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Analysis of Infectious Diseases Cases Escalation among Tertiary Students: A Binary Logistic Regression

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ABSTRACT

Infectious disease pandemics, such as influenza and COVID-19, have raised significant global concern and anxiety. The transmission of infectious diseases among students and staff in higher education institutions has also shown a concerning trend. Consequently, the primary objective of this study is to identify the factors contributing to the occurrence of infectious disease cases among students using a logistic regression analysis. A total of 62 students from a selected higher learning institution who tested positive for the COVID-19 infectious disease were selected as respondents. The findings revealed that most students adhered to the Standard Operating Procedures (SOPs) with a high compliance rate, ranging from 61% to 95%. However, the lifestyle practices of students while residing in college and attending classes were found to be unhealthy, with the majority exhibiting poor habits ranging from 58% to 97%. Besides, the factors influencing the rise in infectious disease cases include the time taken by students to report symptoms to the health unit, the number of self-tests conducted, and the frequency of student participation in college activities. Additionally, the present study found that the surge in cases was most pronounced during the study week and examination period, with many of the cases being attributed to sporadic transmission. Considering these findings, it is imperative that the monitoring of SOP compliance among students is enhanced, particularly during periods when an increase in cases is anticipated. Furthermore, it is recommended that specific guidelines on SOP adherence and the procedures that students must follow be established to mitigate the spread of infectious diseases.

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1. INTRODUCTION

Nowadays, infectious diseases like chicken pox, influenza, hand, foot, and mouth disease (HFMD), and coronavirus disease 2019 (COVID-19) have caused a great deal of worry and anxiety around the world. Influenza, COVID-19, HFMD, and chicken pox are among infectious diseases that could spread at a faster rate and pose a risk to those who are susceptible to getting infections (Viner et al., 2020). These diseases, which may spread easily from an infected person to others, especially those with lower immunization, indicate that the main route of transmission is human-to-human transmission through droplets and possibly through the oral-fecal route (Ciotti et al., 2020). As mentioned by Brooks et al. (2020), a person, especially a child, is more likely to contract an infectious disease without a flu vaccination because they are less likely to initiate practicing physical distancing and hygiene behaviours, in addition to having naturally lower immunity to infections.

Many countries had previously implemented school or university closures due to higher cases of influenza, HFMD, and COVID-19 outbreaks. According to SteelFisher et al. (2010) and Viner et al. (2020) in their studies, closing schools during an influenza pandemic was a suitable and essential action for reducing the spread of the virus. Additionally, working parents, healthcare professionals, and essential workers who must balance work and childcare would suffer if schools were closed. Johnson et al. (2008) supported by Jackson et al. (2016) found that school closures were enforced during influenza outbreaks in the past because they might limit student-to-student social interactions and slow the spread of the illness for better health protection in the community. Moreover, schools and higher education administration must have strict adherence to the Standard Operating Procedures (SOPs), including quarantine of affected students in line with the SOP guidelines.

Considering this alarming issue, a detailed study is essential for identifying the factors contributing to the rise in infectious disease outbreaks in higher learning institutions and to recommend safe measures to curb further transmission. Therefore, this study aims to propose the necessary steps to mitigate the spread of such infections in the future by identifying the factors responsible for the increase in infectious disease cases among students at Universiti Teknologi MARA (UiTM) Cawangan Pahang.

2. LITERATURE REVIEW

Infectious diseases spanning from the past to the present day have posed a serious threat to global public health, leading to countless illnesses and mortality across communities. These diseases are caused by various pathogens such as bacteria, viruses, fungi, and parasitic protozoa, all of which can be transmitted through the air, direct contact, insect bites, and contaminated food and water. One of the most prevalent medical conditions in the world is a respiratory disease that may be caused by infections. These illnesses typically affect millions of people each year and may lead to high death rates. Upper respiratory infections (URIs), the most common acute illnesses, place a heavy strain on healthcare systems and can cause complications like acute otitis media, especially for children (Danishyar & Ashurst, 2023). Meanwhile, severe conditions like pneumonia and tuberculosis continue to pose major health risks.

