked about the safety of the vaccine ingredients, 2.2 (95% CI:2.1— 2.3), and the long-term effect of the COVID -19 vaccines, 2.2 (95% CI:2.1— 2.3). Looking at the average overall score, participants in our study were rather negative towards the Covid-19 vaccine 3.2 (95% CI:3.1—3.2) (Table 3).

After running a multiple logistic regression to find factors related to acceptance of COVID-19 vaccine, only one variable was significant. Here it was found that a higher acceptance of the vaccine COVID-19 was observed when respondents considered the vaccine to be safe (Table 4).

Table 4. Factor associated with vaccine acceptance

Factor	OR	(95% CI)	Wald statistics(df)	p-value
COVID-19 Vaccines are safe (B=0.786)	2.2	(1.2—4.0)	6.813(1)	0.009

In the present study, we investigated the acceptance of the COVID-19 vaccine among Malaysian university students. Since the COVID-19 vaccine has been commercially available since early 2021, the Malaysian government through the Ministry of Health has been actively involved in the voluntary vaccination of the entire Malaysian population. Compared to reports from studies conducted worldwide on population acceptance and willingness to be vaccinated against COVID-19, Malaysian health science students were among the highest as 95.3% (95% CI 92.8-92.8) of our study participants were accepting COVID 19 vaccination. Based on global studies, COVID-19 vaccine acceptability ranges from 54.8% in Russia to 88.6% in China (Lazarus et al., 2020). Our results also compared favourably with a study in the USA, where 45% of dental students and 23% of medical students were reluctant to be vaccinated against COVID -19 (Kelekar et al., 2021). The study among Cameroonian university students also showed a higher negative acceptance of vaccines (Ajonina-Ekoti et al., 2022). The higher acceptance is also shown by the fact that when the vaccine was available, only 2.2% (6 students) of the total study participants hesitated to be vaccinated. We can relate the higher acceptance to the vaccine as we could see how they look at COVID-19 is not another ordinary seasonal flu but something that need to be cautions at as shown by the higher value of severity towards COVID-19. We can also relate the higher acceptance of the Covid 19 vaccine in this study to the fact that on average respondents did not perceive the COVID-19 vaccine as ordinary flu-like

disease, but as a different kind of flu if you want to compare it to the seasonal flu we used to deal with, 3.8 (95% CI: 3.7—4.0).

Several factors could play a role in the higher acceptance of the vaccine among the study participants. It is possible that study participants studying health sciences remember that they are likely to be caring for patients who are SARS-CoV-2 positive, and they think that they need to make sure that they follow the procedures in place to protect not only themselves but also the patients they are dealing with. This result was also in agreement with a study among nursing students in the USA who were willing to be vaccinated (90%) and had a high vaccination rate (70% reported having received the first dose) (Morris et al., 2022). In the present study, we also observed that vaccine uptake among study participants was high (more than 80% received the booster dose). In Malaysia, young adults were among the last group to be vaccinated, as vaccination was first administered to medical personnel and high-risk groups such as the elderly. As when their time to be vaccinated much up to date and rigorous vaccine research have come out, can play a key role in reducing vaccination concerns among those who vaccinated last. As information became available from trusted sources, any negative views about the efficacy of COVID -19 vaccines were brought to light, so giving them better understanding of its role in preventing diseases and serious illnesses (Morris et al., 2022).

Our study population who affiliated with an academic center were more willing to receive vaccine compared to reports of vaccine hesitancy in some other population studied (Ajonina-Ekoti et al., 2022; Doyle-Campbell et al., 2022; Kelekar et al., 2021). Our findings are consistent with a study among health sciences students in Texas, where hesitancy to vaccinate was also low (Hosek et al., 2022).

Although vaccine acceptance was high, there is still a negative reaction to the Covid 19 vaccine among participants in this study, who still consider the vaccine to be unsafe and to have side effects, with the average score on both questions being quite high. However, on the questions of whether the vaccine contains dangerous ingredients and causes long-term harm, the respondents in our study have a low average score, indicating a positive side of vaccine. Looking at the average overall score, participants in our study were rather negative towards the Covid-19 vaccine. As we can see from the multiple logistic regression analysis, vaccine safety is also the only significant factor predicting vaccine acceptance in this population. In a study by Doyle-Campbell et al. (2022), it was reported that respondents who were hesitant to get vaccinated mainly justified it with concern about the long-term effects of the vaccine (85%) followed by not wanting to miss an exam/class (23%). In another study among college students

also found that vaccine hesitancy was related to concerns about the safety of the vaccine, its effectiveness and information about the vaccine (Silva et al., 2021). Interestingly, a study of university students in Lebanon even reported that hesitation to vaccinate was because the students thought the vaccine was a conspiracy (Hamdan et al., 2022). A successful immunisation program requires a multi-pronged approach, not only with the government-led health program, but also with the helpful platform of social media. As we can see, one of the biggest hurdles to overcome, especially in this population, is the widespread misinformation on the internet or social media platforms. Although participants in our study have high acceptance and uptake of Covid 19 vaccines, accessing positive messages and reliable resources can be challenging. Since the Malaysian Ministry of Health requires students to provide proof of their vaccination status before they are allowed to enter their facilities, this is probably why most of our study populations have higher vaccination rates as they need to use the facilities especially during the clinical years. However, the mandatory Covid 19 vaccination is controversial in some parts of the world (Morris et al., 2022), and we can see from our sample that despite the high vaccination rate, their attitude towards the Covid 19 vaccine is still negative.