Starting with the influenza pandemic, also known as Spanish flu in 1918, to COVID-19 int late 2019, pandemic crises have repeatedly shaped global health, further straining healthcare systems, disrupting economies, and affecting societies worldwide. COVID-19, caused by the SARS-CoV-2 virus, was first identified in December 2019 in Wuhan, China, causing millions of deaths and healthcare strain (Zhou et al., 2020). Generally, SARS-CoV-2 spreads at varying rates, influenced by factors such as virus variants and public health measures (Zhang et al., 2021). In contrast, influenza viruses tend to cause yearly seasonal outbreaks typically peaking during the winter months following a predictable pattern of infection. The H1N1 strain of influenza also led to a global pandemic in 2009, thus emphasising the critical need for effective surveillance and prompt intervention (Smith et al., 2010). The rise of antimicrobial resistance (AMR) makes infections harder to treat, highlighting the urgent need for better prevention and more effective treatments. The understanding level of infectious diseases has advanced greatly since ancient times, with early medical methods lacking a distinct idea of pathogens (Sakai & Morimoto, 2022).

There are various strategies for preventing infectious diseases, particularly COVID-19 and influenza, which are caused by viral infections. Prevention strategies focus on reducing transmission, strengthening immunity, and using appropriate treatments that include vaccination, promoting proper hygiene, addressing antimicrobial resistance, and developing innovative disease control technologies. Prevention efforts primarily aim to minimise the spread of infections, subsequently boosting the body's defenses and applying the right treatments when needed. The discovery of bacteria in the 19th century led to the development of vaccines and antibiotics in the 20th century. Ahmed, Zviedrite, and Uzicanin (2018) found that countries such as Mexico and the United States of America implemented strict isolation measures and used vaccines to help reduce the spread of the H1N1 influenza pandemic in 2009. Furthermore, Nickol and Kindrachuk (2019) in their study stressed that vaccination rates are still below the national target, requiring the need for continued research and public awareness campaigns to address the healthcare burden of influenza. They also stated that certain precautions must be taken to control diseases that could spread rapidly, especially when a virus is highly contagious, and no treatment or vaccine is available. In addition, Dhakad et al. (2022) found that although antibiotics fight harmful microorganisms and treat infections, overuse or a weakened immune system can reduce their effectiveness. This means that the rapid loss of antibiotic effectiveness poses a severe threat to public health, hence requiring global collaboration. In this regard, the important steps that should be practiced in daily life include washing hands frequently, keeping a safe distance from others, isolating sick people, tracking contacts, quarantining those exposed, closing schools and higher learning institutions, and limiting travel.

The COVID-19 pandemic, although lacking immediate antiviral treatments or vaccines, prompted a quick search for therapies, with candidates entering clinical trials by March 2020 and the availability of vaccines in early 2021. Vaccines, including mRNA-based (Pfizer, Moderna) and viral vector (Johnson & Johnson, AstraZeneca) for COVID-19, as well as annual flu shots, are essential in preventing severe illness, hospitalisation, and death. For this reason, Luo et al. (2021) found that encouraging the public to get vaccinated is essential for managing both COVID-19 and the flu. Despite the development of mRNA vaccines to combat the disease, the virus continues to evolve, giving rise to new variants such as Alpha, Beta, Gamma, Delta, and Omicron—variants that can evade immunity and continue to spread globally (Matsuura, 2022). In addition, Conceição Silva et al. (2023) found that reviewing current vaccine development against infectious diseases, highlighting historical milestones, conducting research on challenges like hesitancy, and highlighting gaps in protecting against many pathogens are all useful for better vaccine development strategies. The positive vaccine development promising the flu vaccination is vital during the COVID-19 pandemic to lower hospitalisations and preserve healthcare resources (Sunitha & Sudhakar, 2023). This further strengthens the need for continued innovation, multidisciplinary approaches, and global collaboration to improve vaccine design, effectiveness, and deployment for both human and veterinary health. Masignani et al. (2025) also stressed the importance of the collaboration between public and private sectors, in addition to the global equity efforts for addressing unmet vaccine needs and enhancing sustainable access worldwide.

3. METHODOLOGY

This is a cross-sectional study that focuses on a selected infectious disease, COVID-19, covering positive cases among students at UiTM Cawangan Pahang, Jengka Campus. The respondents consisted of 62 students from UiTM Cawangan Pahang, Jengka Campus, who were confirmed to be positive for COVID-19 and were identified from the records of UiTM Cawangan Pahang Health Unit, Jengka Campus. Data collection was carried out through phone calls or online interviews via the Google Meet platform using a set of questionnaires. All respondent information was kept confidential and used solely for research purposes.

The questionnaire was developed by considering four key elements: demographic characteristics (three items), health characteristics (seven items), compliance with SOPs, and lifestyle practices at the college and

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faculty. For the demographic and health sections, data were obtained from UiTM Cawangan Pahang Health Unit, Jengka Campus, while the SOP compliance section includes questions based on the list of three SOPs that have been set accordingly, which comprise SOP compliance by students at the residential college (10 items), SOP compliance by students at the faculty (10 items), and SOP compliance by students when off campus (six items). The lifestyle section involves the practices, awareness level, and self-control of students at the college (seven items) and faculty (five items).

All data were precisely recorded and analysed using statistical software to identify the factors contributing to the rise in infectious disease outbreaks on campus. Descriptive analysis was conducted involving frequency, percentage, and mean scores for all elements related to demographic characteristics, clinical factors, and behavior to identify any significant trends that could influence the contributing factors to increased COVID-19 positive cases. Moreover, a logistic regression analysis was performed to identify the factors (predictor variables) that influence the increase in cases and non-compliance with SOPs among selected students, which could be presented by a binary indicator variable, where the values are 0 (no) and 1 (yes) for each subject as 'success' or 'failure'. The π(x) denotes the 'success' probability at value x; thus, the logistic regression model has a linear form for the logit of this probability:

$$logit[\pi(x)] = log\left[\frac{\hat{\pi}(x)}{1-\hat{\pi}(x)}\right] = \alpha + \beta x. \quad (1)$$

Model selection is an important step to ensure that the final model is accurate and parsimonious in logistic regression analysis. Both forward and backward stepwise selections are performed when using the automatic stepwise selection method for variable selection. All potential predictor variables in the main effects model were examined using the stepwise method for additional interactions between pairs of variables. At this point, the preliminary final model was acquired. Further analysis was done to confirm the predictive validity and accuracy of the logistic regression model, and the stepwise method was used to select the estimated logistic model. Using the Akaike Information Criterion (AIC) as the primary decision rule, the stepwise method systematically adds or eliminates predictor variables based on a predetermined criterion. The best model has the lowest AIC value, as AIC evaluates models by balancing goodness of fit with model complexity to reduce the risk of overfitting while maintaining high predictive accuracy. In this study, the process began with a full model of all 48 potential predictors developed using the stepwise method. All potential predictors were added (forward selection), removed (backward elimination), or combined (stepwise selection), and the AIC value was recalculated at each step. The procedure continued iteratively, comparing competing models and retaining the model with the lowest AIC value at each stage to ensure that only the significant predictors influencing the binary outcome predictors are included in the final model. The estimated logistic regression model obtained would then be deemed statistically sound, interpretable, and suitable for inference or prediction purposes.

4. FINDINGS AND DISCUSSION

This section consists of two parts: data exploration and logistic regression model. The data exploration part represents the descriptive statistics for demographic characteristics, health characteristics, compliance with SOPs, and the lifestyle practices of the respondents. On the other hand, the logistic regression model part contains the logistic model with the associated factors influencing the escalation of COVID-19 cases and compliance with SOPs among respondents.

4.1 Data Exploration

Sixty-two students participated in the present study, comprising 49 (79%) males and 13 (21%) females aged between 19 and 24 years old, with most of them being 21 years old (25 students, 40.3%) and 19 years old (20 students, 30.6%). In addition, three students were found to have underlying health conditions, while the remaining 59 did not report any risk-related health issues. Of all respondents, 47 considered themselves as

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not having strong immunity, while the other 15 students reported having a good immune system. Overall, 57 students agreed, at least to some extent, that they have been maintaining good health. Furthermore, 35 students demonstrated a high level of awareness by reporting their health status within one day. However, the findings also revealed that three students (5%) only reported symptoms after a delay of five days.

Figure 1 below illustrates the trend of increased COVID-19 cases. The study also found that such a trend occurred during the study week leading up to the exams, with most cases involving infections through sporadic transmission.