Research on social media, which disproportionately promotes hesitant attitudes towards vaccination, shows that anti-vaccination content elicits greater user engagement, with anti-vaccination tweets 4.13 times more likely to be retweeted (Puri et al., 2020). In one study by Silva et al. (2021), it was reported that nearly 60% of study participants used social media to learn about Covid-19. Therefore, it is crucial that higher authorities in higher education and public health departments counteract the negative information about the Covid-19 vaccine by specifically using the platforms preferred by students. In addition, most of our students indicated that they were more concerned about the side effects and safety of vaccines. Therefore, programs should tailor educational messages to address these specific concerns. It can be difficult to navigate health information, especially for young adults whose health care has been organised and directed by parents and caregivers for most of their lives. Overcoming vaccine hesitancy is not one-size-fits-all, but knowing the target group and their needs is an important step. Targeted education about vaccine-preventable diseases, immunology and critical thinking, delivered through various communication channels, has been shown to reduce vaccination hesitancy and defuse vaccine misinformation (Johnson et al., 2019).

Among the strengths of the study is the large sample size in one of the largest university systems in Malaysia. We also controlled for student characteristics that might be related to student mental health and underlying chronic diseases.

Limitations of the study include the cross-sectional design, which cannot establish cause and effect or directionality. The study included more female than male participants. Finally, we did not study with an interview-based type of question, mostly asked online, so some of the items may not have been fully understood, yet all items were validated with face validity before distribution of the questionnaires. Appropriate future research considering the Health Belief Model to further explore students' beliefs about vaccination is warranted.

#### 4. CONCLUSION

Understanding the student belief on vaccination in higher education especially among health sciences student is a critical step in slowing community spread and achieving COVID -19 immunity thresholds. Students surveyed have high acceptance and uptake of the COVID -19 vaccine. Students are willing to be vaccinated against COVID-19 provided the vaccines are proven safe.