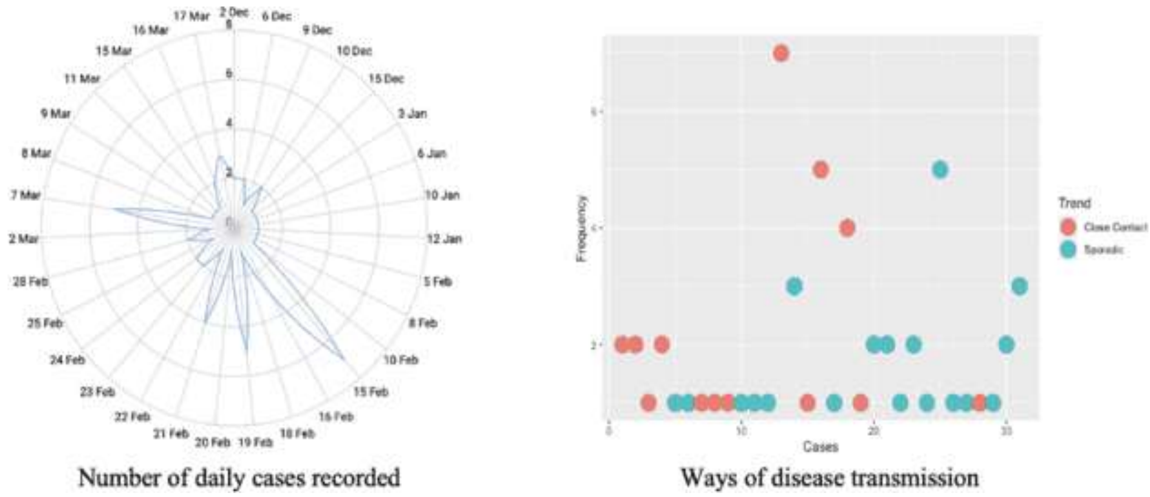

Fig. 1. Trend of increasing COVID-19 cases

Meanwhile, Figure 2 shows the percentage of SOP compliance by students at the residential college. Overall, all students adhered to the SOPs at a satisfactory level while staying in the residential college, with compliance rates ranging from 60% to 87% across all ten SOPs.

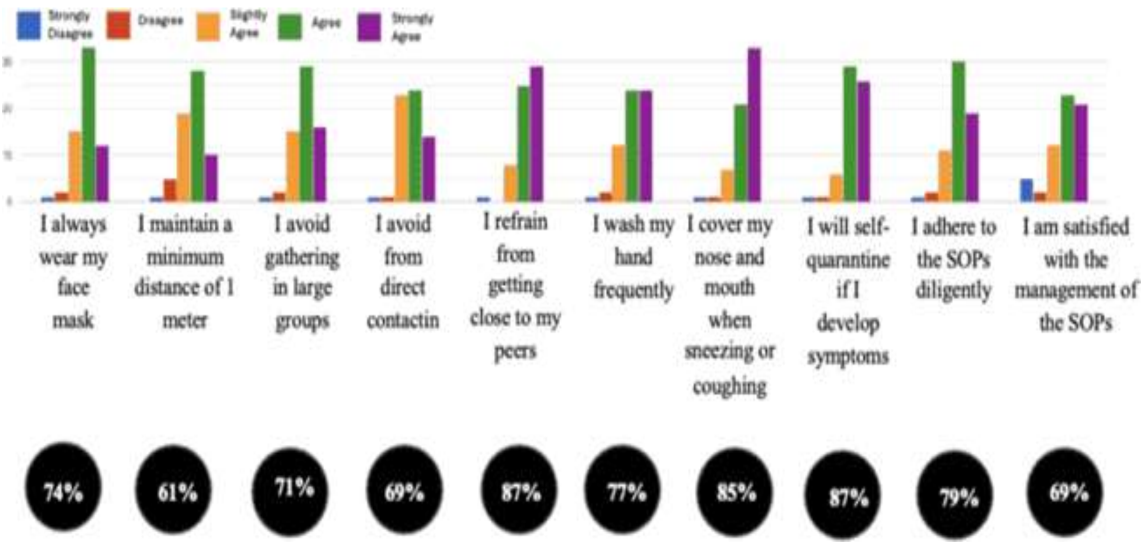

Fig. 2. SOP compliance by students at the residential college

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Figure 3 displays the percentage of SOP compliance among students at the faculty. In general, all students followed the SOPs at an acceptable level, with compliance rates varying from 77% to 92%. Figure 4 shows the percentage of SOP compliance by students when off campus. Overall, all students complied with the SOPs at a satisfactory level, with compliance rates ranging from 82% to 95%. Figures 5 and 6 show the percentage of student lifestyles at the residential college and faculty. Most students exhibited unhealthy lifestyles, with high percentages recorded from 81% to 97% at the residential college and from 63% to 90% at the faculty for activities involving friends, such as eating together, studying together for more than 15 minutes, chatting for more than 15 minutes, and engaging in recreational activities together.

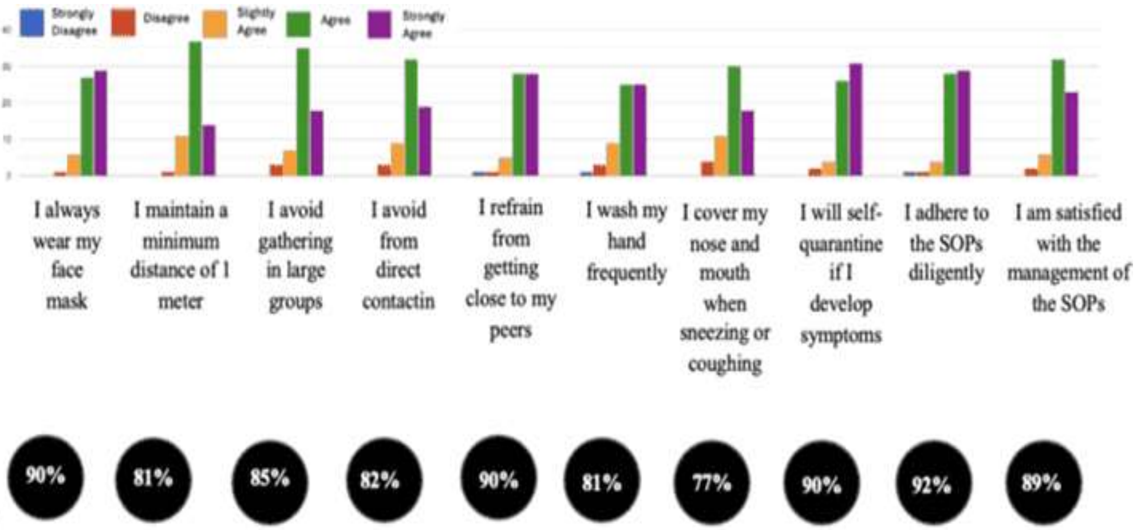

Fig. 3. SOP compliance by students at the faculty

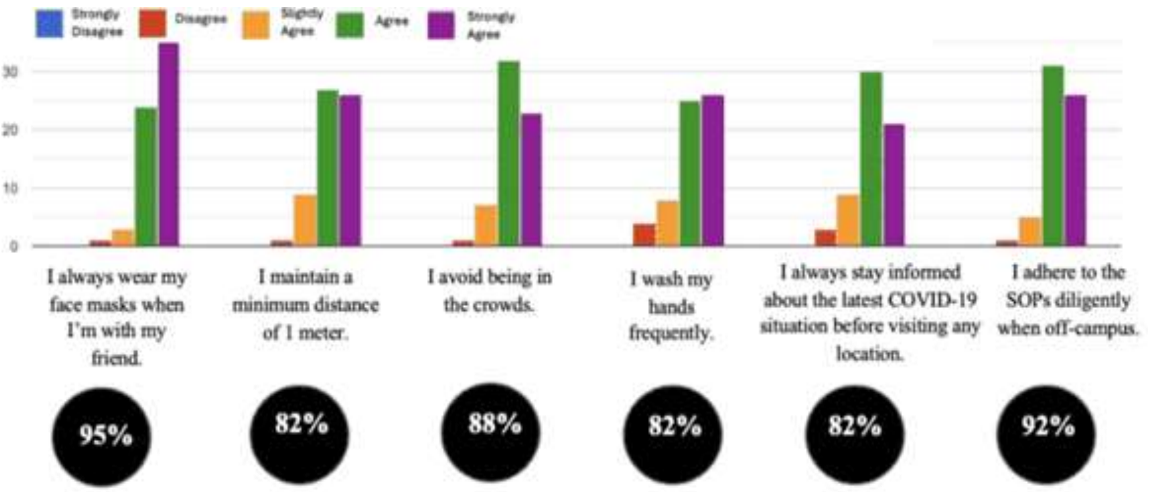

Fig. 4. SOP compliance by students when off campus

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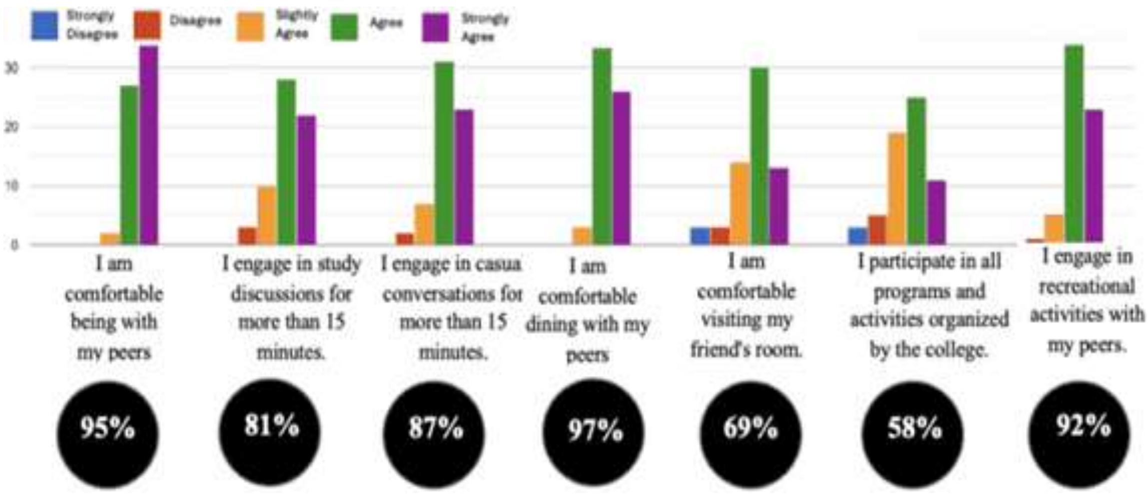