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#### REFERENCES

- Abdul Taib, N. A., Baha Raja, D., Teo, A. K. J., Kamarulzaman, A., William, T., HS, A. S., Mokhtar, S. A., Ting, C. Y., Yap, W. A., Kim, M. C. Y., & Edwin Amir, L. (2022). Characterisation of COVID-19 deaths by vaccination types and status in Malaysia between February and September 2021. *The Lancet Regional Health - Western Pacific*, 18. <https://doi.org/10.1016/j.lanwpc.2021.100354>
- Ajonina-Ekoti, I. U., Ware, K. B., Nfor, C. K., Akomoneh, E. A., Djam, A., Chia-Garba, M., Wepnyu, G. N., Awambeng, D., Abendong, K., Manjong, F. T., Nwongo, O., & Ajonina, M. U. (2022). COVID-19 perceptions and vaccine hesitancy: Acceptance, attitude, and barriers among Cameroonians. *Journal of the American Pharmacists Association*, 62(6), 1823–1829. <https://doi.org/10.1016/j.japh.2022.07.002>
- Boehmer, T. K., DeVies, J., Caruso, E., van Santen, K. L., Tang, S., Black, C. L., Hartnett, K. P., Kite-Powell, A., Dietz, S., Lozier, M., & Gundlapalli, A. v. (2020). Changing Age Distribution of the COVID-19 Pandemic — United States, May–August 2020. *MMWR. Morbidity and Mortality Weekly Report*, 69(39), 1404–1409. <https://doi.org/10.15585/MMWR.MM6939E1>
- Bouza, E., Pérez-Granda, M. J., Escribano, P., Fernández-del-Rey, R., Pastor, I., Moure, Z., Catalán, P., Alonso, R., Muñoz, P., & Guinea, J. (2020). Outbreak of COVID-19 in a nursing home in Madrid. *Journal of Infection*, 81(4), 647–679. <https://doi.org/10.1016/j.jinf.2020.06.055>
- Doyle-Campbell, C., Mattison, M. J., Amedeo, V., Gaffney, S., & Achadinha, H. (2022). COVID-19 vaccine status and hesitancy in pharmacy students. *Currents in Pharmacy Teaching and Learning*, 14(4), 476–481. <https://doi.org/10.1016/j.cptl.2022.03.011>
- Hamdan, M. B., Singh, S., Polavarapu, M., Jordan, T., & Melhem, N. (2022). Hesitancy to COVID-19 Vaccines among University Students in Lebanon. *International Journal of Infectious Diseases*, 116, S61. <https://doi.org/10.1016/j.ijid.2021.12.144>
- Hosek, M. G., Chidester, A. B., Gelfond, J., & Taylor, B. S. (2022). Low Prevalence of COVID-19 Vaccine Hesitancy in Students Across Health Science Disciplines in Texas. *Vaccine: X*, 10. <https://doi.org/10.1016/j.jvax.2022.100154>
- Jayasundara, P., Peariasamy, K. M., Law, K. B., Abd Rahim, K. N. K., Lee, S. W., Ghazali, I. M. M., Abayawardana, M., Le, L. V., Khalaf, R. K. S., Razali, K., Le, X., Chong, Z. L., McBryde, E. S., Meehan, M. T., Caldwell, J. M., Ragonnet, R., & Trauer, J. M. (2021). Sustaining effective COVID-19 control in Malaysia through large-scale vaccination. *Epidemics*, 37. <https://doi.org/10.1016/j.epidem.2021.100517>
- Johnson, D. K., Mello, E. J., Walker, T. D., Hood, S. J., Jensen, J. L., & Poole, B. D. (2019). Combating Vaccine Hesitancy with Vaccine-Preventable Disease Familiarization: An Interview and Curriculum Intervention for College Students. *Vaccines* 2019, Vol. 7, Page 39, 7(2), 39. <https://doi.org/10.3390/VACCINES7020039>
- Kelekar, A. K., Lucia, V. C., Afonso, N. M., & Mascarenhas, A. K. (2021). COVID-19 vaccine acceptance and hesitancy among dental and medical students. *The Journal of the American Dental Association*, 152(8), 596–603. <https://doi.org/10.1016/j.adaj.2021.03.006>
- Ladhani, S. N., Chow, J. Y., Janarthanan, R., Fok, J., Crawley-Boevey, E., Vusirikala, A., Fernandez, E., Perez, M. S., Tang, S., Dun-Campbell, K., Wynne-Evans, E., Bell, A., Patel, B., Amin-Chowdhury, Z., Aiano, F., Paranthaman, K., Ma, T., Saavedra-Campos, M., Myers, R., ... Ramsay, M. E. (2020). Increased risk of SARS-CoV-2 infection in staff working across different care homes: enhanced CoVID-19 outbreak investigations in London care Homes. *Journal of Infection*, 81(4), 621–624. <https://doi.org/10.1016/j.jinf.2020.07.027>
- Lazarus, J. v., Ratzan, S. C., Palayew, A., Gostin, L. O., Larson, H. J., Rabin, K., Kimball, S., & El-Mohandes, A. (2020). A global survey of potential acceptance of a COVID-19 vaccine. *Nature Medicine* 2020 27:2, 27(2), 225–228. <https://doi.org/10.1038/s41591-020-1124-9>
- Li, Q., Feng, W., & Quan, Y. H. (2020). Trend and forecasting of the COVID-19 outbreak in China. *Journal of Infection*, 80(4), 469–496. <https://doi.org/10.1016/j.jinf.2020.02.014>
- Marzo, R. R., Ahmad, A., Abid, K., Khatiwada, A. P., Ahmed, A., Kyaw, T. M., Abidin, I. B. Z., Srithar, M., Sinnathamby, S., Sarvasundram, A. P., & Shrestha, S. (2022). Factors influencing the acceptability of COVID-19 vaccination: A cross-sectional study from Malaysia. *Vacunas*, 23, S33–S40. <https://doi.org/10.1016/j.vacun.2021.07.007>
- Morris, J. L., Baniak, L. M., Luyster, F. S., & Dunbar-Jacob, J. (2022). Covid-19 vaccine confidence and hesitancy in nursing students and faculty at a large academic medical center. *Nursing Outlook*, 70(2), 347–354. <https://doi.org/10.1016/j.outlook.2021.10.010>
- Puri, N., Coomes, E. A., Haghbayan, H., & Gunaratne, K. (2020). Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases.

- <https://doi.org/10.1080/21645515.2020.1780846>, 2586–2593. <https://doi.org/10.1080/21645515.2020.1780846>
- Silva, J., Bratberg, J., & Lemay, V. (2021). COVID-19 and influenza vaccine hesitancy among college students. *Journal of the American Pharmacists Association*, 61(6), 709-714.e1. <https://doi.org/10.1016/j.japh.2021.05.009>
- Tsai, S. C., Chang, W. W., & Lee, W. sen. (2022). Analysis of an outbreak of COVID-19(alpha-variant) with rapid progression to mortality in Taipei, Taiwan. *Journal of Infection*, 84(1), e33–e34. <https://doi.org/10.1016/j.jinf.2021.11.009>
- Wilson, E., Donovan, C. v., Campbell, M., Chai, T., Pittman, K., Seña, A. C., Pettifor, A., Weber, D. J., Mallick, A., Cope, A., Porterfield, D. S., Pettigrew, E., & Moore, Z. (2020). Multiple COVID-19 Clusters on a University Campus — North Carolina, August 2020. *MMWR. Morbidity and Mortality Weekly Report*, 69(39), 1416–1418. <https://doi.org/10.15585/MMWR.MM6939E3>