Fig. 5. Student lifestyles at the residential college

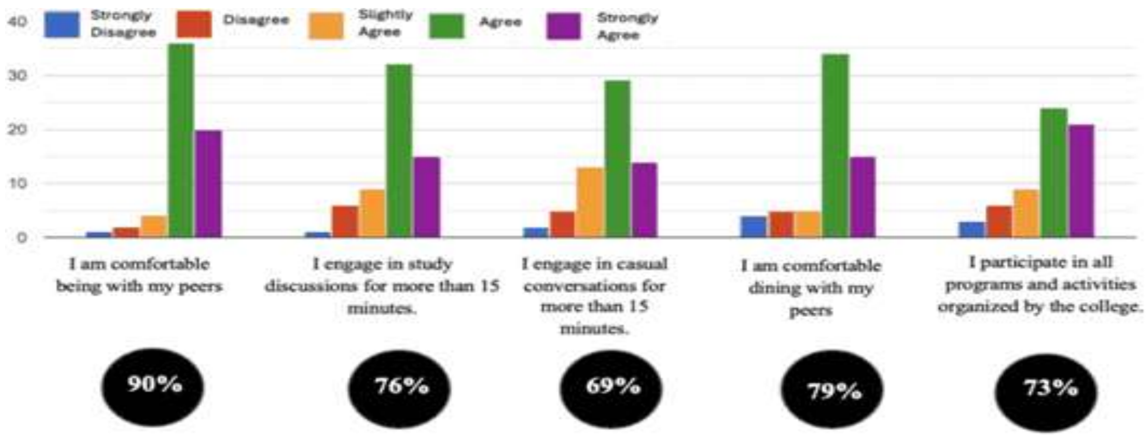

Fig. 6. Student lifestyles at the faculty

4.2 Logistic Regression Model

There are two models considered in this section: the associated factors influencing the rise in COVID-19 cases and the associated factors influencing SOP non-compliance among students, as shown in Tables 1 and 2, respectively. Table 1 shows the coefficient values of all predictor variables with the p-value for Model 1. There are three predictors associated with the escalation of COVID-19 cases since the p-value obtained was less than 0.05, which are (1) the time taken by students to report COVID-19 symptoms to the health unit, (2) the number of self-administered tests conducted by symptomatic students, and (3) the frequency of student participation in activities organised within the college. Based on the model, there is a 17% chance that the number of cases will increase if students are given an extra day to report symptoms to the health unit. Additionally, if students take one more self-test, there is an 11% chance that the number of infectious disease cases will rise. This indicates that the higher the frequency of self-tests taken by symptomatic students, the greater the contribution to the 11% increase in cases. Furthermore, for every extra college activity that students engage in, there is a 5% chance that the number of cases will increase.

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Table 1. Coefficient of predictor variables in the equation for model 1

Variables	B[a]	Exp (B)[b]	*p*-value
X_7 (Notification duration)	**-1.7265**	**0.1779**	**0.0056**
X_8 (Number of self-administered tests)	**-2.1663**	**0.1146**	**0.0096**
X_{14} (Avoiding direct contact)	-1.5602	0.2101	0.2637
X_{18} (Self-quarantine)	-40.9528	1.6384×10^{-18}	0.9946
X_{27} (Refraining from touching the face)	1.3978	4.0462	0.2718
X_{31} (Face mask usage when off campus)	20.7360	1012	0.9964
X_{37} (Comfort with peers in the college)	-27.2573	1.4531×10^{-12}	0.9974
X_{41} (Visiting peer's dormitory room)	1.8312	6.2413	0.1580
X_{42} (Participating in all college activities)	**-2.8560**	**0.0575**	**0.0483**

[a]Value of coefficient [b]Exponential value of coefficient

Table 2 shows the coefficient values of all predictors with the p-value for Model 2. Evidently, Model 2 shows that the use of face masks was the sole predictor linked to students' non- compliance with SOPs. As such, it is possible to indicate that if students wore face masks on campus, then their compliance with SOPs would be 42 times higher by referring to the exp(B) value obtained.

Table 2. Coefficient of predictor variables in the equation for model 2

Variables	B[a]	Exp (B)[b]	*p*-value
X_{12} (Face mask usage)	**3.7377**	**42.0013**	**2.14×10^{-5}**

[a]Value of coefficient [b]Exponential value of coefficient

This study has led to the development of two models that impact the rise in infectious disease case instances and the associated factors that influence students' non-compliance with the SOPs. Therefore, the estimated logistic model selected using the stepwise method from the lowest values of the Akaike Information Criterion (AIC) is written as follows:

Model 1

$$ln\left[\frac{\hat{\pi}(x)}{1-\hat{\pi}(x)}\right] = -56.54 - 1.73X_7 - 2.17X_8 - 1.56X_{14} - 40.95X_{18} + 1.40X_{27} + 20.74X_{31} - 27.26X_{37} + 1.83X_{41} - 2.86X_{42} \quad (2)$$

Model 2

$$ln\left[\frac{\hat{\pi}(x)}{1-\hat{\pi}(x)}\right] = -0.6931 - 3.74X_{11} \quad (3)$$

By highlighting several important aspects of infection risk and student lifestyle choices, this study seeks to evaluate students' adherence to the established Standard Operating Procedures (SOPs) and determine the factors that contribute to the incidence of infectious disease cases among students. According to the results, most of the students were in good health during such cases and were highly conscious of the importance of reporting on their health conditions. In addition, all students generally followed the SOPs at a satisfactory level during their time at the residential college and when off campus. All students also followed the SOPs at an acceptable level during their lecture time at the faculty. However, the results also showed that the trend of rising cases of infectious disease occurred during the study week leading up to the exams, with most cases involving infections through sporadic transmission. Moreover, most of the students were found to have unhealthy lifestyles while residing in college and attending classes. In addition, most of them exhibited poor habits that include activities involving friends, such as eating together, studying together for more than 15 minutes, chatting for more than 15 minutes, and engaging in recreational activities together.

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5. CONCLUSION

The present study indicates that university management and students exhibit good knowledge and practice towards SOPs during the infectious disease pandemic. However, the time taken by students to report infectious disease symptoms to the health unit, the number of self-administered tests conducted by symptomatic students, the frequency of student participation in activities organised within the college, and the use of face masks which all serve as significant predictors identified in this study may provide valuable insights into enhancing the monitoring of SOP compliance among students, particularly during periods when an increase in cases is anticipated.

The implementation of structured awareness programs, regular briefings, and clear communication channels can further strengthen students' understanding and commitment to SOP compliance towards infectious diseases through feedback systems and ongoing monitoring. For instance, it is recommended that the university prepare a specific guideline on SOP adherence, which emphasises the importance of good knowledge of infectious disease cases and encourages students at the institution to have a positive attitude toward following SOPs within the college to maximise the impact of the guideline. Voluntary and active participation among university management, lecturers, and student representatives may also encourage a sense of shared accountability and responsibility to promote the SOPs. Collectively, these measures may contribute to a safer campus environment and better preparedness in managing future public health challenges.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Noor Izyan Mohamad Adnan led the manuscript writing, data validation, data analysis, and coordination of the research process. Sharifah Norhuda Syed Wahid contributed to statistical analysis and interpretation of findings. Fadila Amira Razali and Yusharina Yusof assisted in literature review and conclusion. Nazirah Ramli contributed to the conceptualization and overall supervision of data collection. Mohd Kamal Azman Jusoh and Norhaslinda Arun were responsible for the design of research instruments and data collection. Mohd Risham Jaafar, Mohd Faizal Azrul Azwan Muhamed and Nazila Marjan supported data entry and preliminary analysis. All authors read and approved the final version of the manuscript.

REFERENCES

Ahmed, F., Zviedrite, N., & Uzicanin, A. (2018). Effectiveness of workplace social distancing measures in reducing influenza transmission: A systematic review. *BMC Public Health*, 18(1):518. doi: 10.1186/s12889-018-5446-1.

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G.J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet*, 395(10227), 912-920. doi: 10.1016/S0140-6736(20)30460-8.

Ciotti, M., Ciccozzi, M., Terrinoni, A., Jiang, W.C., Wang, C.B., & Bernardini, S. (2020). The COVID-19 pandemic. *Crit Rev Clin Lab Sci*. 57(6):365-388. doi: 10.1080/10408363.2020.1783198.

https://doi.org/10.24191/gading.v10i1.9156

Conceição Silva, F., De Luca, P. M., & Lima-Junior, J. d. C. (2023). Vaccine Development against Infectious Diseases: State of the Art, New Insights, and Future Directions. *Vaccines*, 11(11), 1632. https://doi.org/10.3390/vaccines11111632

Danishyar, A., & Ashurst, J. V. (2023, April 15). *Acute otitis media*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470332

Dhakad, G. G., Patil, R. V., Girase, D. S., Amrutkar, S. P., & Jain, R. S. (2022). Review on Antibiotics. *Asian Journal of Research in Chemistry*, 15(1), 91–96. https://doi.org/10.52711/0974- 4150.2022.00015

Luo, M., Sun, J., Gong, Z., & Wang, Z. (2021). What is always necessary throughout efforts to prevent and control COVID-19 and other infectious diseases? A physical containment strategy and public mobilization and management. *BioScience Trends*, 15(3), 188-191.

Jackson, C., Vynnycky, E., & Mangtani, P. (2016). The Relationship Between School Holidays and Transmission of Influenza in England and Wales. *American Journal of Epidemiology*, 184(9), 644– 651. doi:10.1093/aje/kww083.

Johnson, A. J., Moore, Z. S., Edelson, P. J., Kinnane, L., Davies, M., Shay, D.K., Balish, A., McCarron, M., Blanton, L., Finelli, L., Averhoff, F., Bresee, J., Engel, J., & Fiore, A. (2008). Household Responses to School Closure Resulting from Outbreak of Influenza B, North Carolina. *Emerging Infectious Diseases*, 14(7), 1024–1030. doi: 10.3201/eid1407.080096.

Masignani, V., Palacios, R., Martin, M., Tibaldi, F., & Vadivelu, V.K. (2025). De-risking vaccine development: lessons, challenges, and prospects. *npj Vaccines* 10, 177. https://doi.org/10.1038/s41541-025-01211-z

Matsuura, Y. (2022). Infection diseases: Past, present, and future. Osaka University, Institute for Microbial Diseases. Drug Delivery System, 37(5), 372-376.

Nickol, M. E., & Kindrachuk, J. (2019). A year of terror and a century of reflection: Perspectives on the great influenza pandemic of 1918–1919. *BMC Infectious Diseases*, 19. https://doi.org/10.1186/s12879-019-3750-8

Sakai, T., & Morimoto, Y. (2022). The History of Infectious Diseases and Medicine. Pathogens, 11(10), 1147. https://doi.org/10.3390/pathogens11101147

Smith, A. M., & Perelson, A. S. (2010). Influenza A virus infection kinetics: Quantitative data and models. *Wiley Interdisciplinary Reviews: Systems Biology and Medicine*, 3(4), 429–445. https://doi.org/10.1002/wsbm.129 (E-pub 31 Dis 2010).

SteelFisher, G.K., Blendon, R.J., Bekheit, M.M., & Lubell, K. (2010). The public's response to the 2009 H1N1 influenza pandemic. *N Engl J Med*, 362(22):e65. doi: 10.1056/NEJMp1005102.

Sunitha, D., & Sudhakar, M. (2023). Corona: Preventive Measures. *Asian Journal of Pharmaceutical Research*, 13(2), 105–108. https://doi.org/10.52711/2231-5691.2023.00021

Viner, R. M., Russell, S., Croker, H., Packer, J., Ward, J., Stansfield, C., Mytton, O., Bonell, C., & Booy, R. (2020). School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. *The Lancet Child & Adolescent Health*, 4(5), 397–404. doi:10.1016/S2352-4642(20)30095-X.

Zhang, Y.D., Chen, D., Hu, L., Shen, L., Wu, R.Y., Cao, F.M., Xu, J.Q., & Wang, L. (2022). Epidemiological characteristics of COVID-19 outbreak in Yangzhou, China, 2021. *BioScience Trends*, 15(3), 188–191. https://doi.org/10.5582/bst.2021.01218

Zhou, P., Yang, X.L., Wang, X.G., Hu, B., Zhang, L., Zhang, W., Si, H.R., Zhu, Y., Li, B., Huang, C.L., Chen, H.D., Chen, J., Luo, Y., Guo, H., Jiang, R.D., Liu, M.Q., Chen, Y., Shen, X.R., Wang, X., Zheng, X.S., Zhao, K., Chen, Q.J., Deng, F., Liu, L.L., Yan, B., Zhan, F.X., Wang, Y.Y., Xiao, G.F., & Shi, Z.L. (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*, 579(7798):270–273. doi: 10.1038/s41586-020-2012-7.

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